Ministry of Business, Innovation & Employment

# National Science Challenges

## Potential Challenges for Consideration by Peak Panel

### Health, Demographic Change and Wellbeing

February 2013

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# 1 Introduction

Forty three submissions were received from the science sector in this domain. These submissions have been grouped as shown in Table 1.

Throughout this document, 'summaries' of the Challenges were written by government officials, based on the submissions, purely for a grouping process. They may or may not correctly reflect the key parts of the submissions, as intended by submitters.

**Table 1: Summary of proposed challenges by grouping**

| Entry Id | Challenge |
|---|---|
| **Public health** | |
| **111** | To minimise the direct and intergenerational costs of mental health issues, in particular sex, drug and alcohol abuse |
| **143** | How can we reduce obesity in New Zealand to reduce premature disease and reduction in lifetime productivity? |
| **154** | Lifelong Brain Health: Maximising the Brain Health of all New Zealanders |
| **227** | Improve health and prevent disease by improving behavioural habits in the population |
| **337** | The increasing rate of Diabetes in the community, particularly in low socio economic areas. The challenge aims to look at the causes for this increase, public perception and the opportunity to use high school science as a means to educate |
| **350** | Reduce the occurrence of rheumatic fever in New Zealand |
| **353** | Quality of life through to older age: nutrition for life |
| **422** | To increase health outcomes from health spend by using science, innovative tools and emerging technologies to best focus interventions. |
| **475** | Healthy, Productive and Resilient Kiwis: Addressing Non-Communicable Diseases, Addictions and Mental Health Issues |
| **Health system** | |
| **63** | Specific guidelines and research has not yet been done into exercise guidelines for people with chronic illnesses and disability |
| **144** | Develop and implement a national system for real-time identification, intervention and monitoring of mental health, addiction and lifestyle issues (MH & A) with significant benefit to the on-going health and wellbeing of New Zealanders |
| **167** | To strengthen the evidence base for clinical decision making in reproductive and sexual health in order to improve health outcomes |
| **216** | Improve stroke recovery and reduce stroke burden in New Zealand |
| **297** | Neurocomputing technologies for understanding the mind, for engineering applications and for improving the wellbeing of the New Zealander |
| **330** | Cost-effective health care for New Zealanders |
| **346** | Good end-of-life care for all New Zealanders |

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| **371** | To provide a health system that helps sustain the fitness and wellbeing of New Zealand's population while operating within a cost and revenue framework that ensures value for money and is consistent with the capacity of the economy |
| **404** | Building on advances in modern medicine, information technology and models of care to meet the future challenges for our nation |
| **415** | Achieving a Healthy New Zealand Population |
| **Aetiology** | |
| **235** | To end the suffering caused by neurological disease and disorders: escalate the funding of world-class neurological research in New Zealand to achieve prevention, treatment and recovery goals |
| **276** | To investigate the underlying causes of cardiovascular disease, which will form the base to develop new clinical interventions, therapeutics and lifestyle attitudes to prevent and improve the cardiovascular health of New Zealanders |
| **405** | Keeping New Zealanders healthy, productive and independent throughout life |
| **407** | Turning back the rising tide: Reducing the projected impact of chronic conditions on New Zealanders, their families and their health system |
| **424** | Lifelong Health |
| **455** | Lifelong Health for All People in New Zealand - "Improve and enhance lifelong health outcomes by considering WHO health determinants, a socio-ecological health perspective and the Treaty of Waitangi." |
| **Health Treatments** | |
| **377** | Using bacteria to cure cancer by enhancing the patient's own immune response |
| **387** | To develop effective new treatment for malignant melanoma, by leveraging New Zealand's expertise in melanoma research, drug and immune therapy discovery, and clinical trials |
| **Providing the best start to life** | |
| **186** | To improve maternal and perinatal health in New Zealand and reduce inequalities in maternal and perinatal outcomes. To provide the healthiest start possible for all children in New Zealand |
| **295** | An environment supportive of optimal growth and development of children; future health proofing |
| **333** | Showcase the short and long-term positive impacts home-based Early Childhood Education has in providing for a strong, resilient nation that can reach its full potential, socially and economically |
| **340** | What Determines a Healthy Start to Life? |
| **348** | Raising children for a healthy society: How can we nurture, educate and socialize children so they emerge into adulthood as healthy, autonomous individuals able to contribute economically and socially, and equipped to raise a healthy new generation |

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| **376** | Healthy pregnancies for healthy lives. 6000 NZ babies / year have a poorly functioning placenta resulting in small babies, preeclampsia or miscarriage. To ensure every Kiwi starts a long, healthy life we must predict and fix these placental disorders |
| **476** | Good start in life: Ensuring New Zealand is a great place to raise kids |
| **Managing an ageing population** | |
| **184** | To better understand the nature of ageing populations on New Zealand society in terms of social cohesion and the equitable and ethical provision of services |
| **223** | To improve the health of the New Zealand's population by reducing the impact of the country's greatest health issues. To identify the potential impact of dementia for New Zealand's aging population and how this can be best addressed and managed |
| **288** | New Zealand successfully manages the transition to an older population |
| **327** | Understanding demographic change in NZ (rates of fertility, natural growth and structural/numerical population ageing) migration (internal, immigration, emigration) and the economic implications, including skills supply/demand and labour market matching |
| **332** | Older New Zealanders are assured high levels of quality of life by achieving optimum health, economic security and meaningful participation |
| **342** | Older people live independently longer and at lower cost |
| **406** | Adding Healthy Independent Years to the Lifespan of New Zealanders |
| **470** | Managing the health and labour force challenges of population ageing |
| **473** | Enhancing the quality of life, independence and contribution to New Zealand of older people |

# 2 Public Health

The submissions in this group are shown with their underpinning themes in the table below. Each submission follows in full.

**Table 2: Summary of proposed challenges and themes**

| Entry Id | Challenge | Themes |
|---|---|---|
| **111** | To minimise the direct and intergenerational costs of mental health issues, in particular sex, drug and alcohol abuse. | 1. Identify the direct, intergenerational and opportunity costs<br>2. Examine the economic benefit of addressing the costs of direct and intergenerational effects of mental health problems (and in particular sex, drug and alcohol abuse).<br>3. Research therapeutic jurisprudence and legislative frameworks for pre-emptive therapeutic intervention and the limits of those.<br>4. Therapeutic jurisprudence evaluation and audit procedures |
| **143** | How can we reduce obesity in New Zealand to reduce premature disease and reduction in lifetime productivity? | 1. Political and social solutions to obesity'<br>2. Identifying early life-course determinants of obesity.<br>3. Identification of early diagnostic markers of future obesity. |
| **154** | Lifelong Brain Health: Maximising the Brain Health of all New Zealanders | 1. Improve the brain health and function of children and adolescents<br>2. Develop new therapies and strategies that maximise brain function and maintain a healthy brain throughout adulthood<br>3. Maximise and maintain brain function in the aged population |
| **227** | Improve health and prevent disease by improving behavioural habits in the population | 1. Improving exercise habits in the population<br>2. Determine the benefits of health foods and supplements<br>3. Improve the healthy eating habits of the population |
| **337** | The increasing rate of Diabetes in the community, particularly in low socio economic areas. The challenge aims to look at the causes for this increase, public perception and the opportunity to use high school science as a means to educate | 1. Understanding New Zealand's current awareness of diabetes risk factors and the subsequent effects<br>2. The role of high schools in educating local communities and implementing change<br>3. Managing and maintaining programmes to increase awareness and reduce risk factors. |
| **350** | Reduce the occurrence of | 1. Research the effect of In-fill housing as a cause |

| Entry Id | Challenge | Themes |
|---|---|---|
| | rheumatic fever in New Zealand | of rheumatic fever<br>2. Research the effect of reduced lot-sizes as a cause of rheumatic fever |
| **353** | Quality of life through to older age: nutrition for life | 1. Holistic knowledge and coordination to meet population challenges<br>2. Integrated nutritional care for all population groups<br>3. Targeting nutritional interventions at an individual level<br>4. Foods with high health impact |
| **422** | To increase health outcomes from health spend by using science, innovative tools and emerging technologies to best focus interventions. | 1. Secure, online access to information can ensure more accurate risk factor assessment, better intervention point identification and, ultimately, better health outcomes and optimal use of health resources..<br>2. To target interventions to maximise benefits and reduce risk |
| **475** | Healthy, Productive and Resilient Kiwis: Addressing Non-Communicable Diseases, Addictions and Mental Health Issues | 1. A supportive and responsive environment for better health and wellbeing<br>2. Promoting healthy lifestyles and empowering individuals |

| **Entry ID** | **111** |
|---|---|
| **To minimise the direct and intergenerational costs of mental health issues, in particular sex, drug and alcohol abuse** | |
| **Summary** | This challenge proposes to firstly to conduct a census of those with mental health issues in particularly vulnerable sectors (i.e. recidivist criminal offenders) and determine the costs that they currently impose upon society (i.e. hospital bills, prison incarceration etc.). By identifying this cost, the economic benefit of improving mental health treatment of these patients will be revealed. Such improvements might focus on pre-emptive therapeutic intervention for those identified as 'high-risk' (i.e. individuals with a history of sexual/drug/alcohol abuse). |
| **Theme 1**<br>**Identify the direct, intergenerational and opportunity costs** | |
| **Importance to New Zealand** | Almost all prison inmates and half of all fatal and serious car crashes can be traced back to some form of mental health issue, often compounded by sex, drug or alcohol abuse. Large amounts of regulative burden and infrastructure are based around a punitive response which does not reduce offending or injury. The |

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| | result is a sustainable underclass of around 370,000 people who create a huge economic burden for the rest of society. |
| **Research components** | Identify the number of recidivists, patients, and the chronically dependent people affected by mental health issues (especially sex, drug or alcohol abuse) and the number of other people who are effected by, or provide services to them. Identify the costs imposed by these people both indirectly as Government/taxpayers and directly through the costs of crime. Identify the social costs imposed by these people. Identify the opportunity costs that catering for these people (by others) imposes on Government/ taxpayers. |
| **Theme 2**<br>**Examine the economic benefit of addressing the costs of direct and intergenerational effects of mental health problems (and in particular sex, drug and alcohol abuse)** | |
| **Importance to New Zealand** | Government budget making tends to be organisationally focused rather than solutions focused. Where a solution falls within the scope of a single organisation the answer is simple. Unfortunately mental health issues cut across many Government agencies: Health, justice, police, education, transport to name a few. By determining the economic benefit of addressing those issues it is possible to look at the net present value of investment in order to reduce the on-going costs. The objective would be to determine an appropriate level of investment in people in order to mitigate the effects of mental health costs. |
| **Research components** | The objective is to develop a present value of suitable investment in reducing the costs. This would examine the return on investment to the whole country in terms of GNP. Care would have to be taken to distinguish between spending on people and investing in people. Different success-rate mitigation forecasts would be needed to generate benefit cost ratios for programmes. The ability to transition opportunity costs into benefits (ie more employment in more productive areas) in time would need to be considered. |
| **Theme 3**<br>**Research therapeutic jurisprudence and legislative frameworks for pre-emptive therapeutic intervention and the limits of those** | |
| **Importance to New Zealand** | In many cases people with mental health problems (often stemming from sex, drug or alcohol abuse) are repeatedly coming before the courts. At present courts operate under a punitive model which means that Judges can only issue prescribed sanctions in accordance with the law. The result is the same people are repeatedly sanctioned and in most cases as a result become more likely to reoffend rather than less likely. The objective of this research is to find opportunities for judicial intervention which are therapeutic and reduce the probability of re-offending. This may involve a range of novel approaches to the law including investigating magistrates for sex abuse cases, alcohol and drug courts, and open-term mandated therapies in place of sanctions. |
| **Research components** | International research and study; Experimental courts; A therapeutic review and appeals procedure; A therapeutic charter of rights |

| Theme 4<br><br>Therapeutic jurisprudence evaluation and audit procedures | |
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| **Importance to New Zealand** | Currently the processes to assess the effectiveness of therapeutic jurisprudence interventions are in their infancy. It is important that effectiveness of new processes is measured in order to determine the benefit cost of programmes. It is also important that new therapies can enter the system and that therapies that are less successful can exit the system. |
| **Research components** | Examination of international best practice. Establishment of principles for evaluation and audit. |
| **Research Gaps and Opportunities** | This research is about better managing Government investment in the people of New Zealand. At the moment that is treated as a policy issue within the sphere of politics but it is actually a research question which can identify more or less optimal results. The benefit to New Zealand is to reduce the drag on its economy caused by extremely needy and disruptive people by finding ways to permanently reduce their problems, which they have managed to make everyone else's. |
| **Comments** | Not doing this will continue to waste billions of tax-payers money on a system of sustainable failure. This has huge opportunity costs for the nation. |

| **Entry ID** | **143** |
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| **How can we reduce obesity in New Zealand to reduce premature disease and reduction in lifetime productivity?** | |
| **Summary** | This challenge proposes that the most effective solution to stemming the rise of obesity will be politically driven. Research will therefore focus on the most efficient solutions to impose/ the most efficient ways to impose such solutions- e.g. Pricing of high-calorie foods, advertising etc. Such initiatives will be aided by research that aims to identify those at the highest risk of developing obesity (i.e. epidemiological studies, developmental markers of an obesogenic prenatal environment). |
| **Theme 1**<br><br>**Political and social solutions to obesity** | |
| **Importance to New Zealand** | Behavioural problems such as obesity, alcoholism and cigarette smoking are extraordinarily difficult to solve. It is likely that some of the most effective solutions to obesity, which will an enormous burden on productivity in New Zealand in coming years, will be politically driven social solutions. |
| **Research components** | Which political solutions are effective to avoid obesity? Pricing? Limitation of availability of high calorie foods in schools, workplaces? Advertising? Limitation of access to health resources? High quality social research is needed to inform political decision making. |

| Theme 2<br><br>Identifying early life-course determinants of obesity | |
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| **Importance to New Zealand** | It is likely that interventions for obesity will be more successful, or at least more cost effective, if focussed on children at highest risk. These interventions might be behavioural, but are increasingly likely to involve drug therapy. We need to develop robust tools to identify parents and children at greatest risk of subsequent obesity. |
| **Research components** | Epidemiological life course study of determinants of obesity. This will then evolve into the study of a wide range to imaginative and perhaps draconian interventions to prevent future obesity, or to determine that such intervention is futile once the development programme is set. If childhood or early life intervention is ineffective, the emphasis will need to be placed on prenatal/ preconceptual determinant of childhood obesity and subsequently the modification of these determinants. |
| **Theme 3**<br><br>**Identification of early diagnostic markers of future obesity** | |
| **Importance to New Zealand** | Obesity is a major challenge that will require a multipronged approach. One aspect is to identify biological markers and biological consequences of an obesogenic developmental environment. These markers will serve at least two functions:<br><br>1. To guide early intervention<br>1. To focus therapeutic intervention. |
| **Research components** | Identification of biological markers of an at risk profile. These markers will reflect the impact of the environment on humans, so are unlikely to be genetic (although gene - environment interactions will be present). They may be genetic modifications (known as epigenetic markers) which can now be studied in New Zealand with massive throughput genome sequencing techniques. They may be protein modifications detectable in the blood. They may be anatomic modifications identifiable by high resolution imaging techniques. The obesity epidemic is too profound to limit to specific narrow hypotheses. |
| **Research Gaps and Opportunities** | We know so little about the drivers of obesity. A massive multidisciplinary effort is needed on an unprecedented scale to solve the key health issue of the future. It will need to involve partners from all ethnic backgrounds, radical ideas, and rapid ruthless abandonment of failed strategies. We need highly sophisticated biological and behavioural information on which to build novel therapeutic strategies. Or we may need brave, but evidence based political decisions. The signs are not encouraging as the prevalence of obesity skyrockets. The productivity of an obese New Zealand will be lower and the health burden so much higher than a lean New Zealand. |

| Entry ID | 154 |
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| **Lifelong Brain Health: Maximising the Brain Health of all New Zealanders** | |
| **Summary** | This challenge proposes to draw on a combination of basic and applied research as well as public health approaches to develop more effective ways to minimise and treat acquired and traumatic brain injury. As well as developing new therapies and strategies that maximise brain function and maintain a healthy brain from infancy throughout adulthood. |
| **Theme 1**<br><br>**Improve the brain health and function of children and adolescents** | |
| **Importance to New Zealand** | The incidence of foetal and childhood brain injury in New Zealand is significant, with life-long health, educational, financial and social consequences for individuals, their families and the community. During pregnancy, poor diet, maternal stress, and exposure to toxins including alcohol can contribute to childhood disorders, such as autism and infantile seizures, and later cognitive impairment and adult neurological disorders such as schizophrenia. Foetal alcohol spectrum disorder, for instance, is estimated to occur in up to 1% of live births.[1] Other childhood neurological conditions include cerebral palsy (2.0 to 2.5 per 1,000 live births,[2] with estimated life-long direct costs of US$1,000,000[3]) and traumatic brain injury (mostly falls, 1-2% of children).[4] Overall, 5% of children require special education (41,000) including those who receive support for developmental difficulties and learning difficulties such as dyslexia and attention deficit hyperactivity disorder.[5] Reducing these conditions will reduce the burden of disease for the individual, increasing their independence and self-esteem, and will improve the lives of their families, reduce the life-long costs of care to society, and increase productivity as these individuals and their caregivers (re)enter the workforce.<br>1. In utero brain damage from alcohol: a preventable tragedy. D Sellman, J Connor. NZMJ 2009; 122 (1306)<br>2. http://www.cpsoc.org.nz/CP/index.htm<br>3. CDC. Economic costs associated with mental retardation, cerebral palsy, hearing loss, and vision impairment. 2003. MMWR 53(3): 57-9, 2004.<br>4. Prevalence of traumatic brain injury among children, adolescents and young adults: prospective evidence from a birth cohort. McKinlay A, et al. Brain Inj. 2008 Feb;22(2):175-81.<br>5. http://www.stats.govt.nz/browse_for_stats/health/disabilities/DisabilitySurvey2006_HOTP06.aspx |
| **Research components** | • Develop public health and community based interventions to minimise head trauma from accidents and sports injuries<br>• Draw on a combination of basic and applied research as well as public health approaches to develop more effective ways to minimise and treat acquired and traumatic brain injury<br>• Develop new therapies to allow the brain to heal itself through the promotion of adaptive neural plasticity that will improve recovery from acquired and traumatic |

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| | neurological dysfunction<br>• Investigate new ways to reduce and treat sensory dysfunction that occur as a result of peripheral as well as central damage and maladaptation<br>• Determine novel biomarkers and changes in brain neurochemistry associated with mental illness<br>• Develop new behavioural and pharmacological methods to treat mental illness<br>• Investigate new multidisciplinary approaches to reduce and treat alcohol- and drug-induced brain injury |
| **Research Gaps and Opportunities** | Develop new therapies and strategies that maximise brain function and maintain a healthy brain throughout adulthood |
| | Many adult New Zealanders are affected by impaired brain function that results in loss of quality of life, individual and family stress and lost productivity. Stroke and traumatic brain injury (TBI) are leading causes of morbidity, disability and mortality, accounting for 8% of the total disability-adjusted life years lost and 11.7% of premature mortality in New Zealand.[1] About 7–8000 people experience a stroke each year, while 22–33,000 people experience a TBI, at an estimated direct cost of NZ$219-253 million per annum.[1] Sensory disabilities affect more than 8% of adults (239,000), while 7% (224,500) have other disabilities, such as difficulty speaking, learning or remembering.[2] New Zealand also has a high prevalence of mental health disorders, with anxiety (14.7%), mood disorder (7.7%) and substance abuse (3.5%) rates being among the highest in the world.[3] Approximately 20% of the population have experienced a mental health disorder resulting in significant welfare costs and productivity loss. The employment rate is 32% in those with, versus 69% in those without, mental illness; the average number of hours worked is 29.8 vs 37.5 hours per week for the general population.[4] There is also a substantial economic benefit to developing new therapies; in 2009 a treatment for mild cognitive impairment was estimated to be worth about $5 billion<br>1. Applied brain injury research in New Zealand: can we do better? VL Feigin, S Barker-Collo. NZMJ 2008;121 (1268) 2893-98<br>2. http://www.stats.govt.nz/browse_for_stats/health/disabilities/DisabilitySurvey2006_HOTP06.aspx<br>3. http://www.mentalhealth.org.nz/page/128-mental-health-quick-statistics<br>4. http://www.likeminds.org.nz/file/downloads/pdf/file_104.pdf |
| | • Develop public health and community based interventions to minimise head trauma from accidents and sports injuries<br>• Draw on a combination of basic and applied research as well as public health approaches to develop more effective ways to minimise and treat acquired and traumatic brain injury<br>• Develop new therapies to allow the brain to heal itself through the promotion of adaptive neural plasticity that will improve recovery from acquired and traumatic neurological dysfunction<br>• Investigate new ways to reduce and treat sensory dysfunction that occur as a result of peripheral as well as central damage and maladaptation |

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| | • Determine novel biomarkers and changes in brain neurochemistry associated with mental illness<br>• Develop new behavioural and pharmacological methods to treat mental illness<br>• Investigate new multidisciplinary approaches to reduce and treat alcohol- and drug-induced brain injury |
| **Theme 2**<br><br>**Maximise and maintain brain function in the aged population** | |
| | The proportion of the New Zealand population over 65 years is estimated to increase by 84% from 512,000 to 944,000 by 2026.[1] Healthy ageing is characterised by low levels of disability, high cognitive and functional capacity and an active engagement in life. The most important ingredient of healthy ageing is a healthy brain, with an absence of age-related diseases and dysfunction. Maximising good quality of life, and reducing the demand and cost associated with residential-care services, are critical factors in coping with the expected increase in the number of those aged over 85 [the biggest users of aged residential care services], predicted to increase from 58,000 to 116,500 by 2026.[1] One primary cause of lost quality-of-life is dementia, as a result of changes in the structure of the brain that affect memory, thinking, behaviour, personality and emotion. It is a progressive syndrome, symptoms worsen over time and it is one of the biggest problems as sociated with aged care. In 2008 there were 40,746 New Zealanders with dementia and by 2026 this is projected to increase to 74,821 people.[2] By 2050, 2.7% (150 000) of the population will have dementia. Sensory disabilities also have a high and increasing prevalence in older people; for example, hearing loss is expected to affect 26.7% of the population by 2050 (based on Australian data).[3]<br><br>1. Aged Residential Care Service Review - New Zealand Aged Care<br>2. Dementia Economic Impact Report 2008<br>3. Listen Hear! The economic impact and cost of Hearing Loss in Australia (2006) |
| | • Investigate and develop new therapies to reduce and moderate the effects of normal aging on brain function so that the elderly can maintain independence and community involvement for as long as possible<br>• Develop specialized imaging techniques and brain tissue analyses to allow earlier diagnosis, monitoring and intervention in degenerative brain disorders (including Alzheimer's, Parkinson's, Huntington's disease)<br>• Investigate new ways to reduce the impact of dementia and other neurodegenerative conditions on normal activities of living to reduce the loss of independence which current occurs in patients with these conditions<br>• Develop new therapies to arrest, treat and reverse degenerative processes in the brain to restore greater independence<br>• Develop novel pharmacological and behavioural therapies to moderate existing disabilities associated with disease and or degenerative processes in the brain |
| **Research Gaps and Opportunities** | Understanding the healthy and diseased brain is an important and major scientific challenge, the outcomes of which affect all New Zealanders and their future health and well-being. This challenge draws on the wealth of world class expertise in |

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| | brain research and neurological conditions that has been established in NZ (in particular in the two Brain Research Centres in Auckland and Otago) to provide a strong and continuous platform of research to ensure New Zealanders have a "healthy brain" throughout their lifespan. The strong international research links established by neuroscience researchers throughout New Zealand means that this challenge will be an opportunity to pool world class local and international expertise and resources on a significant NZ health issue which will have a major financial impact on both in maximising future productivity and reducing health and welfare costs.<br><br>New Zealand has an outstanding neuroscience capability and the capacity to be among the best in the world, but to reach this level we need to address gaps in the areas of neural imaging (MRI and PET scanning), genetic models of neural disorders, drug and medical device development and clinical translational medicine. Investment in these areas would facilitate a clinical translational neuroscience effort that will be world leading.<br><br>A major gap is the current short-term funding structure for research in NZ, which affects long-term stability and growth of research capacity across the spectrum. Long-term continuity of funding would allow the development on the national level of centres of international research excellence. |
| **Comments** | Names of individuals were removed from this comments section to protect people's privacy [OIA: 9(2)(a)]. This submission is made on behalf of the Centre for Brain Research at the University of Auckland (which represents the collective interests of 53 research groups from across the University of Auckland and the clinical research groups involved in neurology services at Auckland Hospital) and after discussion with the Directors of the Brain Health Research Centre of the University of Otago and the Neurological Foundation of New Zealand along with many other trust and charities involved with the community support of research and patients.<br><br>This submission also has the formal support of the Alzheimer's New Zealand Charitable Trust Inc. www.alzheimersresearch.org.nz. Dementia is one of the most significant social, health and economic crises of the 21st century. We all need to act urgently to develop research and care strategies so that the impact of this disease can be managed.<br><br>The successful completion of this Challenge will require close co-ordination of the efforts of both the Auckland and Otago Research Centres, their associated clinical groupings, other brain health and mental health research groups at AUT, Victoria and Canterbury Universities and the support of funding bodies and commercial and community partners involved in rehabilitation and support of patients. |

| Entry ID | 227 |
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| **Improve health and prevent disease by improving behavioural habits in the population** | |
| **Summary** | This challenge proposes to drive New Zealanders to pro-actively improve their health/prevent disease by modifying their behavioural habits- Targets might include exercise (to prevent obesity), and promoting healthy eating. |
| **Theme 1**<br>**Improving exercise habits in the population** | |
| **Importance to New Zealand** | One of the best ways to improve health and prevent disease is regular exercise. New Zealanders are eating more and exercising less. This leads to health problems and expenses. If New Zealanders move more, they will be healthier and generate less public expenses in health. |
| **Research components** | How to make people move more (e.g. gamification, psychology, etc). |
| **Theme 2**<br>**Determine the benefits of health foods and supplements** | |
| **Importance to New Zealand** | New Zealand has a reputation for natural foods and food supplements. Generating scientific evidence of the health benefits of using these health foods and supplements will not only improve their use for New Zealanders, but also generate exports into international markets. |
| **Research components** | In vitro and in vivo studies of the health benefits of New Zealand health foods and supplements. |
| **Theme 3**<br>**Improve the healthy eating habits of the population** | |
| **Importance to New Zealand** | Similar to improving exercise habits, improving eating habits will lead to improved health, prevention of disease, and lowering of public expenses in health. |
| **Research components** | What are healthy eating habits? (Nutrition). How to promote healthy eating habits in the population (Psychology). |
| **Research Gaps and Opportunities** | There is a body of research showing the benefits of exercise and healthy eating habits. However, there is not much research on what are the best ways for the general population to take up these habits. New technologies provide new opportunities to address these problems (e.g. gamification). |

| Entry ID | 337 |
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| **The increasing rate of diabetes in the community, particularly in low socio economic areas. The challenge aims to look at the causes for this increase, public perception and the opportunity to use high school science as a means to educate** | |
| **Summary** | This challenge aims to look for the causes of the increase of diabetes, and then develop resources to educate the public on the disease/preventative measures. This will involve identifying diabetes risk factors relevant to particular socio-economic sectors, and then developing tools that can increase public awareness of these risk factors. High schools are identified as a relevant target for the education of local communities about these risks, and therefore implementing changes. |
| **Theme 1**<br><br>**Understanding New Zealand's current awareness of diabetes risk factors and the subsequent effects** | |
| **Importance to New Zealand** | Diabetes is a major health concern that is resulting in increasing economic, physical and societal issues. The statistics show that diabetes is increasing particularly in areas of low socio economic status and there are proportionally higher numbers of pacific and Maori with Type 2 diabetes. Control of blood glucose in early life has been linked to reduced risk and also increased ability to treat if people do get diagnosed with diabetes later in life. The implications that diabetes has on patients can vary and involve changes in a person's ability to work and function within the family. There is also an estimated 100, 000 people that have diabetes and do not know as they have not been tested. As their diabetes is untreated it causes increased health effects long term and can result in irreversible conditions occurring that could of been prevented with earlier detection. |
| **Research components** | Component 1: Investigate who gets tested for diabetes, why they get tested and look at the reasons why people at risk of diabetes may not get tested.<br><br>Component 2: Develop tools to increase awareness of risk factors and effects particularly targeting reaching audiences that do not get tested.<br><br>Component 3: develop tools to bring testing into the local community and increase the number of individuals that are receiving tests for diabetes<br><br>Component 4: Collect and analyse data relevant to local and national communities. |
| **Theme 2**<br><br>**The role of high schools in educating local communities and implementing change** | |
| **Importance to New Zealand** | Local communities used to be based around a church, marae, or community hall. This has increasingly disappeared as communities have grown, blended and the immersion of larger cities has developed. Schools are now the centre point for families and local communities as they host education, sporting and cultural |

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| | events. The role of the school needs to be developed to increase social cohesion as school communities include diverse groups of people that may otherwise not interact. |
| **Research components** | Component 1: Identify the role of school in local community and how its role can be enhanced to develop a greater sense of community.<br><br>Component 2: Look at how school programmes can integrate with community outreach initiatives to hit more of the target population<br><br>Component 3: Develop real world science contexts with meaning to increase learners engagement and knowledge of scientific process and scientific literacy<br><br>Component 4: look at how development of authentic programmes of learning can increase student self-efficacy |
| **Theme 3**<br><br>**Managing and maintaining programmes to increase awareness and reduce risk factors** | |
| **Importance to New Zealand** | Early detection of diabetes is often the result of patients with an awareness of risk factors seeking testing. As not all of the population is aware of the risk factors or has access to testing due to social factors, there are many people living with diabetes without detection. In addition to this, many of the programmes for treatment are self-management programmes which rely on individuals understanding the risk factors of not following programmes, having the time and resources to follow/manage programmes and having the support needed to sustain programmes.<br><br>Language and cultural barriers can also cause problems in regards to management of diabetes. Developing sustainable programmes, that allow this portion of the population to receive the assistance they need, will lead to long term economic, and health benefits for the country. |
| **Research components** | 1: Develop programmes that are targeted at the local community to increase physical activity<br><br>2: Develop programmes to educate about diet and alternatives to high risk foods.<br><br>3: Build sustainable relationships with existing community initiatives that result in on-going research and outcomes. |
| **Research Gaps and Opportunities** | Research has been carried out into the numbers of those affected in New Zealand, the risk factors that contribute toward diabetes and the outcomes of living with diabetes. While there are programmes such as the HOPE initiative of Diabetes Auckland, these rely on external support and management through the district health board or other parties. By increasing ownership of research and implementation of programmes in schools, local school and wider communities will be able to sustainably manage, run and implement local and regional change.<br><br>The Liggins Institute of Auckland University also addresses Diabetes within an Achievement Standard at Level 1 NCEA, however, this focuses on education of the science of diabetes to learners not the outreach to wider community. |
| **Comments** | Pacific and Maori communities often feel disempowered in research and initiatives |

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| | due to negative perceived outcomes or stigma associated with results. By creating links through whanau, pathways may open to more positive engagement in research. Low socio-economic areas that traditionally have a higher proportion of diabetes can often become stuck in a cycle of no change due to low self-belief and community belief. Through active participation in a programme that they are implementing, and that has a clear success outcome, there will be increased sense of power to make change. |

| **Entry ID** | **350** |
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| **Reduce the occurrence of rheumatic fever in New Zealand** | |
| **Summary** | The goal of this proposal is to reduce the occurrence of rheumatic fever in New Zealand. This proposes the following research themes:<br><br>(1) research the effect of In-fill housing as a cause of rheumatic fever - health urban/land development health planning and Policy Land Planning and Policy Geography Land Surveying Maths (combined to analyse development compared with rates of rheumatic fever)<br><br>(2) research the effect of reduced lot-sizes as a cause of rheumatic fever - Health Urban/Land Development Health Policy Land Planning and Policy Geography Land Surveying Maths (combined to analyse development compared with rates of rheumatic fever). |
| **Theme 1**<br><br>**Research the effect of In-fill housing as a cause of rheumatic fever** | |
| **Importance to New Zealand** | It's an aspect of overcrowding not researched and understood as a cause of rheumatic fever. If addressed, it may help with reducing rheumatic fever's occurrence rate by avoiding too much in-fill housing if it's found to be related. The benefits are better health of the population. |
| **Research components** | Health Urban/Land Development Health Planning and Policy Land Planning and Policy Geography Land Surveying Maths Combine the above to analyse development compared with rates of rheumatic fever |
| **Theme 2**<br><br>**Research the effect of reduced lot-sizes as a cause of rheumatic fever** | |
| **Importance to New Zealand** | It's another aspect of overcrowding not researched and understood as a cause of rheumatic fever. If addressed, it may help with reducing rheumatic fever's occurrence rate by avoiding too much reduction in lot sizes if it's found to be related. The benefits are better health of the population. |
| **Research components** | Health Urban/Land Development Health Policy Land Planning and Policy Geography Land Surveying Maths Combine the above to analyse development compared with rates of rheumatic fever. |
| **Research** | At the moment, there are research gaps as to the effects of overcrowding on the |

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| **Gaps and Opportunities** | cause of rheumatic fever. The relevant authorities and organisations are dealing with the cold and damp aspects, but not all the overcrowding aspects. There is only a little research concerning overcrowding within an individual house-hold. That causation is proven. A lot of City Councils and District Health Boards are in a transition stage. The themes described would add to that already known so their planners can have the opportunity to try and reduce the occurrence rate of rheumatic fever. |

| **Entry ID** | **353** |
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| **Quality of life through to older age: nutrition for life** | |
| **Summary** | This challenge states that one of the main routes to stemming the rise in chronic disease is through a nation-wide improvement in diet ('nutritional care'). As different communities often report different health needs, these improvements need to be based on the collection and integration of community/individual specific information, rather than a 'one-size fits all' approach. Components of this research include data generation/collection, and investigating ways in which to deliver community/individual specific nutritional intervention. |
| **Theme 1**<br>**Holistic knowledge and coordination to meet population challenges** | |
| **Importance to New Zealand** | Chronic diseases are becoming an unsustainable burden to the individual, family/whanau, community and economy. The majority of home-grown knowledge from relevant health research is disconnected, and fails to reach the consumer.<br><br>A key challenge for the many players in nutritional research is therefore to be connected in the underlying health intelligence as a driver of the research agenda, to collaborate to greater levels and to synthesize this into a form that can be translated through community and health service providers.<br><br>The incremental gains postulated from traditional and new advances in human nutrition (including personalised medicine) need to be taken through clinical trials into knowledge and systems able to reach the consumer so that step-wise, rather than independent incremental changes can be made. This should be driven at community rather than individual level to be effective. |
| **Research components** | On-going health intelligence at a population level shall be raised to include in-depth analysis from a new and open area of ethical use of personal health data. This will include access to health information and tissue banks to quantify point-in-time status, generational trends and individual variation in order to target nutritional goals.<br><br>Importantly, it is the interconnectedness and translation of related human health research that needs to occur to bring significant change in our population health status. A more holistic approach will help to identify and drive priorities in nutritional health research. A new era in the degree of home-grown clinical trials using nutritional interventions and human response (with genome analysis where relevant) shall commence. Longitudinal studies specific to diet will commence. |

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| **Theme 2**<br>**Integrated nutritional care for all population groups** | |
| **Importance to New Zealand** | Various communities within New Zealand, whether they be based on ethnicity, geographical remoteness to health services, or social determinants, report differing needs for health improvement through nutritional knowledge and intervention. Rather than being a 'one size fits all' approach, each community will benefit from a suite of dedicated knowledge and interventions based on the data emanating from Theme 1. |
| **Research components** | A new phase in remote health delivery is just beginning in New Zealand, with both high- and low-risk IT options yet to be fully tested and implemented. This requires the engagement and study of the health workforce as much as the patient in real-life settings, technology issues (and further hardware and software development) and healthcare access research for each community. In addition, models of nutritional intervention will be developed with cost-benefit analysis at community level to provide aspirational models of care. |
| **Theme 3**<br>**Targeting nutritional interventions at an individual level** | |
| **Importance to New Zealand** | There is mounting evidence that individuals respond in different ways to the same nutritional element, just as they do to medicines. Understanding one's own response would be beneficial for self-imposed dietary intervention, but the role of healthcare professionals would also benefit from this. |
| **Research components** | Studies on genetic markers, proteomics and metabolomics within specific population groups will enable baseline and individual nutritional interventions to be developed and followed over medium terms periods. Home-based self-diagnostic kits will be developed for a range of physiological, genetic and biochemical markers found to be associated with nutritional and health status. Clinical trials will quantify the link between dietary intervention and health outcome. This will also be applied to other growing fields of research such as recovery after surgery, metabolic risk and specific disease mitigation (e.g. some mental health conditions, diabetes, cardiovascular disease, and stroke). To address this challenge, the impact of nutritional interventions from in utero to older age will be investigated, with strong evaluation. |
| **Theme 4**<br>**Foods with high health impact** | |
| **Importance to New Zealand** | There is already research and development underway to breed, select and formulate new natural foods with very specific or enhanced biological impact, based on novel or enhanced components. This will provide a preventative as well as curative function. |
| **Research components** | The key to addressing this goal is to take research from theoretical, laboratory or animal studies to human trials in a safe and low-risk manner, in order to substantiate health claims. New natural food products will be developed and trialled on a semi-commercial scale with consumers. With a goal of relieving the |

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| | burden of chronic disease in our communities, the health sector will be intimately engaged in the research life cycle, including the capacity to translate research into healthcare practice. Public debate will also be courted in contentious areas such as food fortification. |
| **Research Gaps and Opportunities** | There is an opportunity to make more significant health gains in getting existing, let alone new knowledge, into practice. The disconnect between research-intensive agencies and the health workforce can be bridged more effectively through life-cycle approach to research and more home-grown interventional studies with humans, on a scale able to assess their degree of impact. Some areas of research are relatively new, including greater emphasis on remote care, individualised markers and new food products. New Zealand has sufficient expertise and capacity to conduct this research - international links currently exist and will continue to benefit this platform. Having a more coordinated and prioritised approach to the nutrition research agenda will provide a shorter-term impact than the current dispersed approach. Furthermore, too little health research in New Zealand is focussed on the very applied end of research.<br><br>For those with chronic health conditions, a more engaging model with the research-active healthcare workforce would act as a guiding and facilitating partner in delivering societal health benefits. It is being increasingly established that nutritional interventions could provide overt health gains for those with chronic conditions. New impacts are constantly being hypothesized, and these need to be followed up through clinical trials. This is achievable. |

| **Entry ID** | **422** |
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| **To increase health outcomes from health spend by using science, innovative tools and emerging technologies to best focus interventions** | |
| **Summary** | The goal of this proposal appears to be to increase health outcomes from health spend by using science, innovative tools and emerging technologies to best focus interventions.<br><br>The suggested research components include: Epidemiology if infections and non-infectious diseases (including hospital, clinical and pharmaco epidemiology), pharmaco-economics, microbiology etc. |
| **Theme 1**<br><br>**Secure, online access to information can ensure more accurate risk factor assessment, better intervention point identification and, ultimately, better health outcomes and optimal use of health resources** | |
| **Importance to New Zealand** | Improving health outcomes from New Zealand's public health service is a key government priority. However, the health budget needs to be carefully managed, particularly as the demands on the health system increase as New Zealand's population ages and the treatment options expand. It can be challenging to identify which of the ever-increasing range of treatment options will deliver the |

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| | best, and most affordable, results.<br><br>If New Zealand's public health system is to operate efficiently and effectively in the future we need to ensure that the most appropriate interventions are used. Using information to scientifically analyse the personal, procedural, treatment, institutional and organismal risk factors of disease would inform public health interventions and deliver the best health outcomes. This would require the ready availability of New Zealand's public health data for analysis as well as information from international data.<br><br>Evidence-base analysis will ensure that the most appropriate interventions for each patient are used. Ineffective and obsolete products and practices can be identified and discontinued, new, better interventions introduced, as well as patients who would benefit most from certain interventions identified.<br><br>Without good scientific evidence, the uptake of health interventions could be influenced by a range of personal, institutional and financial factors. This may result in suboptimal health outcomes and inefficient use of resources. |
| **Research components** | To achieve this theme and identify potential intervention points that will improve population and personal health outcomes the key components are the collection and analysis of information.<br><br>Currently, a large amount of important public health data is missing because it is either not being collected or is not available for analysis. Missing data can have a significant effect on the conclusions that can be drawn. As sharing information electronically becomes easier we have a significant opportunity to collate information for analysis, particularly for larger datasets where information may be collected by a number of organisations.<br><br>To inform best practice in New Zealand's health system, New Zealand data needs to be systematically collated and analysed along with international data. |
| **Theme 2**<br><br>**To target interventions to maximise benefits and reduce risk** | |
| **Importance to New Zealand** | Healthcare spending using current models of care and intervention processes is likely to outstrip New Zealand's ability to pay within a decade (Ministerial Review Group report, 2009).<br><br>Throughout the continuum of care, greater scrutiny is needed to ensure that health interventions provide a tangible benefit to health at the personal and/or population level and that negative impacts of interventions are avoided or mitigated. Intelligent analysis would ensure that the best interventions are used at the right time for people or populations.<br><br>The reshaped National Health Committee (NHC) is already looking at new interventions at the personal level (e.g. surgical and non-surgical interventions) and beginning to consider the benefits of existing personal health interventions as well as population level interventions.<br><br>Focussing our investment where there is the most benefit will ensure the country makes the best use of our scarce health resources and continues to enjoy a high- |

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| | quality health system and high-health status.<br><br>Better analysis and intelligence will support the health system to:<br>• focus on interventions that will make a difference<br>• focus interventions on the people and situations where it will make the greatest difference<br>• avoid implementation of interventions in situations where benefit is likely to be minimal or of questionable value.<br>• prioritise and re-prioritise resources<br><br>Informing the current and future direction of the New Zealand's health system. |
| **Research components** | This theme is dependent on those functions that integrate information from various health care databases to produce information that will provide cost-benefit and cost-effectiveness analysis.<br><br>The main research components would be:<br>• Epidemiology if infections and non-infectious diseases (including hospital, clinical and pharmaco epidemiology)<br>• Pharmaco-economics<br>• Microbiology<br>• Genomics<br>• Health economics<br>• Clinical trials<br>• Public health<br>• Health care and health care technologies<br>• Decision analysis and support<br>• Evaluation<br>• Cultural expertise<br>Migrating information from databases and platforms into analytical frameworks will enable potential interventions to be identified and trialled/ evaluated and recommendations made regarding future best practice.<br>Some examples include:<br>• Acute and chronic rheumatic fever is a target for Better Public Services.– Identifying risk factors for the various forms of rheumatic fever, which affect Māori and Pacific people disproportionately, attributable risk, and the cost-benefit of interventions to prevent the disease are a priority. The study of diseases in these populations call for different approaches to the gathering and use of epidemiological data.<br>• *Clostridium difficile* is a potential threat to health that has been realised overseas in outbreaks of disease caused by hypervirulent strains. Identifying new strains rapidly and identifying procedural, demographic, personal, genetic, institutional, and organismal risk factors for disease and for the absence of disease will be pre-requisites for the appropriate targeted management of this illness and modifiable risk factors.<br>• Clarifying the risk factors for challenging chronic diseases, such as diabetes and heart disease, and their complications in different populations in New Zealand and the benefits of different personal or population level interventions<br>• Understanding the impacts of personalised medicine where genomic information |

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| | may alter the benefit profile of an intervention (e.g. the efficacy of a pharmaceutical). |
| **Research Gaps and Opportunities** | The examples above include areas in which gaps and opportunities exist. In particular, there are many conditions for which the key preventive or therapeutic factors have not been identified, leaving healthcare without effective interventions.<br><br>In other areas, while evidence has been gathered overseas, it is not yet clear how that evidence can be applied to the multi-ethnic New Zealand situation.<br><br>Other gaps will clearly be found where we have, as yet, no knowledge on, for example, emerging disease, microbial or environmental, which may result from climate change or biosecurity incursions. New Zealand must be prepared scientifically and intellectually to effectively address these incidents as they arise. |

| **Entry ID** | **475** |
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| **Healthy, Productive and Resilient Kiwis: Addressing Non-Communicable Diseases, Addictions and Mental Health Issues** | |
| **Summary** | This challenge proposes to address and implement preventative strategies to deal with non-communicable disease, addictions, and other mental health issues. Research will identify the causes of such problems (i.e. what factors lead to addictions), and devise ways in which strategies to deal with these problems can be implemented and promoted to encourage healthy lifestyles. |
| **Theme 1**<br><br>**A supportive and responsive environment for better health and wellbeing** | |
| **Importance to New Zealand** | Goal: 90% of adolescents and adults are screened and offered intervention for smoking and the use of other harmful substances by 2020(or similar). Halve the prevalence of tobacco smoking by 2020, and by 2025 achieve the government's goal of smoking prevalence less than 5% |
| **Research components** | Investigating the obstacles in New Zealand to implementing proven, cost-effective interventions against NCDs, addictions and mental health issues.<br><br>Investigating environmental changes that bring economic and environmental benefits, as well as reducing the risk of NCDs, addictions and mental health issues.<br><br>Identifying the optimum mix of policy, regulation and education that will achieve the goal of making New Zealand smoke free by 2025.<br><br>Exploring the causes of harmful use of alcohol, including the role of the alcohol industry, and design and trial interventions to address these causes.<br><br>Investigating what lies behind New Zealand's "obesogenic environment", and trial interventions to reduce energy intake and increase energy expenditure.<br><br>Improving understanding of population profiles (genetic factors, cultural factors |

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| | etc.) for improved targeting of interventions to address issues causing low life expectancy.<br><br>Identifying and developing mitigations of individual and environmental factors that promote unhealthy or self-harming behaviour, long term negative health conditions and poor adherence to effective treatments. |
| **Theme 2**<br><br>**Promoting healthy lifestyles and empowering individuals** | |
| **Importance to New Zealand** | Goals: Reduce the morbidity/mortality of New Zealanders due to non-communicable diseases by 25% by 2030 (or similar). Reduce annual suicide rate by 10% by 2020 (or similar) Reduce prevalence of obesity by 5% by 2020 (or similar) |
| **Research components** | Improving the detection of risk factors, and develop interventions to tackle risk factors or identify effective management and monitoring of individuals with defined health risks<br><br>Developing understanding of factors impacting health literacy and self-management of personal health and risk and design and test potential interventions to enhance individual health care including nutritional, exercise and social media based. |
| **Research Gaps and Opportunities** | New Zealand has a significant number of people unable to contribute fully to the country's economic and social wellbeing due to non-communicable diseases (NCDs), addictions and mental health issues. Reducing the prevalence and seriousness of these diseases and issues will increase the well-being of the population; will significantly reduce welfare and healthcare costs; and will increase participation in the labour market and other positive contributions to society. |

# 3 Health Systems

The submissions in this group are shown with their underpinning themes in the table below. Each submission follows in full.

**Table 3: Summary of proposed challenges and themes**

| Entry Id | Challenge | Themes |
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| **63** | Specific guidelines and research has not yet been done into exercise guidelines for people with chronic illnesses and disability | 1. To determine the frequency, intensity, duration and type of exercise required to derive benefit for people with chronic illness and disability. |
| **144** | Develop and implement a national system for real-time identification, intervention and monitoring of mental health, addiction and lifestyle issues (MH & A) with significant benefit to the on-going health and wellbeing of New Zealanders | 1. All adolescents and adults have the opportunity to be electronically screened for mental health, addiction and lifestyle issues prior to consultation with their general practitioner or other primary health care provider and offered appropriate treatment<br>2. Specific populations of patients are identified on the basis of factors such as gender, age, ethnicity, clinical conditions, socioeconomic position, location and offered additional tailored and targeted MH & A and lifestyle screening<br>3. People in the community including secondary school students can complete electronic screening for mental health, addiction and lifestyle issues and be offered a range of self-care options and health literacy education<br>4. National repository of anonymised individual primary care and community screening data available for monitoring of MH & A issues at national regional (DHB, PHO) and practice levels to align service provision with need and improve through benchmarking. |
| **167** | To strengthen the evidence base for clinical decision making in reproductive and sexual health in order to improve health outcomes | 1. To summarize the evidence for a range of health care interventions for menstrual disorders and sub fertility<br>2. Identify the gaps in the evidence base for reproductive and sexual health<br>3. Improving birth rates in New Zealand |
| **216** | Improve stroke recovery and reduce stroke burden in New Zealand | 1. Understanding New Zealand's current and future burden from stroke<br>2. Developing best-practice based tool for self-management to improve post-stroke outcomes and recovery<br>3. Improving stroke outcomes for stroke survivors and their family caregivers in New Zealand |

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| | | 4. Translating the evidence into clinical practice |
| **297** | Neurocomputing technologies for understanding the mind, for engineering applications and for improving the wellbeing of the New Zealander | 1. Develop principally new methods for integrated processing of the enormous volume of multimodal brain data and knowledge, from a high level functioning, to genetic and molecular level, for a better understanding of brain cognitive processes and the mind<br>2. Develop principally new methods for brain data analysis related to brain damage prevention, brain disease outcome prediction and brain rehabilitation, including stroke, traumatic brain injuries, dementia, Alzheimer's Disease and other<br>3. Develop principally new software and hardware systems for neuromorphic computation and their engineering applications and applications to predict environmental and ecological disasters |
| **330** | Cost-effective health care for New Zealanders | 1. Evidence-informed decision making for healthcare practitioners and health consumers and policy makers<br>2. Evidence-informed decision making for healthcare consumers<br>3. Evidence-informed decision making for policy makers |
| **346** | Good end-of-life care for all New Zealanders | 1. Understanding the priorities of New Zealanders for end of life care<br>2. Establishing current experiences at the end of life for patients and their family/whanau<br>3. Developing new models of palliative and end of life care fit for an ageing population |
| **371** | To provide a health system that helps sustain the fitness and wellbeing of New Zealand's population while operating within a cost and revenue framework that ensures value for money and is consistent with the capacity of the economy. | 1. Biomedical technologies, fighting disease and addiction<br>2. Health self-management<br>3. Medical technologies, organisation and<br>4. Clinical practice |
| **404** | Building on advances in modern medicine, information technology and models of care to meet the future challenges for our nation. | 1. Utilising innovations in health IT and medical technologies to improve patient care and boost economic returns for New Zealand<br>2. Developing personalised medicine systems that give all New Zealand people the tools & information they need to better manage their own health<br>3. Innovations and new models of care that will |

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| | | meet the complex needs of an ageing population, that is both ethnically diverse & geographically spread<br>4. A systematic programme of comparative effectiveness reviews that will ensure that our scarce resources are being used to maximum effect with minimal patient harm |
| **415** | Achieving a Healthy New Zealand Population | 1. Novel drug discovery<br>2. Personalised Healthcare and Rehabilitation<br>3. Use of disruptive engineering technologies in the health sector |

| **Entry ID** | **63** |
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| **Specific guidelines and research has not yet been done into exercise guidelines for people with chronic illnesses and disability** | |
| **Summary** | A wide ranging challenge which incorporates development and co-option of existing technologies to improve sustainable production (for example in the agricultural sector), improving scientific infrastructure to better respond to potential biological/environmental issues. |
| **Theme 1**<br>**To determine the frequency, intensity, duration and type of exercise required to derive benefit for people with chronic illness and disability** | |
| **Importance to New Zealand** | New Zealand has a large population of older generations, and 1 in 4 people suffer from Rheumatoid arthritis, for example. Many others suffer from another form of chronic illness which causes strain to economy in the missed days of employment, also hospital and GP appointment and medical tests to monitor progression. If we can increase activity, we can increase self-management of chronic illnesses, even improve the severity of immediate symptoms and prevent further severity of the disease. |
| **Research components** | Physiotherapy background, medical knowledge and health psychology. |
| **Research Gaps and Opportunities** | The gap is that there has been no systematic approach in an experimental sense into developing the level of exercise required for benefit. There is also misinformation in the form of out dated warning about dangers of exercise for these groups. Furthermore there is the benefit of added employment if there were to be specialists that could be employed to implement any subsequent finding and derive the benefit researched. |

| Entry ID | 144 |
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| **Develop and implement a national system for real-time identification, intervention and monitoring of mental health, addiction and lifestyle issues (MH & A) with significant benefit to the on-going health and wellbeing of New Zealanders** | |
| **Summary** | This challenge proposes to develop and implement a national system for real-time identification, intervention and monitoring of mental health, addiction and lifestyle issues. This will integrate and make readily available to healthcare professionals relevant aspects of patient history such as previous drug dependence/mental health issues etc. This will allow more appropriate/personal treatments to be prescribed. |
| **Theme 1**<br>**All adolescents and adults have the opportunity to be electronically screened for mental health, addiction and lifestyle issues prior to consultation with their general practitioner or other primary health care provider and offered appropriate treatment** | |
| **Importance to New Zealand** | Summarised results of patients' issues with tobacco, alcohol, other drug misuse, gambling, depression, anxiety, exposure to abuse, anger control and physical inactivity are immediately accessible electronically at the pointy of care, including scored and interpreted results of additional tools if completed. This can be achieved using the New Zealand developed and validated electronic Case-finding and Help Assessment Tool (eCHAT) – see RESEARCH GAP and OTHER COMMENTS. The help question enables patients to prioritise issues and indicate willingness to change. Patient/provider conversations are facilitated and assisted by links to stepped-care decision supports.<br><br>There are substantial long-term health and disability costs of these multiple health risk behaviours which often go undetected. The growing burden of disabling and costly chronic disease in our aging population is likely to overwhelm our health system if not prevented and managed. Eighty per cent of New Zealanders visit their general practice at least annually. Routine multi-domain systematic screening and intervening for these conditions and high-risk behaviours in primary care addresses modifiable risk factors across the spectrum of health promotion, primary and secondary prevention through to chronic condition management. Māori, Pacific Island and socially deprived people often present at late stages of disease, thus electronic screening can help reduce health disparities by proactively identifying modifiable risk factors before they progress to chronic conditions, a cost-effective approach because it is administered pre-consultation. The clinician may initiate screening with patients or help them complete if partially finished. |
| **Research components** | Implement electronic screening into New Zealand general practices using participatory research action methodology to monitor and evaluate effects of innovation on improving practice. The instrument eCHAT is ideally placed to implement this screening. It has been shown to have high acceptability and validity with Māori, Pacific and Asian populations. For five domains positive |

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| | responses lead to added scored tools through branching logic (the WHO ASSIST for smoking, drinking, other drugs, PHQ-9 for depression, GAD-7 for anxiety).<br><br>Measure patient outcomes with respect to interventions delivered and changes achieved eg smoking cessation, reduced PHQ-9 depression scores. Positive screening links to stepped-care decision supports from self-management (information sheets, helplines, web-based resources including-therapy), practitioner-initiated (prescriptions, brief interventions) to community-based and secondary care referrals. There are possible research streams across the nine domains. Using a generic 'whole person' approach rather than a disease focus to screening, by combining multiple risky health behaviours and negative mood states acknowledges the co-existence and inter-relationship of these domains, and how intervening in one can have positive effects on another<br><br>Assess patient feedback to their access to the stepped-care decision-supports. Understand the process of implementing the system into primary care, embedding and integrating it into existing organisational and professional settings using Normalization Process Theory and methodology.<br><br>Explore this system as an exemplar for use of IT to integrate fragmented components of other aspects of the health system. |
| **Theme 2**<br>**Specific populations of patients are identified on the basis of factors such as gender, age, ethnicity, clinical conditions, socioeconomic position, location and offered additional tailored and targeted MH & A and lifestyle screening** | |
| **Importance to New Zealand** | The current electronic tool (eCHAT) is generic (gender, age and ethnicity-neutral). For five domains a positive screen triggers additional tools –ASSIST for smoking, alcohol and other drug use, PHQ-9 for depression and GAD-7 for anxiety. Repeating screening at a later date allows ease of tracking of patients' progress over time. Demographic and clinical data can be captured and then branching logic used to offer variations more suitable to specific sub-populations. Examples include youth-friendly versions with added tools such as assessing risky sexual behaviours and access to youth-specific e-therapies such as SPARX (self-help computer programme for young people with symptoms of depression), maternity-specific interventions and disease-specific screens eg for diabetes (healthy eating) or respiratory function). Ethnic groups and other vulnerable populations can be targeted for early prevention and intervention to reduce disparities. Patients could also identify if English is not their language of choice and translated versions be made available.<br><br>World Health Organization targets to address diabetes and non-communicable diseases include reducing smoking, harmful alcohol use and physical inactivity. Detecting and addressing MH & A issues in populations can result in significant health gains. Smoking, excessive alcohol use, problematic illicit drug use and problem gambling have a significant negative emotional and financial as well as physical impact on individuals, their families and the community. People with co-occurring conditions are more likely to be anxious and / or depressed, with a bi-directional relationship. Previously these issues have been identified and dealt |

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| | with as individual health issues rather than as co-occurring problems. |
| **Research components** | Identify at-risk groups, develop, test and implement the addition of demographic or condition-specific screening tests for various at-risk populations.<br>Evaluate the effect on patients and primary care practice staff in meeting health needs, developing care pathways and delivering specific clinical programmes.<br>Perform cost effectiveness analyses on introduction of targeted screening for mental health, addiction and lifestyle issues.<br><br>Summarised results are available to patients' health providers (eg general practice, practice nurse) at the point of care in the electronic medical record. Electronic screening facilitates the conversation between patient and provider. Stepped care support is then available for shared decision-making. First tier is self-management (information sheets, helplines, web-based resources including e-therapies), second is interventions provided by general practitioner or nurse (eg brief intervention, ABC Smoking Cessation, Green Prescription, medications such as nicotine replacement, antidepressants), next is referral to community-based services internal or external to practice or Primary Health Organisation (eg mental health or community worker, non-governmental organisations, private practitioner, customised to the practice) and finally referral to secondary services (eg Community Alcohol and Drugs Service, psychiatric services). Because there is extreme flexibility with the capability for on-going addition of interventions and pathways there is the capability to add or embed demographic (eg youth) or condition (eg pregnancy, chronic disease) specific tools and interventions. |
| **Theme 3**<br>**People in the community including secondary school students can complete electronic screening for mental health, addiction and lifestyle issues and be offered a range of self-care options and health literacy education** | |
| **Importance to New Zealand** | Patients screened for MH & A prior to a practice visit (eg where patients can access their own health record via a patient portal) using any device by which they access the internet (eg PC, mobile device, iPad) can have the suite of self-management (1st tier) interventions made available without having to consult their primary health care provider. Interventions include information sheets, helplines and website resources including e-therapies. Because self-management for chronic disease improves outcomes, decreases the primary care professional workload and reduces costs, it needs to become an integral part of high-quality primary care. Decile 1 to 3 secondary school students (whose schools have associated health clinics) can complete electronic MH & A screening with access to self-care plus clinic staff support. This could be entry into HEEADSS assessments. Similarly electronic screening can be conducted in settings such as marae and community centres. |
| **Research components** | Identify the issues detected by electronic screening in these various settings, the proportion where help is wanted and the interventions and resources accessed.<br>Evaluate using mixed methodology the impact of electronic screening and access to available resources on people using the electronic system in community settings. |

| Theme 4<br>**National repository of anonymised individual primary care and community screening data available for monitoring of MH & A issues at national regional (DHB, PHO) and practice levels to align service provision with need and improve through benchmarking** | |
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| **Importance to New Zealand** | The electronic screening system operates in a collaborative, multi-vendor, standards-based ecosystem using co-existing available toolsets for both vendor and customer applications. This implements integration, workflow and clinical pathways with integration across services, systems and programmes across the healthcare continuum. Healthcare providers collaborate by using National IT Board standards-compliant applications from numerous vendors deployed across different healthcare services. This ensures healthcare providers can access pathways from multiple healthcare services, reducing fragmentation by multiple funders of healthcare (eg Ministry of Health, DHB, ACC). This minimises "reinventing the wheel", avoids single vendor monopoly, creates an environment that encourages innovation in response to the evolving needs of the health system and enables change, particularly regarding models of care.<br><br>Currently identification of, and addressing, MH & A issues is fragmented and piecemeal with no unified dataset. While DHBs and non-governmental organisations contribute national MH & A information service activity and outcomes data to the PRIMHD datamart, there is no national primary care and community repository to measure change over time. Population surveillance can utilise a network of sentinel practices. At the DHB level screening data can help inform needs for secondary and community-based services. Data can assist addiction and mental health services co-existing problems initiative, to enhance integration of primary and secondary services. PHOs can use data to assess practice performance and meeting of targets. Individual practices can use data to audit their populations with respect to detected modifiable conditions and interventions delivered and identify patients with similar need, who then are offered group therapy. |
| **Research components** | Develop a data warehouse and analytical real-time population health tool to collate and analyse primary care and community-based MH & D data to monitor need and service performance, benchmarking and improving service effectiveness in accordance with the MH & A Blueprint II. Utilisation of aggregated individual level data of MH & A conditions and interventions provided using the electronic screening system will allow surveillance of trends and geographical variations, assessment of service needs and evaluation of performance through ad hoc queries, and case-finding for enrolment of patients into specific programmes. The system is a mechanism to provide primary care information on identification of mental health and addiction issues and provision of appropriate stepped-care interventions, from self-management to practice-delivered brief interventions and medications, community-level services (non-government organisations, government agencies such as WINZ) and secondary care services. At the national level electronic screening data will assist with population monitoring. This can be facilitated by use of sentinel practices. The tool would be tested at the national, District Health Boards, Primary health Organisations and general practice levels. |

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| | Explore means to integrate primary and community care MH & A population data with the secondary care PRIMHD (Programme for the Integration of Mental Health Data) dataset.<br><br>Collaborate with Workforce Centres (Te Pou, Matua Raki, Le Va, The Werry Centre, Te Rau Matatini) to incorporate their resources, including training materials for primary care workers, within the decision support platform for increased accessibility of resources primary care providers and collaboration between primary and specialist services. |
| **Research Gaps and Opportunities** | There are significant gaps in our knowledge as to how best assist people to make healthy changes (eg to their substance muses or exercise) or improve mood states and the relative effectiveness of different interventions and care plans. This system can facilitate such research. These evaluations are feasible to make and New Zealand has a pool of capable researchers who could conduct this work should funding be available. These include researchers working in the different MH&A and lifestyle domains such as tobacco control, mental health, addictions, physical activity, and prevention of violence. Such research is relatively inexpensive to conduct. This electronic screening can take less than a minute if all responses are negative, and even with positive responses to a number of issues it can usually be completed within five minutes.<br><br>While other multi-domain instruments exist, they tend to only deal with specific conditions (eg substance abuse, mental ill ness), disease states (eg diabetes) or populations (eg adolescent, elderly, pregnant) none are generic primary care tools combining lifestyle factors and mental health issues. The innovative help question allows patients to direct both their care and its timing by assessing their readiness for potential behaviour change. Threatening questions about illegal or sensitive behaviours are desensitised by being embedded within a broader context of questions addressing other issues. Patient-entered screening fosters self-management, enabling patients to identify positive changes they can make in their lives and then providing them with resources and support. |
| **Comments** | Research components can include evaluating the effects of screening and intervening in each of the nine domains discretely as well as their interaction eg the effect of increasing physical activity on other factors such as depression scores or smoking. Social interaction between patient and health provider can be studied using conversation analysis of videotaped consultations. Progressive roll-out of electronic screening system could enable randomised controlled trial of its effectiveness of patient outcomes and cost-effectiveness analysis. Research fields can include clinical evaluations and trials, epidemiology, health geography, health systems, health economics, sociology and psychology. The system can be the entry-point to test numerous interventions involving issues such as smoking and other drug cessation, addressing problematic drinking or gambling, treatment of depression and anxiety, addressing abuse issues, anger management and increasing physical activity.<br><br>Secure encrypted eCHAT completed by patients entered onto a web database then messaged to the electronic medical record (EMR). The screening system meets national (Health Information Standards Organisation, HISO) interoperability |

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| | standards, working with all electronic medical record compliant to the HISO 10014.2 Online Forms Architecture Technical Specification. This executes as an embedded application that provides context-specific decision support, retrieval of patient information resources and, where referral is required, identification of suitable providers combined with an electronic mechanism for doing and sending the referral during the consultation. Clinical data can be retrieved from the EMR, its referral forms and other embedded applications can write consult notes and other data back to the EMR and place summary documents into the inbox. |

| **Entry ID** | **167** |
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| **To strengthen the evidence base for clinical decision making in reproductive and sexual health in order to improve health outcomes** | |
| **Summary** | This challenge proposes to strengthen the evidence base for clinical decision making in reproductive and sexual health in order to improve health outcomes - Areas which are identified as needing significant research are; menstrual disorders/sub-fertility, reproductive/sexual health practices, and New Zealand specific birth rates. Generally, research will focus on systematic reviews of pre-existing literature in order to build up a sound and informed repertoire of knowledge (which will then be utilised in decision making/guidance etc.). |
| **Theme 1**<br>**To summarize the evidence for a range of health care interventions for menstrual disorders and sub fertility** | |
| **Importance to New Zealand** | Menstrual disorders are common and many women seek care from a general practitioner or gynaecologist about their problems with menstruation. In addition, many women require costly treatments including surgery and often they have to take time off work. Some women may end up with infertility problems that could have been prevented by better health care in adolescence. We are seeking to provide the best care for these women who may have a range of menstrual disorders such as fibroids and endometriosis. We will do this by summarizing the body of evidence for a range of interventions such as laparoscopic surgery and medications. |
| **Research components** | Systematic reviews of individual studies are considered the best evidence for clinical decision making. The Cochrane Menstrual Disorders and Subfertility Group is part of the global Cochrane Collaboration and produces systematic reviews of interventions for menstrual disorders and sub fertility. We have already produced 180 reviews which we aim to update every two years. Producing up to date reviews is important but a challenge and requires resourcing. The components of this theme are<br>1. Cover all topics in menstrual disorders and subfertility. We estimate that there are at least another 50 relevant reviews.<br>2. Update reviews every two years. |

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| | 3. Send out simple summaries to all relevant stakeholders such as GPs and gynaecologists in New Zealand.<br><br>4. Encourage the uptake of this information through working with guideline and protocol developers in New Zealand. |
| **Theme 2**<br><br>**Identify the gaps in the evidence base for reproductive and sexual health** | |
| **Importance to New Zealand** | By identifying the gaps we can plan a research agenda for primary clinical studies in reproductive and sexual health. This will allow for better selection of clinical studies to be made and for faster research outputs that can be implemented in clinical practice. For example, there is a lack of evidence about the use of the levonorgestrel intrauterine device for perimenopausal women with endometrial hyperplasia. Many of these women will end up with a hysterectomy when they could have been treated more simply with a levonorgestrel intrauterine device with considerable savings for the health sector as well as far less intervention for the patient. |
| **Research components** | 1. Undertake a stock take of the clinical trials and systematic reviews already undertaken.<br><br>2. Involve patients in identifying which topics are important to them. e.g. menstrual problems, subfertility etc.<br><br>3. Identify the gaps and prioritize a research agenda for sexual and reproductive health topics<br><br>4. Promote this agenda to research and research funding bodies. |
| **Theme 3**<br><br>**Improving birth rates in New Zealand** | |
| **Importance to New Zealand** | Most Western countries are facing a declining birth rate, particularly in Europe, Japan and in North America where the birth rate is as low as 1.2. In Australia when the birth rate fell below 2, the federal government arranged a payment at birth as an incentive to mothers to have more children. This strategy has been successful.<br><br>In New Zealand the birth rate is currently 2.1. It is likely that it will fall further if we follow international trends. Currently one in 6 New Zealand couples attempting to start a family has not been successful after one year of trying. As a result New Zealand should be concerned to maintain our birth rate by assisting women with infertility to receive the best possible treatment and also to encourage not to delay starting their family until it is too late. Furthermore fertility treatments are high cost, not funded completely by the public health system, and have only moderate success rates (at best only 20-30% live birth per cycle started) and therefore the stakes are high for both couples and health providers. |
| **Research components** | 1. Surveying women about the underlying reasons for delaying childbearing.<br><br>2. Identifying the current evidence for fertility - considering the body of evidence for treatment - what works and what doesn't work? |

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| | 3. Identifying gaps in the evidence.<br><br>4. Planning and supporting new clinical trials. e.g. Many fertility clinics use a combination of adjuncts such as steroids, antioxidants, growth hormone but there is no evidence for the effectiveness of these treatments let alone in combination.<br><br>5. Supporting new laboratory research to improve outcomes. E.g. Which culture media is superior. There are a range of products and few of them have been adequately tested against each other. |
| **Research Gaps and Opportunities** | There is a lack of well-designed clinical studies in reproductive and sexual health topics. By identifying the gaps and prioritizing research we should be able to make progress on improving reproductive and sexual health in New Zealand. |
| **Comments** | Reproductive and sexual health topics have had difficulty with funding in current research environments as there is a tendency to funding big ticket items such as cardiovascular disease and cancer. |

| **Entry ID** | **216** |
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| **Improve stroke recovery and reduce stroke burden in New Zealand** | |
| **Summary** | This challenge proposes to improve stroke recovery and reduce the economic burden of stroke patients (predicted to increase as the population ages). It will perform population based studies will allow both the current and future burden of stroke in New Zealand to be identified. With stroke such a prevalent condition, development of self-management guidelines for those recovering from stroke is predicted to be the most affordable/sustainable method of treatment/rehab. Improvement of health outcomes for stroke survivors in New Zealand will increase the quality of life for stroke-survivors (and their family), and also reduce their significant economic burden (i.e. through lost productivity). |
| **Theme 1**<br><br>**Understanding New Zealand's current and future burden from stroke** | |
| **Importance to New Zealand** | There are currently over 45,000 stroke survivors at any given time in New Zealand and this number is going to increase due to aging of the population and improved survival of stroke patients. Currently, only a fraction of stroke survivors discharged from hospitals do receive community rehabilitation for only a short period of time and most of the time stroke survivors do nothing to improve their recovery. On-going, and accessible and individualised rehabilitation is important for continued recovery and improvement in health and wellbeing after stroke. Given the increasing number of stroke survivors, health care New Zealand systems now and in future will not be able to cope with the community needs of stroke survivors requiring on-going rehabilitation. |
| **Research components** | Our on-going ARCOS stroke incidence projects provide a unique opportunity to provide accurate estimates of the on-going burden of stroke in New Zealand (including economic costs and community rehabilitation services) and its |

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| | projections over the next 10-20 years. We will be using population-based study designs (over 7000 stroke cases) to estimate the current burden and projects of the stroke burden due to aging of the population and better survival, including health economic estimates and needs required to reduce stroke burden in New Zealand. |
| **Theme 2**<br><br>**Developing best-practice based tool for self-management to improve post-stroke outcomes and recovery** | |
| **Importance to New Zealand** | Effective and affordable self-management care and rehabilitation via education and self-training is a highly sustainable strategy to improve the situation and reduce stroke burden among stroke survivors and their family caregivers. However, understanding of verbal and written stroke educational and training information is often poor. Effective learning tools to help stroke survivors and their caregivers to cope with the aftermath of stroke are lacking. This suggests a need for the development of more effective learning tools.<br><br>Observational learning is well established as one of the most effective tools for professional teaching and skill development, and as yet there is no evidence of its effectiveness post-stroke. We hypothesise that a theory-driven intervention based on observational learning presented through a DVD, as an adjunct to routine stroke education, may improve outcomes in both stroke survivors and their caregivers. |
| **Research components** | The role model observational learning tool for stroke recovery and coping (in DVD format) is currently based on best available evidence, including educational materials and books endorsed by the New Zealand Stroke Foundation, National Stroke Foundation of Australia, the World Federation for Neurorehabilitation and the World Stroke Organization. The DVDs will be provided by the New Zealand Stroke Education Charitable Trust.<br><br>The observational learning intervention DVD menu includes common areas of post-stroke care and rehabilitation/adaptation. The choice of the most relevant items for each participant will be based on patient-oriented goals as per discussion with and recommendations by the rehabilitation specialist or clinician involved in the trial at the time of randomisation (based upon a standard interview). These DVDs will field tested for their acceptability by stroke survivors and their family caregivers and the content of the DVD will be amended to meet the most current practice-based stroke recovery, care and rehabilitation tools that can be used by stroke survivors and their family caregivers for better post-stroke recovery at home or any other facilities, thus reducing the burden of stroke rehabilitation currently placed on community rehabilitation services while providing an unrestricted access to such DVD-based rehabilitation services. |
| **Theme 3**<br><br>**Improving stroke outcomes for stroke survivors and their family caregivers in New Zealand** | |
| **Importance to New Zealand** | Currently, only direct life-time cost of stroke in New Zealand is estimated over $450M per year. The indirect (e.g. costs due to lost productivity) and out of |

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| | pocket costs are likely to be in the order of 3-4 times of the direct cost. All these costs are projected to be doubled by 2030 due to aging of the population and improved survival of stroke patients. Any effective strategy to significantly improve recovery post-stroke has a potential of not only saving hundreds of millions of dollars to our economy but also improving quality of life for stroke survivors and their family caregivers. |
| **Research components** | The only scientifically proven way to test an effectiveness of clinical intervention is a randomized controlled trial. Therefore, the effectiveness of the suggested self-management DVD-based rehabilitation tool will be tested in the setting of a randomized controlled trial. Stroke survivors and their family caregivers (when available) will be encouraged to watch all or particular sections of the DVD video clips showing rehabilitation, care and/or coping strategies (as instructed by the rehabilitation specialist at the interview) to achieve the identified goal(s) as often as needed but no less than twice a week during the first month after discharge, once a week during the second month, and fortnightly during the third month after randomisation.<br><br>The first DVD educational session with some instructions (if required) will be carried out in-person at the time of randomisation. The participants will be offered an opportunity to phone the rehabilitation specialist should they have a question, whenever it is deemed feasible by the rehabilitation specialist, to maximize tailoring of the intervention to the participant's needs/goals. Participants assigned to usual care will not receive DVDs but may be given some recommendations by the rehabilitation therapist at the time of the interview as they would have normally receive from a rehabilitation specialist. All study participants will receive their usual care from their treating physicians and health specialists. Participants will be randomly assigned to receive standard stroke educational care or the observational learning intervention DVD plus standard stroke education. Commonly accepted outcome measures will be employed. |
| **Theme 4**<br><br>**Translating the evidence into clinical practice** | |
| **Importance to New Zealand** | Any new proven cost-effective clinical strategy needs to be translated into clinical practice to take full advantage of the new intervention (in our case, stroke self-management DVDs). However, several important steps need to be accomplished to allow this to happen. |
| **Research components** | This will include a marketing research, evaluation of best strategies to deliver stroke rehabilitation DVDs and evaluation of their acceptability, true generalizability and efficacy in the phase IV of the trial. |
| **Research Gaps and Opportunities** | The stroke self-management DVDs of the New Zealand Stroke Education Charitable Trust are the only currently available self-management DVDs in the world. They are the only stroke educational DVDs supported by the World Stroke Organisation. This project, if supported by the grant, will be endorsed by the World Stroke Organisation and if the trial is positive, the distribution of the DVDs will be supported by the World Stroke Organisation throughout the world. This will provide a unique opportunity for New Zealand to lead the world in stroke recovery |

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| | and reducing stroke burden. This trial will test a novel DVD-based observational learning tool distributed. Gaining direct evidence in assessing consistency of recruitment, compliance and efficacy across countries would be of immense public health advantage.<br><br>Results of this research will allow the clinical testing of a potentially widely applicable strategy to improve the health and well-being of both stroke survivors and informal caregivers. The role model observational learning tools to be tested in the study, if proved to be effective, could have a vital and positive impact on reducing the burden of stroke in our communities and worldwide. |
| **Comments** | This project is seen as a joint venture between National Institute for Stroke & Applied Neurosciences of AUT University, University of Auckland, Waikato University and New Zealand Stroke Education Charitable Trust. |

| **Entry ID** | **297** |
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| **Neurocomputing technologies for understanding the mind, for engineering applications and for improving the wellbeing of the New Zealander** | |
| **Summary** | The goal of this proposal is to develop neurocomputing technologies for understanding the mind, for engineering applications and for improving wellbeing. |
| **Theme 1**<br><br>**Develop principally new methods for integrated processing of the enormous volume of multimodal brain data and knowledge, from a high level functioning, to genetic and molecular level, for a better understanding of brain cognitive processes and the mind** | |
| **Importance to New Zealand** | Despite the wide spread ICT across all areas of science and everyday life, very little progress has been made in the development of principally new information processing methods. This fact is hindering now the further progress in science and technology. This is acutely seen in the area of brain data analysis. An enormous amount of brain data has been already collected, including brain structural and functional data under different conditions, molecular and genetic data, in an attempt to make a progress in medicine, health, cognitive science, engineering, education, neuro-economics, games, etc. Yet, there is no unifying computational framework to deal with all these types of data in order to better understand this data and the processes that generated it.<br><br>This theme will address this problem by offering for the first time new computational methods that will allow modelling brain data using the same computational paradigm that generated the data, namely neurocomputation and spiking neural networks in particular. New generic and specific methods and systems will be built using both data and prior knowledge about the source of data (the structure and functionality of the brain). This theme is addressing a fundamental goal of understanding cognitive processes, and ultimately understanding consciousness and the mind through neurocomputation. This theme will make use of data collected in New Zealand and elsewhere. There is enormous |

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| | benefit from this research both for the New Zealand society and economy at large, and for the mental, cognitive and intellectual wellbeing of each New Zealander. |
| **Research components** | 1. Novel neurocomputing technologies Develop novel neurocomputing methods, including spiking neural networks (SNN). SNN use the same information principle that generates data in the brain. New methods need to be developed to model and understand multimodal, complex, spatio-temporal brain data. New Zealand has one of the internationally leading groups in neurocomputing – the Knowledge Engineering and Discovery Research Institute (KEDRI, http://www.kedri.aut.ac.nz) at the Auckland University of Technology. KEDRI collaborates intensively with partners from Europe and China in this area.<br><br>2. Personalised modelling for personalised medicine Develop principally new methods for personalised data processing, including genetic-, ethnical-, clinical-, and personality data as well as environmental and ecological factors for a better prediction and prevention of a brain disease or harmful brain events. Neurocomputing will be the core of these technologies. Other statistical and mathematical modelling techniques will be included too. KEDRI has a patent on personalised modelling and a spin-off company Crunchouse already dedicated to this research. Working collaboration is established with the Chinese Academy of Sciences.<br><br>3. Applications of neurocomputing technologies for brain activity and brain-gene data modelling and for the understanding of cognitive processes Develop new methods based on neurocomputation for accurate brain data analysis, including: EEG, MEG, fMRI, genetic and other brain data in their spatio-temporal integration related to cognitive functions. KEDRI has already established working collaborations with partners from Europe and China.<br>4. Neuroinformatics science centre in New Zealand. Establish cross-universities, interdisciplinary Neuroinformatics Centre for advanced research and postgraduate study to attract postgraduate students nationally and internationally (e.g. http://www/ini.ethz.ch). |
| **Theme 2**<br><br>**Develop principally new methods for brain data analysis related to brain damage prevention, brain disease outcome prediction and brain rehabilitation, including stroke, traumatic brain injuries, dementia, Alzheimer's Disease and other** | |
| **Importance to New Zealand** | Brain damage is influenced by multiple triggering factors over a certain time period preceding the event occurrence. Many of these events are preventable if early predicted. For example, 90% of the more than 15mln new cases of stroke that occur globally every year could be prevented. Many of the Alzheimer's Disease (AD) cases can be predicted and prevented having in mind that the predicted number of AD patients in the USA in 2050 will be more than 15 million.<br><br>The number of cases in New Zealand is also dramatically increasing. Brain injury (BI) is a leading cause of disability and death in youth and early middle age in New Zealand (New Zealand) and internationally, having a significant impact on the individual, their immediate and extended family, friends, and society. Current evidence suggests there are about 5 million deaths from BI worldwide with half of |

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| | these due to traumatic brain injury (TBI). Once a brain damage has occurred, could the outcome of certain treatment be predicted and could rehabilitation process improve through the use of smarter information technologies?<br><br>There is an enormous amount of brain data collected related to brain diseases and brain damage, including clinical, molecular, personal etc. Unfortunately, there are still no efficient machine learning methods for the analysis of this data and for the early diagnosis, prediction, prevention and rehabilitation for most of brain diseases. This theme will develop such methods based on neurocomputing and personalised modelling for the benefit of the New Zealander and the science at large. |
| **Research components** | Neurocomputation for brain damage/disease risk evaluation. Develop principally new information methods and systems based on neurocomputation for data analysis, modelling and understanding, related to brain disease/damage risk evaluation, including stroke and traumatic brain injury.<br><br>Neurocomputation for brain disease outcome prediction. Develop principally new information methods and systems based on neurocomputation for data analysis, modelling and understanding, related to brain disease/damage outcome prediction and design of optimal treatment.<br><br>Neurorobotics, neurorehabilitation and neuroprosthetics. Develop principally new information methods and software and hardware systems based on neurocomputation for helping disabled people as a result of brain damage/disease. Develop neurorehabilitation robots and neuroprosthetics. |
| **Theme 3**<br><br>**Develop principally new software and hardware systems for neuromorphic computation and their engineering applications and applications to predict environmental and ecological disasters** | |
| **Importance to New Zealand** | Enormous amount of data has been collected from environmental and ecological processes that are spatio-temporal by nature. A vast amount of knowledge has been accumulated. Still, there is no efficient way to process this information and to predict many events that bring disasters and destroy the environment. Existing methods have been 'recycled' with little success blaming the complexity of the problems. New Zealand and its population are particularly vulnerable in this respect.<br><br>New information methods and neuromorphic systems for spatio-temporal data modelling and pattern recognition have just been released. They were developed by a New Zealand team – KEDRI (www.kedri.aut.ac.nz) [name removed to protect privacy OIA: 9(2)(a)]. in collaboration with European partners and funded by the EU FP7 (http://ncs.ethz.ch/projects/evospike/). It is important that these methods and systems are applied for the benefit of New Zealand and the New Zealander and new methods and systems are further developed in terms of robotic applications and environmental and ecological disasters prediction |
| **Research components** | Develop new type of robots that use neurocomputers for smart information processing and decision making. Neuromorphic chips and systems for |

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| | engineering applications have been already developed (e.g.: http://ncs.ethz.ch). New methods based on SNN have also been recently developed by New Zealanders for complex spatio-temporal data modelling and pattern recognition (http://ncs.ethz.ch/projects/evospike).<br><br>This research will apply the hardware and the methods developed for smarter robotic systems and for automated control of vehicles. 2. Neurocomputation for the prediction of environmental and ecological disasters. Develop new types of information systems based on neurocomputing for environmental and ecological disasters prediction. This theme will bridge the gap between existing neurocomputing software and hardware systems and methods for data analysis on the one hand and the need of data analysis and event prediction in ecology and environment for the benefit of New Zealand on the other hand. This research includes the development of systems based on neurocomputing for the prediction of events based on spatio-temporal data. Applications will include: earthquake prediction; establishment of harmful species in New Zealand |
| **Research Gaps and Opportunities** | Enormous volume of data has been collected across almost all domain areas of science and technology. That includes: various data related to the brain and the mind (e.g. EEG, fMRI, genetic); brain disease data; environmental and ecological data. It is well understood that proper and efficient analysis of these data is of utmost importance. Yet, there are no efficient computational methods that can deal with complex, heterogeneous spatio-temporal data and that can integrate different sources of data, information and knowledge. The challenge is obviously to Information and Computer Sciences in collaboration with other sciences.<br><br>This research proposes a solution through the development and utilisation of novel neurocomputing methods and systems. The full utilisation of the proposed challenge will make it possible to bridge the gap between the available enormous amount of data and the still little understanding of cognition, the mind and natural processes. That will boost research and technologies across many disciplines, such as ICT, health, medicine, cognitive science, economics, ecology, and environment.<br><br>Most importantly, it will improve the wellbeing of the individual New Zealander. New Zealand has the reputation and the resources to conduct this research at the frontiers of science. The Knowledge Engineering and Discovery Research Institute (KEDRI, http://www.kedri.aut.ac.nz) at the Auckland University of Technology is already established internationally as a leader in the field. KEDRI has partnering institutions in New Zealand such as the National Institute for Applied Neuroscience and Stroke (NISAN) and the National Center for Bioprotection, along with other organisations. It is actively collaborating with partners from Europe (e.g. Institute for Neuroinformatics, ETH Zurich, http://www.ini.ethz.ch) and China (Chinese Academy of Sciences Institute for Automation and Shanghai JiaoTong University). |
| **Comments** | Despite the funding that has been given so far to the area of mathematical and information sciences in New Zealand, there has been very little achieved in terms of the development of principally new and more efficient data analysis, data mining and machine learning methods. Perhaps, one of the exceptions is the |

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| | analytical tool developed, patented and used in Pacific Edge Biotechnology Ltd (http://www.pebl.co.nz).<br><br>The proposed challenge will contribute to the area of ICT with a new direction for the development of information science and machine learning in particular, resulting in principally new software and hardware system development with various applications in medicine, health, cognitive systems, robotics, brain-computer interfaces, environment and ecology. It can potentially lead to the establishment of a new standard for modelling and study of data related to cognitive processes and ultimately – to understanding consciousness and the mind, utilising fully available brain data and accumulated knowledge across disciplines.<br><br>New Zealand has leading scientists in the area of neurocomputing, personalised modelling and brain data analysis. [Individuals' names removed OIA: 9(2)(a)] |

| **Entry ID** | **330** |
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| **Cost-effective health care for New Zealanders** | |
| **Summary** | This challenge proposes to ensure that the health care system uses the most effective interventions to keep people well and to optimise their care. Ensuring this will involve; Developing or adapting guidelines or evidence-informed resources to ensure the most effective treatments for the majority are used in the first instance, communicating this information to health practitioners, identifying the need for Clinical trials where vital evidence is missing, and working with consumers to look at ways to promote access to unbiased, reliable and understandable sources of healthcare information. |
| **Theme 1**<br><br>**Evidence-informed decision making for healthcare practitioners and health consumers and policy makers** | |
| **Importance to New Zealand** | Currently health care practitioners find it difficult to sift through the myriad of health care information to determine which information is reliable, based on a strong foundation of evidence and is appropriate for the New Zealand context of care. Why important: New Zealand has an aging population, threatened epidemic of obesity, inequitable outcomes and a limited healthcare purse. There is a need to ensure that health care system uses the most effective interventions to keep people well and to optimise their care. |
| **Research components** | • Identify where we have evidence and where there are gaps<br>• Develop or adapt guidelines or evidence-informed resources to ensure the most effective treatments for the majority are used in the first instance<br>• Communicate the information to health practitioners, identify the need for Clinical trials where vital evidence is missing |

| Theme 2<br><br>Evidence-informed decision making for healthcare consumers | |
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| **Importance to New Zealand** | Healthcare consumers can get a variety of conflicting information and advice, presented in many ways from publicly available sites. It would be beneficial for consumers to have access to accurate evidence-based healthcare presented in a way that is comprehensible and useful. Access to this information gives consumers the power to contribute to the discussions about their care and allows for safe and effective healthcare decisions to be made. |
| **Research components** | Conduct systematic reviews into the best ways to inform consumers • Provide access to unbiased, reliable and understandable sources of healthcare information • Work with consumers to look at ways to promote access to unbiased, reliable and understandable sources of healthcare information |
| **Theme 3**<br><br>**Evidence-informed decision making for policy makers** | |
| **Importance to New Zealand** | Policy makers need to make decisions about funding of national programmes as well as the overall healthcare budget. These decisions need to incorporate the public's desires and the government vision with the latest healthcare initiatives and effective treatments. |
| **Research components** | Provide a skill base (Centre of Evidence) to respond to policy makers need for prompt and accurate evidence-based information.<br><br>Develop guidelines, evidence-based resources and practice advice to explain the most effective use of existing and new healthcare interventions in the New Zealand environment.<br><br>Conduct systematic reviews and health technology assessments to provide up to date information to under pin healthcare decision making |
| **Research Gaps and Opportunities** | New Zealand is one of the few OECD countries without a national centre to coordinate evidence-based activities. A new agency needs to be an independent body that can provide a skill base to assist policy makers, healthcare providers and consumers with their evidence needs with the ability to initiate new projects and co-ordinate the activity of existing groups and individuals working in these areas so that there is national consistency and co-ordination.<br><br>Currently New Zealand has many groups within in government, universities, DHB's PHOs etc that all undertake evidence based initiatives. However, these initiatives are not coordinated and we are doubling up on some activities and ignoring others entirely. We would like to recommend that we take a practical approach and consolidate our efforts to allow for the best evidence informed information to get to consumers, practitioners and policy makers alike. |

| Entry ID | 346 |
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| **Good end-of-life care for all New Zealanders** | |
| **Summary** | This challenge proposes to increase understanding of what is important to New Zealanders across different ethnic and cultural groups as a fundamental starting point to develop new models of palliative and end of life care. This will involve quantitative and qualitative research to explore current experiences of end of life and bereavement for people dying across all settings (home, hospice, hospital, aged residential care) and with different life limiting illnesses. |
| **Theme 1**<br>**Understanding the priorities of New Zealanders for end of life care** | |
| **Importance to New Zealand** | No national evidence regarding what New Zealanders prioritise at the end of life is available. Models of palliative and end of life care delivery in New Zealand have been adopted from the UK and are not informed by the views and/or experiences of the general public and those with experience of life limiting illness and bereavement. Within the next 15 years, the numbers of people dying who could benefit from palliative care is estimated to reach almost 20,000 annually; many more family and whanau are also affected during their relatives' illness and following bereavement. Only a small minority of people with life limiting illness have access to hospice and specialist palliative care services. Understanding what is important to New Zealanders across different ethnic and cultural groups is a fundamental starting point to develop new models of palliative and end of life care which acknowledge the context of an ageing population and constrained health resources. |
| **Research components** | Identify priorities at the end of life amongst New Zealanders, paying particular attention to differences by ethnic/cultural group.<br><br>Engage communities in public debate about what a 'good death' means within the unique New Zealand context. |
| **Theme 2**<br>**Establishing current experiences at the end of life for patients and their family/whanau** | |
| **Importance to New Zealand** | No national picture exists regarding the quality of palliative and end of life care delivery in New Zealand and the extent to which it meets patient and family/whanau need. Significant, and growing, numbers of people are affected by deaths from life limiting illness in New Zealand every year. End of life is the most expensive time for the health service, but does the investment translate into optimum patient and family/whanau outcomes? |
| **Research components** | Quantitative and qualitative research to explore current experiences of end of life and bereavement for people dying across all settings (home, hospice, hospital, aged residential care) and with different life limiting illnesses. |

| Theme 3<br><br>Developing new models of palliative and end of life care fit for an ageing population | |
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| **Importance to New Zealand** | Ageing populations, coupled with constrained health care resources, pose significant challenges for ensuing high quality, equitable end of life care which is in line with patient and family/whanau preference. Current patterns of care are typically reactive and over reliant on expensive, and often unwanted, hospitalisations and medical intervention. Patients also have very few opportunities to make decisions about the care and treatment they receive. There is significant potential to better utilise limited health care resources to meet patient and family/whanau need. A predicted significant increase in mortality over the next 20 years means current models of care delivery are unsustainable for New Zealand. The World Health Organisation has identified developing new models of end of life care fit for an ageing population as a global public health priority. |
| **Research components** | Interrogating and costing current patterns of service utilisation in the last year of life in relation to patient/family preference for, and satisfaction with care.<br><br>Using economic modelling techniques and research evidence to develop and trial new models of care. Priority to be given to identifying models that develop capacity in palliative and end of life care, and strengthen specialist-generalist partnership working, in non-specialist settings (e.g. Aged Residential Care). |
| **Research Gaps and Opportunities** | Very little research exploring palliative and end of life care has been conducted in New Zealand. Models of care have been imported from other countries. This is worrying given the culturally specific nature of death and dying. Current patterns of care are also not economically sustainable given the context of an ageing population and the increasing medicalization of dying. Providing good end of life care has been identified as a marker of our health as a society. This challenge provides a significant opportunity to develop new, sustainable models of end of life tailored to the unique New Zealand context. |

| **Entry ID** | **371** |
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| **To provide a health system that helps sustain the fitness and wellbeing of New Zealand's population while operating within a cost and revenue framework that ensures value for money and is consistent with the capacity of the economy** | |
| **Summary** | This challenge aims to develop/provide a health system that cost-effectively sustains the wellbeing of New Zealand's population. Research will be aimed at enhancing health sector performance through; basic and applied bio/medical research (i.e. improved early stage detection and treatment of disease), promoting healthy self-management, developing innovation technologies that improve the delivery of healthcare (i.e. infrastructure and information management), and improving the efficiency and efficacy of clinical practice. |

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| **Theme 1**<br><br>**Biomedical technologies, fighting disease and addiction: To develop and apply medical research discoveries, such as new and improved early stage detection and treatment of disease, that will enhance health sector performance** | |
| **Importance to New Zealand** | Many common diseases including cancers, infectious, neurological and metabolic diseases are diagnosed relatively late when treatment options are restricted and expensive. Specific early-stage diagnostics and therapeutics have potential to reduce the burden of disease by tailoring and more accurately targeting treatment at an early stage. Screening bioactive compounds for new and improved therapeutics, ranging from drug discovery to natural or complementary medicines, offers significant potential to generate health benefits for the community.<br><br>Similarly, better understanding disease provides insights for the development of more effective treatment regimes which may also be expected to reduce the cost of common environmental (including life-style) and infectious diseases. Emerging resistance to antibiotics is an example of the need to develop new therapeutics. Other common diseases including diabetes need better therapies.<br><br>New Zealand has expertise to contribute strongly to development of better treatments both locally and internationally. BERL's estimate of the cost of drug addiction in New Zealand is $7B pa (BERL 2009). Other countries face correspondingly daunting statistics. Finding solutions to drug addiction would materially benefit New Zealand's social and economic wellbeing and meet a strong demand from overseas jurisdictions suffering similar consequences of drug addiction. |
| **Research components** | Application of core science disciplines for the discovery and development of drugs, vaccines and other treatments (genomics, proteomics, neuroscience, chemical genetics, cell and molecular biology, chemistry) behavioural science, personalised medicine, translational medicine, clinical trials capability. |
| **Theme 2**<br><br>**Health self-management: To promote health self-management as a way to improve population health while reducing health costs, by for example, mitigating the impact of lifestyle factors on the incidence of disease and introducing better performing medical d** | |
| **Importance to New Zealand** | New Zealand has a burden of lifestyle diseases for which achieving environmental and behavioural change across the population will be important to improving health outcomes. Even for non-lifestyle diseases there are environmental and behavioural changes that will contribute significantly to cost effective healthcare treatments. Identifying the modifiable causes of the lifestyle contributions to diseases and finding ways to remove or palliate them will make a substantial reduction to the burden of disease on the health system, will improve quality of life and will reduce health care costs.<br><br>Health self-management combined with professional healthcare is likely to result in a less costly and more effective health system than one involving healthcare alone. New and improved medical devices offer another opportunity to extend health self-management, improve patient outcomes, and reduce medical cost. The |

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| | development of devices that can monitor and assess patient physiology and function and remotely communicate to healthcare professionals facilitates patient care in the home and at remote locations, offering benefits in terms of the quality of health care and health delivery costs.<br><br>Similarly, development of simple, standardised and intuitive medical devices will enable users, whether health professions or patients, to confidently and competently use new and advancing biomedical technologies for better health outcomes within limited budgets. |
| **Research components** | Sociology, psychology, relevant clinical disciplines, nursing, nutrition, exercise science, health economics, industrial design, computing, engineering. |
| **Theme 3**<br><br>**Medical technologies, organisation and structure: To develop innovative new technologies that support delivery of primary, secondary and tertiary healthcare, including better medical devices, infrastructure, information management, and organisational sys** | |
| **Importance to New Zealand** | The tools available to medical professionals to assist them in their duties have a profound effect on the quality and cost of services provided and the success of health outcomes. Such technologies cover a wide range of non-medicinal products that enable the health system to operate, as well as operational and management tools that support the smooth and efficient functioning of the health system.<br><br>Further, operational issues have a determining effect on the performance of health systems, irrespective of how good the system's core health technologies are. The benefits of leading edge health technologies (both biomedical and medical), while critical to a high performing health system, are not sufficient alone to guarantee optimal performance of the overall system. The benefits of leading edge health technologies can be quickly dissipated by poor investment decisions and underperforming assets.<br><br>Efficient utilisation of capital (plant and buildings), a balanced mix of labour across the health workforce, and deployment of appropriate support technologies will be critical to maximising health sector productivity. |
| **Research components** | Industrial design, computing, engineering, nursing, information management, business management, psychology, health economics, computing science, sociology. |
| **Theme 4**<br><br>**Clinical practice: To identify areas where potential exists to make gains in the efficiency and effectiveness of health delivery and outcomes. Conduct studies to inform clinical practice and implement new and improved systems and processes within the heal** | |
| **Importance to New Zealand** | There is an opportunity to improve the efficiency and effectiveness of the health system by focusing on improvements in clinical practice; how the system operates, the medical principles that guide practice, and preferred treatment options. By focussing on big issues (prevalence, morbidity and/or cost) and challenging accepted wisdom the scope for qualitative and quantitative improvements in health care is substantial. |

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| **Research components** | Clinical research, clinical disciplines, translational research. |
| **Comments** | The real cost of the provision of public health care in New Zealand has been increasing at more than twice the growth of GDP over the period 2000-2010 ("Health Expenditure Trends in New Zealand 2000–2010" Ministry of Health, 2012). Both demand and supply-side factors are major contributors to this cost escalation, including changing demographics and advances in medical technologies. The issue for New Zealand, however, is that such cost increases cannot continue unabated. Ways of optimally employing a mix of workforce skills, medical technologies, physical resources, and clinical and management practices must be found that will ensure quality health care within a manageable budget. This proposal involves four schools at Victoria University, two other universities, two CRIs, two independent research institutes, and a DHB. |

| **Entry ID** | **404** |
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| **Building on advances in modern medicine, information technology and models of care to meet the future challenges for our nation** | |
| **Summary** | This challenge proposes to develop and build on innovative advances in health IT, in order to establish systems that meet the future health needs of New Zealand. This will involve developing medical technologies that improve patient care (such as a standardised patient-record keeping system), which will allow the establishment of personalised medical systems that allow better self-management of health, and will meet the complex needs of an ethnically diverse, aging population (e.g. if patients themselves have access to their personal records they will be able to better monitor disease-risk factors). |
| **Theme 1**<br>**Utilising innovations in health IT and medical technologies to improve patient care and boost economic returns for New Zealand** | |
| **Importance to New Zealand** | Health innovation is an area of strength for New Zealand, and a number of exciting innovations are currently under development that will lead to better screening, earlier diagnosis of disease, better management of chronic diseases, personalised medicine, and reduced patient harm. We are a small country that is ideally placed to develop a standardised national patient records system that will provide better integrated care for our populations, wherever they are living. We also have the capacity to develop systems that will allow patients to participate more actively in monitoring and maintaining their own health. |
| **Research components** | 1. Development of new technologies supporting genetic, diagnostic or prognostic tests that will lead to improved healthcare for New Zealand patients.<br>2. Development of health technologies with the potential to significantly alter clinical practice.<br>3. Development of IT systems that allow authorised access to standardised patient records by any health-professional in the country. |

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| | 4. Development of IT systems that allow individuals to access their medical records, view their care plan and record their progress against personalised goals. |
| **Theme 2**<br><br>**Developing personalised medicine systems that give all New Zealand people the tools & information they need to better manage their own health** | |
| **Importance to New Zealand** | We need to harness unprecedented medical advances that can revolutionise the way the healthcare is delivered and empower people to work with their medical teams, families & communities for better health. |
| **Research components** | 1. Clinical use of tests for genetic markers that predict disease risks, responses to treatment and outcomes, and allow healthcare to be tailored to the individual.<br>2. Uptake of new technologies that allow individuals to monitor their risk factors at home & follow protocols to reduce their risks and optimise their health.<br>3. Use of computerised algorithms that assist health professionals in assessing risk and optimising treatment. |
| **Theme 3**<br><br>**Innovations and new models of care that will meet the complex needs of an ageing population, that is both ethnically diverse & geographically spread** | |
| **Importance to New Zealand** | As our population ages, we will have an increasing number of individuals with multiple conditions. The needs of, and levels of support for, our elders will differ according to ethnicity and we will need new models for better co-ordination of care. Telemedicine is of great benefit for a population as geographically dispersed as ours and there is still innovation and knowledge needed before we have the evidence and the tools to implement such services to best effect nationwide, in all population groups. |
| **Research components** | 1. Ethnicity-specific models of care that link the patient, their healthcare team, their family & their community in an interactive & adaptive model of care.<br>2. Increased use of telemedicine technology to improve health delivery in rural areas & access to specialist health care.<br>3. Use of models of care & uptake of technologies that allow older citizens to stay in their own homes for as long as they want to.<br>4. Innovations in rehabilitation that improve the chances of returning to independent living environment. |
| **Theme 4**<br><br>**A systematic programme of comparative effectiveness reviews that will ensure that our scarce resources are being used to maximum effect with minimal patient harm** | |
| **Importance to New Zealand** | In the practice of modern medicine, issues relating to comparative effectiveness are raised with every innovation in care, new treatment or protocol. The evidence to make an informed decision is often lacking. We must address this in a systematic way for an efficient and safe health system. In addition, as our knowledge increases existing practices and protocols are often called in to question. Accepted best practice has been found to be unsafe under particular |

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| | circumstances, and evidence is needed to establish new protocols for care. |
| **Research components** | 1. Cost-benefit and effectiveness analyses of new health technologies, treatments and models of care.<br>2. Comparative effectiveness analyses of treatment protocols, care plans and established practice in light of new or conflicting evidence.<br>3. Studies of the safety and cost-effectiveness of existing practices and treatments, where clinical evidence suggests that they may harm patients or waste resources. |
| **Research Gaps and Opportunities** | New Zealand is host to a large number of highly innovative health research projects and programmes. The first virtual organ developed through the Physiome Project – the heart – was created by a team at the Auckland University Bioengineering Institute. The advances in imaging technology and opportunities to enhance clinical practice are now under-development. Other advances include the development of a cordless heart pump, which will make a major difference to those needing a heart transplant.<br><br>Major advances in cancer treatment are underway in New Zealand, both through the development of drugs that selectively target the oxygen deprived areas of tumours at the Auckland Cancer Society Research Centre and through work in other major centres to develop new drugs toxic only to tumours and a cancer vaccine that mobilises the patient's own immune system to destroy the disease. Vaccines are also being developed to treat asthma and other allergic conditions. (Research hosted and driven by The Malaghan Institute.) Our engineers are developing novel artificial limbs and robotic aids and the food industry is constantly making advances in the development of foods with added health benefits.<br><br>Our cardiovascular researchers have identified a number of biological markers for development into diagnostic and prognostic tests, and we have neuroscientists and bioechemists working on similar tests to achieve earlier diagnosis and determine prognosis in Alzheimer's disease. A ground-breaking test for early diagnosis of bladder cancer is also under development.<br><br>Our public health researchers have developed advanced risk-prediction software and interventions that involve mobile phones to engage the public in reducing their own risks and modifying risky behaviours. There is nationwide interest in developing a standardised system for medical records and evaluating the cost-effectiveness of new technologies. The opportunities under this challenge are truly enormous.<br><br>The gaps in our knowledge are also large. The advent of new technologies may also create additional issues of access to the best possible care for older adults, rural communities and some ethnic groups. If we do not better understand and address the issues that underlie disparities, we risk making them worse and creating even greater pressure on communities and our already over-burdened health system. Major gaps also exist in terms of the knowledge needed to run our health system safely and cost-effectively. However, in all these areas we have the capacity and capability to address them, if better co-ordination, communication and networks are established. |

| Entry ID | 415 |
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| **Achieving a Healthy New Zealand Population** | |
| **Summary** | The goal of this proposal aims at achieving a Healthy New Zealand Population. Themes suggested include:<br>1. Identification of factors that contribute to the onset, maintenance and relapse to disease.<br>2. Novel drug discovery<br>3. Personalised Healthcare and Rehabilitation<br>4. Use of disruptive engineering technologies in the health sector.<br>The proposed research components included: regional models for disease transmission, instantaneous updates to local doctors of current infections, chemistry and chemical engineering of drug discovery etc. |
| **Theme 1**<br>**Identification of factors that contribute to the onset, maintenance and relapse to disease**<br>**Objective: Use genetic analyses, demographic analyses targeting specific groups, identification of environmental variables (including environmental toxins), to address Theme 1** | |
| **Theme 2**<br>**Novel drug discovery**<br>**Goal: Identifying indigenous resources, modifying traditional medications for greater selectivity, using chemical and biological analyses to find likely active ingredients, to address Theme 2** | |
| **Theme 3**<br>**Personalised Healthcare and Rehabilitation**<br>**Objective: Genetic, environmental and social factors, novel intervention, diet. Encouraging personal responsibility in rehabilitation. Development of homecare approaches, improved compliance. Preparing for demographic challenges in the health sector** | |
| **Theme 4**<br>**Use of disruptive engineering technologies in the health sector; Objective: Develop novel engineering solutions to address New Zealand and global health problems** | |
| **Importance to New Zealand** | The expected benefits from the four themes above have many aspects in common. Here we cluster these expected benefits into a generalised list:<br>• Lower social cost<br>• More engaged society<br>• More productive workplace<br>• Increased overseas earnings<br>• A better place to live and work<br>• Increased life expectancy<br>• Lower hospital admissions<br>• A better informed public regarding health issues<br>• Improved interlinking of health, engineering, science specialists with the New Zealand public |

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| **Research components** | Regional models for disease transmission. This will involve statistical and psychological methods to identify the fundamental aspects relating to the four themes.<br><br>Instantaneous updates to local doctors of current infections, using methods from operations research and communication theory.<br><br>Chemistry and chemical engineering of drug discovery. This is expected to involve New Zealand researchers in international research networks.<br><br>Design, marketing, construction of novel devices for rehabilitation from injury. This is an inter-disciplinary area, with many research components from each discipline area.<br><br>New engineering technologies for the health sector. An example would be replacing the x-rays used in dental laboratories with ultrasonic detection.<br><br>Plasticity theory – understand more thoroughly how the brain assists in remediation<br><br>Better linkages between engineering, brain plasticity, and the medical sector, to develop low cost, home-based technologies to assist those with disabilities |
| **Research Gaps and Opportunities** | A major research gap arises from the current, science-based funding system, and the health-based funding system, which largely separates the science and health professions into their own disciplines. Further, engineers have great difficulty in obtaining funding from either system. The opportunity from the Research Challenges is to better link these different communities, to obtain better health outcomes for New Zealanders.<br><br>If New Zealand is to address the increasing cost of hospital care, and the increasing age-based pressures on our health system, then engineering and web-based solutions will become of increasing importance, and will require increasing uptake. |
| **Comments** | The Themes above have been structured to resemble the standard concept of a cliff, with an ambulance at the bottom of the cliff, and construction of a fence at the top of the cliff. Theme 1 defines the topography of the health sector, helping to identify the cliff. Themes 2 and 4 define the ambulance at the bottom of the cliff – often we will be unable to avoid falling down the cliff. Theme 3 defines the fence at the top of the cliff.<br><br>New Zealand has excellent opportunities to succeed in niche areas of this general sector of business, either from novel drug discovery; designing and manufacturing novel devices for those with disabilities; producing novel disruptive technologies (eg, replacing x-rays by ultrasonic); or by developing technologies which will remove care from a hospital setting, and placing it into the home.<br>These are very significant economic and social opportunities for New Zealand, and New Zealand should consider this as a possible National Science Challenge. |

# 4 Aetiology

The submissions in this group are shown with their underpinning themes in the table below. Each submission follows in full.

**Table 4: Summary of proposed challenges and themes**

| Entry Id | Challenge | Themes |
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| **235** | To end the suffering caused by neurological disease and disorders: escalate the funding of world-class neurological research in New Zealand to achieve prevention, treatment and recovery goals. | 1. Identify current and future impact of neurological disease on the population of New Zealand.<br>2. Identify current neurological research being carried out across New Zealand.<br>3. Identify gaps in current research funding; escalate research with potential<br>4. Identify and implement prevention, treatment and recovery strategies |
| **276** | To investigate the underlying causes of cardiovascular disease, which will form the base to develop new clinical interventions, therapeutics and lifestyle attitudes to prevent and improve the cardiovascular health of New Zealanders | 1. Understand- Understand the underlying causes and consequences of Cardiovascular Disease in New Zealand<br>2. Prevent - Prevent the development of Cardiovascular Disease in New Zealand<br>3. Treat - Improve the health and management of patients with Cardiovascular Disease in New Zealand |
| **405** | Keeping New Zealanders healthy, productive and independent throughout life | 1. Understanding what keeps New Zealanders healthy<br>2. Health protection, promotion and prevention<br>3. Early and effective intervention<br>4. Diversity and health |
| **407** | Turning back the rising tide: Reducing the projected impact of chronic conditions on New Zealanders, their families and their health system | 1. Interventions that will positively impact on early development, resulting on better health in later life<br>2. Using science to change behaviour and reduce obesity<br>3. New treatments and technologies with the potential to substantially reduce the incidence and impact of cardiovascular disease<br>4. New treatments and technologies with the potential to substantially reduce the impact of cancer and diabetes |
| **424** | Lifelong Health | 1. A healthy start to life<br>2. Affordable medicine for a modern society<br>3. Aging Aotearoa. |
| **455** | Lifelong Health for All People in New Zealand - “Improve and | 1. A healthy start for all people |

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| | enhance lifelong health outcomes by considering WHO health determinants, a socio-ecological health perspective and the Treaty of Waitangi.” | 2. Health promotion and harm reduction<br>3. Accessible health resources for all<br>4. Contextualizing health |

| **Entry ID** | **235** |
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| **To end the suffering caused by neurological disease and disorders: escalate the funding of world-class neurological research in New Zealand to achieve prevention, treatment and recovery goals** | |
| **Summary** | This challenge proposes to identify and end the suffering caused by neurological disease and disorders within New Zealand. Currently, the treatment options for devastating neurological diseases and disorders are extremely limited, and cures do not yet exist. |
| **Theme 1**<br>**Identify current and future impact of neurological disease on the population of New Zealand** | |
| **Importance to New Zealand** | Currently, the treatment options for devastating neurological diseases and disorders are extremely limited, and cures do not yet exist. However, research carried out by New Zealand’s world-leading neuroscientists, and funded by The Neurological Foundation, has provided extraordinary insight into brain disease, and illustrates the global significance of the dedicated work being carried out in this country. Further, this work provides hope for the one in five New Zealanders who will be struck with a brain disorder in their lifetime.<br><br>By 2051, almost a third of New Zealanders will be aged 65 and over. Dementia cases in particular are expected to double unless researchers can find a cause, effective treatments, or ultimately, a cure. The incidence of stroke is also rising, and is forecast to become the biggest single cause of death and disability (stroke currently ranks second after heart disease, and is the biggest cause of long-term disability in this country). Research is key to finding the causes and cures of these disorders, and in the last few years, our neuroscientists have made significant findings in this rapidly advancing field. |
| **Research components** | Research component: Classify all neurological diseases by patient in New Zealand, gather quantitative data, then assign current and future costs - ensuring our ageing population is accounted for (dementia and other neurodegenerative diseases) |
| **Theme 2**<br>**Identify current neurological research being carried out across New Zealand.** | |
| **Importance to New Zealand** | There is much neurological research being carried out across hospitals and research institutions in New Zealand, but no body of information exists that can provide a complete overview. In order for Theme 3 to occur, this information |

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| | needs to be collected and prepared for analysis. |
| **Research components** | Research component: Capture data across all hospitals and research institutions to identify all current areas of neurological research being carried out across New Zealand. |
| **Theme 3**<br><br>**Identify gaps in current research funding; escalate research with potential** | |
| **Importance to New Zealand** | There is much world-class neurological research being carried out in New Zealand in specific areas such as neurodegenerative disease, stroke and multiple sclerosis. This research depends on continued funding over many years to progress it to therapy development. At the same time, many areas of neurological research do not have any funding allocated and no predominant, consistent research focus (migraine, motor neurone disease), yet these areas are critical as they affect thousands of New Zealanders. |
| **Research components** | Research component 1: identify and map areas of neurological research requiring urgent funding. Research component 2: identify promising areas of neurological research where funding should be escalated. Research component 3: identify future costs required across both gaps and developing promising research |
| **Theme 4**<br><br>**Identify and implement prevention, treatment and recovery strategies** | |
| **Importance to New Zealand** | Over the last four decades, the field of neurological research has established a strong position on the expansive medical research continuum in New Zealand. The Neurological Foundation remains the only dedicated neurological research funding body nationally, and we have worked hard to raise funds and maximise our resources in response to the growth of this field.<br><br>Our neuroscientists and clinical researchers have reached a standard of excellence that justifies a major funding commitment and the Neurological Foundation's substantial annual budget of $2 million is a measure of that. We recognise however that neurological research in this country has more leads than it has resources to pursue them. The number of high quality grant applications that we receive in each grant round reflects that, but the reality is that our research budget does not stretch to fund all worthy projects.<br><br>In 1972, the Neurological Foundation received five research grant applications; in 2012 it is likely this number will exceed 50. With an increase in the incidence of neurological disorders, it is crucial that the many scientists and clinicians committed to finding treatments and cures have the opportunity to progress their work. As our population ages and grows, so do the neurological disease and disorder statistics. We must continue to make greater strides forward into the future to meet this demand to end the suffering of today and prevent the suffering of tomorrow. |
| **Research components** | Research component 1: develop therapies for prevention, treatments and recovery for neurological disease. Research component 2: correlate these therapies into clinical practice. |

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| **Research Gaps and Opportunities** | The growth of neurological research has been driven by two main factors. The first is the reality of the social and economic burden of neurological disease as our baby boomers come of age and our population grows. Dementia beds are numbered, and hospital stroke units are full. Secondly, scientists, both in New Zealand and globally, are beginning to decipher the mysteries of the brain and the underlying mechanisms of brain disease. Treatments and cures for many disorders are within our reach in this lifetime, but committed, urgent funding needs to be secured to ensure progress can continue. The burden of neurological disease won't go away. New Zealand's neurological researchers have the talent, the commitment and the desire to keep recent momentum going - guaranteed funding is critical for them to make a significant contribution to achieving this challenge. |
| **Comments** | The Neurological Foundation is an independent body and charitable trust that raises funds to ensure this country's top neuroscientists can continue leading-edge research into neurological disorders. We share a noble vision with these scientists: to progress research so that significant advances can be made in the prevention and cure of neurological disorders. One day, this will greatly reduce the level of suffering and premature death from diseases of the brain and nervous system. Alzheimer's, Parkinson's, Huntington's and motor neurone diseases, stroke, multiple sclerosis, migraine, epilepsy and traumatic brain injury are just a few of the wide spectrum of disorders that are the focus of the research we fund. These disorders are brutal and uncompromising, and with the rapid growth of New Zealand's ageing population, an epidemic of neurodegenerative disorders is predicted in the coming decades. |

| **Entry ID** | **276** |
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| **To investigate the underlying causes of cardiovascular disease, which will form the base to develop new clinical interventions, therapeutics and lifestyle attitudes to prevent and improve the cardiovascular health of New Zealanders** | |
| **Summary** | By investigating the underlying causes of cardiovascular disease in New Zealand, new clinical interventions, therapeutics and lifestyle attitudes can be developed that improve the cardiovascular health of New Zealanders. Research into the underlying causes of cardiovascular disease will occur across a range of disciplines including genetic, cell and animal-based disease models in parallel with human samples. In addition to this, research will be carried out to identify life-style factors that prevent/encourage the development of heart-disease. |
| **Theme 1**<br>**Understand- Understand the underlying causes and consequences of Cardiovascular Disease in New Zealand** | |
| **Importance to New Zealand** | Cardiovascular disease is still the leading cause of death in New Zealand. Despite remarkable achievements in mortality rates over the past 50 years, more than |

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| | 10,000 New Zealanders died of diseases of the circulatory system in 2009. The increasing number of elderly New Zealanders and the forthcoming epidemic of obesity and diabetes mean that there is a significant chance of increases in the burden of cardiovascular disease in the future. More than the mortality burden, cardiovascular conditions can have a terrible impact on quality of life.<br><br>World Health Organization projections to the year 2030 indicate that cardiovascular disease will retain its position as the leading cause of death worldwide, and that cardiovascular disease will be the biggest cause of disability in high-income countries. Unusually for a high-income country, New Zealand must also struggle with the burden of rheumatic heart disease, in particular among Māori and Pacific Peoples. We can therefore expect an ongoing burden of cardiovascular disease in New Zealand, both on mortality and quality of life. However, we aim to challenge these projections, with the goal to understand, prevent and treat cardiovascular disease of New Zealanders.<br><br>As consequence we aim to reduce the mortality burden of cardiovascular disease below that of cancer and lung diseases, and improve the quality of life of people with chronic cardiovascular disease. With a concerted and planned approach, New Zealand has the opportunity to set an example to the rest of the world |
| **Research components** | The integrative focus across the following themes will be on the four major cardiovascular diseases, namely cardiomyopathies (diseases of the heart muscle), arrhythmias, atherosclerosis, and valvular heart disease. Theme 1 Understand<br><br>Component 1Pathophysiology and Biomarkers To understand the pathophysiology of the four major types of cardiovascular disease and to identify biological markers for the early detection. Both research components are strongly represented within HeartOtago (a consortium of cardiovascular researchers and cardiovascular clinicians located at the University of Otago and Dunedin Hospital). HeartOtago uses sophisticated genetic, cell and animal-based disease models in parallel with human samples (tissue and blood) to identify the underlying pathophysiological changes in the heart during cardiovascular disease. HeartOtago also recognises that obesity and diabetes are important lifestyle-induced factors that contribute to the development of the different types of cardiovascular disease. |
| **Theme 2**<br><br>**Prevent - Prevent the development of Cardiovascular Disease in New Zealand** | |
| **Importance to New Zealand** | Cardiovascular disease is still the leading cause of death in New Zealand. Despite remarkable achievements in mortality rates over the past 50 years, more than 10,000 New Zealanders died of diseases of the circulatory system in 2009. The increasing number of elderly New Zealanders and the forthcoming epidemic of obesity and diabetes mean that there is a significant chance of increases in the burden of cardiovascular disease in the future. More than the mortality burden, cardiovascular conditions can have a terrible impact on quality of life.<br><br>World Health Organization projections to the year 2030 indicate that cardiovascular disease will retain its position as the leading cause of death |

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| | worldwide, and that cardiovascular disease will be the biggest cause of disability in high-income countries. Unusually for a high-income country, New Zealand must also struggle with the burden of rheumatic heart disease, in particular among Māori and Pacific Peoples. We can therefore expect an ongoing burden of cardiovascular disease in New Zealand, both on mortality and quality of life. However, we aim to challenge these projections, with the goal to understand, prevent and treat cardiovascular disease of New Zealanders.<br><br>As consequence we aim to reduce the mortality burden of cardiovascular disease below that of cancer and lung diseases, and improve the quality of life of people with chronic cardiovascular disease. With a concerted and planned approach, New Zealand has the opportunity to set an example to the rest of the world. |
| **Research components** | The integrative focus across the following themes will be on the four major cardiovascular diseases, namely cardiomyopathies (diseases of the heart muscle), arrhythmias, atherosclerosis, and valvular heart disease.<br><br>Component 1: Education Actively promotes the importance, knowledge and understanding of lifestyle choices to the general public, especially our youth. |
| **Theme 3**<br><br>**Treat - Improve the health and management of patients with Cardiovascular Disease in New Zealand** | |
| **Importance to New Zealand** | Cardiovascular disease is still the leading cause of death in New Zealand. Despite remarkable achievements in mortality rates over the past 50 years, more than 10,000 New Zealanders died of diseases of the circulatory system in 2009. The increasing number of elderly New Zealanders and the forthcoming epidemic of obesity and diabetes mean that there is a significant chance of increases in the burden of cardiovascular disease in the future. More than the mortality burden, cardiovascular conditions can have a terrible impact on quality of life.<br><br>World Health Organization projections to the year 2030 indicate that cardiovascular disease will retain its position as the leading cause of death worldwide, and that cardiovascular disease will be the biggest cause of disability in high-income countries. Unusually for a high-income country, New Zealand must also struggle with the burden of rheumatic heart disease, in particular among Māori and Pacific Peoples. We can therefore expect an ongoing burden of cardiovascular disease in New Zealand, both on mortality and quality of life. However, we aim to challenge these projections, with the goal to understand, prevent and treat cardiovascular disease of New Zealanders.<br><br>As consequence we aim to reduce the mortality burden of cardiovascular disease below that of cancer and lung diseases, and improve the quality of life of people with chronic cardiovascular disease. With a concerted and planned approach, New Zealand has the opportunity to set an example to the rest of the world |
| **Research components** | The integrative focus across the following themes will be on the four major cardiovascular diseases, namely cardiomyopathies (diseases of the heart muscle), arrhythmias, atherosclerosis, and valvular heart disease. Theme 3 Treat |

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| | Component 1 Therapeutics: Develop new translational therapeutic strategies and interventions based upon new clinical and pre-clinical insights into pathophysiology to improve cardiovascular health.<br><br>Component 2 Lifestyle: Develop new effective approaches to lifestyle solutions needed to improve cardiovascular health. For both treatment components, the link between biomedical researchers and clinicians allows the development of new therapeutic approaches and effective lifestyle changes, which are focused on improving the cardiovascular health of New Zealanders. |
| **Research Gaps and Opportunities** | Despite all the effort made in the past decades on prevention in New Zealand and worldwide, the number of people suffering from cardiovascular disease continues to increase, especially amongst the Māori and Pacific communities. The major roadblock is our lack of understanding of the pathophysiology of most forms of cardiovascular disease. This lack of knowledge makes it difficult to specifically target the underlying problems, leading to ineffective treatment strategies. Even knowledge of the most studied of cardiovascular diseases, atherosclerosis, is often difficult to apply to today's patients, who are older, are more likely to be obese, are more likely to have diabetes, and are less likely to present with an acute heart attack than during previous decades. Patients are more likely to survive their heart attacks, and are often left with heart muscle damage, a risk of heart rhythm problems and sudden death, and the risk of later heart valve disease. A bottom up approach is needed to elucidate and understand the underlying mechanisms and allow new treatment targets to be investigated.<br><br>Although it is crucial to better understand the pathophysiology of cardiovascular disease, so we can treat it, in the long term the solution is the prevention of it ever occurring. Again, this can only be achieved by fully understanding the development of cardiovascular disease and its risk factors. This will permit us to advocate specific lifestyle changes designed to prevent the pathophysiological changes of the cardiovascular system. |
| **Comments** | HeartOtago (www.heart.otago.ac.New Zealand) is comprised of a team of internationally recognised cardiovascular researchers and cardiovascular clinicians located at the University of Otago and Dunedin Hospital. HeartOtago recognises that cardiovascular disease is the number one cause of death in New Zealand, with major consequences for both the health of the New Zealanders and the national Health Care costs. Therefore, the goal of the group is to expand upon traditional cell and animal models to better understand the molecular nature of cardiac disease in patients with cardiovascular disease and to translate the laboratory based cardiovascular research into the clinical setting to improve cardiovascular health. |

| **Entry ID** | **405** |
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| **Keeping New Zealanders healthy, productive and independent throughout life** | |
| **Summary** | This challenge proposes to maintain New Zealanders' health, productivity, and |

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| | independence across their lifespan. This will involve a paradigm shift in health research focus, from how to treat end stage disease-> to identifying the factors that prevent the onset of ill health. This will require an understanding of the genetic, behavioural, social, cultural, nutritional and economic determinants of health, disease and injury, and the interplay between these factors. |
| **Theme 1**<br><br>**Understanding what keeps New Zealanders healthy** | |
| **Importance to New Zealand** | Health research is already leading to new understandings of health and disease that will save both lives and money. However, we currently know much more about how to treat end-stage disease than we know about preventing the onset of ill-health to begin with. This is largely because there are so many diverse and changing influences on our health throughout the life-course. Virtually all major diseases are jointly determined by the interaction of our biology or individual genetic makeup, and a complex sequence of environmental factors – physical, chemical, biological, behavioural, psychological, social, cultural, nutritional and economic – to which we are exposed over the life-course. It is the interplay between our biology and our environment that is integral to the presence or absence of everything from stuttering to depression.<br><br>At the moment there are many more questions raised by the interface between our biology and our environment than there are answers or solutions. Are you likely to develop an addiction? Are you susceptible to a specific illness or disease? What makes us crave high-energy, high-fat, salty foods? We need to understand how our biology in interaction with the environmental determinants of health (physical, social, economic, cultural and nutritional), create and sustain disease, disability and health disparities.<br><br>What makes gaining this level of understanding so critical, is the knowledge that many of the health conditions New Zealanders suffer from are preventable. Obesity is currently poised to replace tobacco-use as the greatest single cause of preventable illness and death in the developed world and indications are that this will happen within the next generation. Obesity is a risk factor for many chronic diseases including type-2 diabetes, heart disease, hypertension, stroke, and certain forms of cancer. Obesity is also a significant complicating factor in treating chronic disease, compounding the length of time and cost of treatment and recovery. Soon, through understanding the interplay between genetic, behavioural, social, economic, environmental, cultural and nutritional factors affecting health, science will be able to predict a person's risk of developing common diseases such as diabetes, cancer and depression.<br><br>Exploring the pivotal relationships and interaction between genes and environment is key to attaining a better understanding of the determinants of chronic disease and lifestyle conditions, and to identify key risk and protective factors, which in turn, will enable us to develop more effective health protection, promotion and prevention strategies (Theme 2). It is potentially our greatest opportunity to reduce mortality and morbidity, and create a healthy population that ages well. |

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| **Research components** | 1. Understanding the behavioural, social, cultural, nutritional and economic determinants of health, disease and injury, and the interplay between these factors.<br>2. Understanding how the interaction between genes and environment influence the onset of disease and injury.<br>3. Identifying risk and protective factors that mitigate against risk and the onset of disease and injury. |
| **Theme 2**<br>**Health protection, promotion and prevention** | |
| **Importance to New Zealand** | Prevention and early intervention strategies are more effective in altering outcomes and reap more economic returns over the life course than those used later in life. It is vital that our health protection, promotion and prevention strategies and plans are based on the latest science and evidence, and that we continue to evaluate and test our approaches to identify what works, so we can continuously improve the success and efficacy of our public health programmes and policies.<br><br>While this theme is important and will make a contribution to improving the health of New Zealanders across a whole array of health issues, there are two areas in particular where we as a country need to make urgent progress in our protection and prevention efforts:<br>• compared to other OECD countries, New Zealand children experience high rates of infectious disease, injury, maltreatment, and overall mortality (OECD, 2009). We know that many adolescent difficulties including crime, substance abuse and mental health problems can be linked back to early childhood (Office of the Prime Minister's Science Advisory Committee, 2011).<br>• mental health problems are a significant issue, particularly for young people who have the highest prevalence rates for most major mental illnesses, which are often also associated with alcohol and drug misuse. New Zealand's youth suicide mortality rate is currently the highest in the OECD.<br><br>Even armed with new life-saving information, there are still the emotional, behavioural and financial circumstances that influence our choices. Unravelling what works and engaging New Zealanders in maintaining and enhancing their health is a considerable challenge. There is tremendous scope for innovation, and new technologies could play a vital role in addressing the 'human' element and enhancing our ability to engage with and maintain our own health.<br><br>If health researchers are given the opportunity to realise the potential on offer, individuals, populations and communities will have access to specifically developed and targeted interventions and preventions that are more effective than ever in preventing, reducing and managing disease and disability. The potential savings in health care alone are enormous. |
| **Research components** | 1. Developing new technologies that support and enable individuals to make healthy choices.<br>2. Developing effective prevention strategies based on diet and lifestyle approaches to improve people's health and independence.<br>3. Testing and improving the success rate of existing and emerging prevention |

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| | strategies, with a particular focus on protecting vulnerable children and youth mental health. |
| **Theme 3**<br>**Early and effective intervention** | |
| **Importance to New Zealand** | Just like prevention, early and effective intervention is key to improving the health and independence of New Zealanders, and for generating savings in the health system through a reduction in lost productivity, hospital care, and expensive drug and treatment regimes. We know that early intervention is the best way to optimise and achieve successful health outcomes, and contain healthcare costs.<br><br>However, the most successful interventions are those that are underpinned by a sound evidence base; that identify and target those most at risk; and that address the complex interrelationship between our biology, environment and health habits. We need science to better inform how we design, target, time and implement our interventions.<br><br>There is enormous opportunity to turn the rising tide if we focus some of our intervention effort on early-life. The right information, resources and skill sets, if offered and developed early in life, could drastically alter the risk profile, health status and life-span of several generations of New Zealanders to come. Similarly, honing our risk profiles will enable us to better target our resources for better effect (and in a more timely way), so we can address risk factors or harmful behaviours, such as, smoking and alcohol or drug misuse before they wreak a myriad of additional health consequences, offers considerable potential. Adopting effective and accurate screening tools, immunisation programmes and diagnostics are critical to the success of early intervention. There is tremendous scope to develop innovative tools and assistive technologies that will produce clear health and commercial gains. |
| **Research components** | 1. Intervention programmes aimed at setting healthy habits for life that cover and address all potential mediators of a healthy lifestyle, including diet, exercise, stress, sleep, addiction, work and living environments.<br>2. Effective and innovative tools and strategies for risk identification, screening, diagnosis and immunisation, with a particular emphasis on rheumatic fever, diabetes, cardiovascular disease and stroke.<br>3. Better public health services, with a particular focus on child health and maternity services, and help for smokers to quit. |
| **Theme 4**<br>**Diversity and health** | |
| **Importance to New Zealand** | Focused, coordinated and multidisciplinary research initiatives are needed to reduce health disparities and improve the health and wellbeing of New Zealand's most vulnerable populations. Equitable access to health and disability services and disparities in health outcomes, quality of life, and life expectancy, continue to be significant problems for New Zealand. New Zealand's young and older populations are considered vulnerable by international standards.<br><br>New Zealand's youth suicide mortality rate is the highest in the OECD. During the last two decades mortality has decreased steadily among non-Māori but only |

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| | minimally among Māori, with cancer mortality actually increasing for Māori. Research suggests that this is partly due to the fact that Māori access mainstream services later than non-Māori, thereby delaying effective treatment. New Zealand Māori males have a life expectancy of 9 years less on average than other New Zealand males. Additional striking health disparities include higher rates of cancer; dental carries; cardiovascular disease; birth defects; child mortality; diabetes; and asthma for poorer people in New Zealand. Pacific men and women are 50 percent more likely to die from avoidable causes than other New Zealanders. The Pacific infant mortality rate is 40 percent higher than the average for all New Zealanders. Pacific peoples have a 25 percent higher lifetime risk of diabetes and will lose an average of 12 years of life as a result.<br><br>There is an urgent need to find solutions to help reduce these disparities, as the implications for New Zealand's economy will be detrimental in the long-term. The challenge is to focus, coordinate and resource our existing research capability to tackle the growing problem of health disparities and the burgeoning health and economic costs associated with this ever-widening gap.<br><br>Given the significant challenges facing the New Zealand health system regarding access to appropriate care and the considerable inequalities and disparities in health experienced by our most vulnerable populations, there is a real need to explore alternative approaches to health care and service delivery by tapping into and building upon our wealth of cultural and community knowledge in order to develop more effective, appropriate and responsive interventions. |
| **Research components** | Equitable access to new, integrated, culturally relevant, affordable and effective models of care.<br><br>Appropriately targeted and tailored population-level, community and whanau-based interventions.<br><br>Technologies that assist people and their families/whanau to manage their own health. |
| **Research Gaps and Opportunities** | New Zealand has well recognised and established research expertise in many of the areas identified as critical to successfully achieving this challenge. We have strong research expertise working at the interface between obesity, diabetes and other lifestyle conditions. We have strong research expertise in the field of nutrition, with several researchers already turning their attention to the role of diet in the development of lifestyle diseases. We have a growing number of behavioural researchers who are taking a broader behavioural, lifestyle and environmental approach to understanding and addressing the problem of lifestyle disease in New Zealand communities and populations. We have a growing number of researchers focused specifically on lifestyle diseases in Māori and Pacific peoples whose goal is to generate culturally effective and relevant interventions and solutions. We also have growing research expertise and capacity with a focus on developing novel and innovative interventions to address the global obesity epidemic, such as trials involving electronic gaming to increase physical activity in children; a supermarket intervention trial to promote healthier food purchases, and the use of Geographic Information Systems (GIS) software to identify key environmental influences on diet and physical activity in New Zealand children. |

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| | New Zealand also has clear clinical research strengths. Importantly, our greatest intervention, diagnostic and health technology successes have resulted from the engagement of clinicians, primary care physicians and nurses in the research enterprise. New Zealand has a strong culture of innovation and a highly skilled clinical research workforce, who, given the tools and the opportunity is capable of delivering high-quality, relevant, innovative and cost-effective treatments, diagnostics, interventions and preventions. New Zealand has also developed critical mass around the significant population health issues facing New Zealand and New Zealanders.<br><br>Considerable opportunity exists to catalyse and co-ordinate the research effort in a way that establishes connections and maximises the opportunity for significant advancement, breakthrough and outcome. Obesity is a pressing national and international public health issue and a good example of where a concerted and co-ordinated approach will have demonstrable social, economic and health gains. It is anticipated that people working together across a variety of disciplines including human genetics, proteomics, bioengineering, bioinformatics, developmental plasticity, longitudinal research, indigenous research, population and community health, nutrition and dietetics, metabolism, pharmacology, exercise physiology, paediatrics, physiology, epidemiology, sociology, health services, health promotion, psychology, public policy, economics and political science, among others, will be necessary to comprehensively address this challenge.<br><br>New Zealand needs to encourage, incentivise and invest in a culture of knowledge translation and innovation. Taking advantage of the convergence of disciplines that underlies the most exciting and important discoveries in science relies on support for multidisciplinary and multi-sectoral teams of researchers as well as teams of researchers working with community groups, policy-influencers, practitioners, industry and others. Partnerships and collaborations will be a critical success factor for this particular challenge, as will our ability to make it easy to assemble teams of diverse and highly skilled researchers who can learn from each other and overcome disciplinary, institutional and geographical distances in order to address complex scientific and technological challenges.<br><br>Benefits for New Zealand in adopting this challenge include: a healthier nation overall and better quality of life for individuals, families and communities; a strengthened, efficient and responsive health system; rapid adoption of sound research into evidence-informed practice, programmes and policies; stimulation of economic development through discovery and innovation; and the opportunity to keep our best and brightest researchers, mentors and educators in New Zealand. |

| Entry ID | 407 |
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| **Turning back the rising tide: Reducing the projected impact of chronic conditions on New Zealanders, their families and their health system** | |
| **Summary** | This challenge proposes to proactively address the impacts of a predicted rise in chronic disease throughout New Zealand. The focus is on finding early determinants of chronic diseases, and developing preventative strategies that translate to improved health in later life. Research will focus on a variety of determinants at different developmental stages (i.e. developmental programming in the womb, epigenetic/genetic association, genetic heritability of disease), with a focus on nationally relevant diseases such as obesity, cancer, diabetes, cardiovascular. |
| **Theme 1**<br>**Interventions that will positively impact on early development, resulting on better health in later life** | |
| **Importance to New Zealand** | Our propensity to be overweight can be set in the womb - even before a woman knows that she is pregnant her dietary choices and restrictions flick genetic switches that determine the metabolic profile of her off-spring. There is now clear evidence that we are missing the opportunity to intervene very early in the life-course to prevent metabolic derangements from developing. Such intervention must occur in school-age children if future generations are to have better metabolic health.<br><br>Rheumatic heart disease is a major cause of preventable death and disability in Māori & Pacific people, who respectively endure rates that are 10 and 20 times greater than other New Zealanders. We can and must tackle the underlying causes to reduce this harm. Epigenetics, the study of how factors such as diet, environmental toxins, and lifestyle affect the expression of genes, is becoming increasingly important in cancer, but also cardiovascular disease, diabetes, and neurological disorders. The changes caused by these disruptions can become stable, inherited traits from generation to generation. |
| **Research components** | 1. Understanding developmental programming in utero and translating this knowledge into effective interventions.<br>2. Intervention programmes aimed at setting healthy habits for life in primary school children and their families.<br>3. Preventing rheumatic fever in childhood, especially in Māori & Pacific populations, to reduce cases of rheumatic heart disease in adulthood.<br>4. The epigenetics of cancer, cardiovascular disease and diabetes, addressing heritability of genetic risk. |
| **Theme 2**<br>**Using science to change behaviour and reduce obesity** | |
| **Importance to New Zealand** | Despite all that is known about healthy eating and the need for an active lifestyle, the incidence of obesity and diabetes continues to increase. We now understand that obesity is mediated by complex, interacting, factors that affect an individual's |

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| | ability to change their diet and behaviour. The 'calories-in-energy-out' view of obesity is challenged by new knowledge on the effects of sleep and stress on appetite control and the way our body stores fat. We now understand that there a strong links between obesity and cancer, that are only now being fully explored. |
| **Research components** | 1. Understanding the mechanisms of action of hormones controlling appetite and satiety and preventing cravings for high-energy foods.<br>2. Research aimed at understanding the links between obesity and other chronic diseases.<br>3. Interventions that incorporate all potential mediators of obesity, including diet, exercise, stress, sleep, addiction, work and living environments. |
| **Theme 3**<br>**New treatments and technologies with the potential to substantially reduce the incidence and impact of cardiovascular disease** | |
| **Importance to New Zealand** | Despite major breakthroughs in understanding, prevention and treatment, cardiovascular disease (CVD) is still the number one killer in the developed world, including New Zealand. Every year 35 per cent of deaths in New Zealand are attributed to CVD. About 80 per cent of these can be explained and were therefore not only premature, but also preventable. Prevention strategies have been less effective in Māori and Pacific communities and we still have few options to treat those with established damage and heart failure. Over the next year, 50,000 people around the world will die from heart failure and 3,000 will be saved by a heart transplant. Donor hearts will continue to be in very short supply, and we have no real alternative for effective treatment.<br><br>New Zealand has a particularly high incidence of rheumatic fever, leaving many young Māori and Pacific people with severe, irreversible damage to their heart valves. This impacts both on the quality and duration of their life. There are around 7,000 new strokes in New Zealand every year, and some 45,000 New Zealanders live with the aftermath of a stroke. Of these, a quarter are under 65 years of age. Just the direct costs of strokes costs this country $450 million annually. |
| **Research components** | 1. Identification of biomarkers and development of diagnostic and prognostic tests that will hasten diagnosis and improve treatment.<br>2. New treatments and strategies to improve the lives of those living with heart failure.<br>3. Non-invasive technologies for assessing heart function and cardiovascular response - and their incorporation into clinical practice.<br>4. Experimental advances in stroke prediction, early diagnosis and rehabilitation - and their translation into clinical practice. |
| **Theme 4**<br>**New treatments and technologies with the potential to substantially reduce the impact of cancer and diabetes** | |
| **Importance to New Zealand** | Cancer is responsible for nearly 30 per cent of deaths in New Zealand every year. Gains made in cardiovascular disease prevention may well contribute to increasing cancer deaths in older adults, as cancer is currently an inevitable |

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| | consequence of advancing age. Most people will develop cancer, if they live long enough. Cancer biology has proved to be immensely complex, with the genetic profile of tumours being as varied as that of the people they affect. It is not surprising that response to treatment varies greatly among patients.<br><br>New knowledge is changing our perception of the causes of cancer, with alcohol and obesity now thought to play a much larger role than previously thought. Approaches to cancer treatment are also being challenged, with some evidence emerging to suggest that in some cases therapeutic goals should be set at controlling cancer rather than eradicating it altogether with aggressive therapies – allowing the patient's own immune response to play a greater role. Meanwhile, novel compounds that deliver toxic drugs selectively to tumour tissues are under development in New Zealand and overseas, along with drugs that attack areas of tumours that have previously been immune to therapy because they do not have a good blood supply. A cancer vaccine is being trialled in New Zealand hospitals that utilises the patient's own immune system, priming it to identify and attack the tumour. This work will ultimately have a huge impact on the way that cancer is treated in the future.<br><br>Approximately 200,000 people are diagnosed with diabetes in New Zealand every year, and at least half that number again remain undiagnosed. Obesity in childhood is leading to an increasing number of children with type-2 diabetes – a disease that we can no longer describe as 'maturity-onset'. The number of children being diagnosed with type-1 diabetes is also increasing. Living with high blood glucose levels from such an early age leads to a much greater risk of damage to vital organs and vasculature and multiple, serious complications. Predictions show that diabetes will place huge stresses on the health system if current trends continue. If we do not improve our record of preventing diabetes and identifying affected individuals early to prevent complications, the consequences will be dire.<br><br>Diabetes is often thought of as a single disease, but nearly 100 new genes have been identified as involved in producing it in recent years. The technology exists to continuously monitor glucose levels, but not to link the results to automated insulin infusions – effectively creating an artificial pancreas. The aim of some major international research programmes is not to control diabetes, but cure it. |
| **Research components** | 1. Research focused on understanding, preventing, screening for, controlling and curing cancer - including personalised medicine to tailor cancer treatment and improve response.<br>2. Identifying pre-diabetes in high-risk individuals and communities, and development of effective, culturally appropriate interventions - including use of mobile phones and other technologies.<br>3. Research focused on understanding and curing diabetes, including genetic studies, beta-cell transplants and artificial pancreas technologies.<br>4. Research on prevention of type 1 diabetes mellitus, including development of vaccines and testing interventions in New Zealand populations. |

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| **Research Gaps and Opportunities** | Across the globe, governments are recognising that chronic diseases can only be addressed by large consortia of research teams, calling on disciplines of science that are not normally involved in medical research. Physicists, engineers, chemists and a host of other scientists are being brought together through major programmes in the United States and Europe. We are uniquely placed in New Zealand to co-ordinate and focus our best scientists with new funding<br><br>Now more than ever we need to bring a broad range of expertise to bear on these complex issues, across disciplines and borders. New Zealand and the United States share a strong research focus on diabetes, cardiovascular disease, cancer and obesity. Both countries have large Polynesian populations that are disproportionately affected by these chronic health issues. The potential for international collaboration with the USA and Europe is excellent.<br><br>In New Zealand, we have major strengths in cardiovascular research (including cordless technology to power heart pumps, diagnostic and prognostic markers, new treatments for heart failure, and a 'virtual' human heart). We have world-class groups looking at cancer genetics, cancer biology and drug development. We host two internationally renowned longitudinal studies linking genes, environment and behaviour to give a unique perspective on the causes, consequences and outcomes of non-communicable disease. We also have an institute devoted to the study of developmental programming – understanding how the intrauterine environment impacts on lifelong health and development. Our public health researchers have built valuable local knowledge resources on life-style risk factors and behaviours, whilst our agricultural research industry explores new advances in functional foods. There is great potential for a co-ordinated research effort to fully utilise the diverse skills and capabilities that have been built in this country and link with the global research effort in this area to provide powerful local solutions. |

| **Entry ID** | **424** |
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| **Lifelong Health** | |
| **Summary** | This challenge proposes to ensure lifelong health for New Zealanders. Research will focus on fertility/development (ensuring that new-borns are given the best possible start to life), effective strategies for disease prevention/early detection (with a focus on factors linked to relevant chronic conditions such as diabetes and obesity), and maintaining a good quality of life for our aging population. |
| **Theme 1**<br><br>**A healthy start to life - Lifelong health has its origins in early life.** | |
| **Importance to New Zealand** | The early years matter greatly for how a child's life turns out, across multiple important domains. There is no doubt that healthy foetal and child development is the foundation of prosperous communities. Maximising human potential is vital for |

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| | economic growth and national well-being. A number of diseases of national significance have origins in early life including heart disease, asthma, allergies, obesity, diabetes, and mental health problems. These health problems are placing a huge and escalating toll on New Zealand, making it essential to intervene as early in life as possible to ensure future health and well-being, and to reduce health care costs.<br><br>Given our status as a first world country, New Zealand has alarmingly high rates of childhood poverty and disease. We have one of the highest rates of obesity in the western world and it starts early in life. By the time our children are 2–4 years of age, 30% are heavier than they should be. Māori and Pacific children experience a disproportionate burden of morbidity and mortality. Hand in hand with our unique mix of ethnic backgrounds, comes the unique imperative to address these disparities. This Theme encourages us to refocus our traditional way of thinking about disease prevention, to place more emphasis on how developmental events impact on lifelong health. In doing so, we will safeguard the future health and well-being of our next generations. |
| **Research components** | This theme focuses on ensuring the best start to life possible for New Zealanders. A large body of scientific evidence now supports the notion that an adult's health and well-being (both physical and mental) is partially determined by the environment they were exposed to during critical stages of development early in life. If we focus resources on the goal of ensuring an optimal early environment for our children — i.e. a healthy start to life — then we are likely to see a decrease in the incidence of many of New Zealand's major health issues with resulting benefits at the level of the individual, the family, society and the economy.<br><br>Fertility, pregnancy, development and epigenetics<br>Healthy babies require healthy mothers. It is now well accepted that the health of the mother (both prior to and during pregnancy) has a significant influence on child development and lifetime risk of disease. For example, poor maternal nutrition during pregnancy and breast-feeding predisposes children to obesity, diabetes, high blood pressure and heart disease later in life.<br><br>Promotion of better maternal, and consequently offspring health, relies on an understanding of how the mother's brain adapts to important aspects of pregnancy, including appetite and body weight regulation, glucose homeostasis, timing of birth, and lactation. Scientific advances in these areas are key to addressing pregnancy complications such as gestational diabetes and obesity, pre-term birth and postpartum mood disorders. Important questions that need addressing in this area are:<br>• Can understanding glucose regulation in the pregnant mother help prevent gestational diabetes?<br>• What are the consequences of gestational diabetes on brain development in the offspring?<br>• What controls the timing of birth, and can we use this knowledge to prevent premature birth?<br>• How does the production of new neurons in the maternal brain protect against the development of mood disorders in the mother after birth? |

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| | A related and important issue for New Zealand is infertility. Abnormal hormonal influences during early life impact upon the brain circuits that control reproduction later on in life and can result in infertility. Increasing our understanding of these events could lead to strategies that will benefit women suffering from infertility caused by disorders such as polycystic ovarian syndrome (a common syndrome affecting 6-10% of women).<br><br>New Zealand is home to the largest neuroendocrinology research cluster in the southern hemisphere, and we are well placed to undertake a wide range of cutting-edge research to address issues of maternal and foetal health. Such knowledge could also readily be transferred to the agricultural sector to improve fertility in the dairy, beef and sheep sectors (i.e., links through to Challenge 6: Sustainably profitable primary industries).<br><br>Nutrition for health and prevention of chronic health problems<br>One of the major determinants of a long and healthy life is good paediatric nutrition. Growth in infancy sets the pattern for future growth, and, if excessive, contributes to childhood and adult obesity. Promoting a healthy lifestyle during early childhood is a key component of decreasing the likelihood of obesity and related disorders such as diabetes and heart disease later in life. The key science questions that must be addressed in order for this to happen are:<br>• What population based approaches will be the most effective at preventing childhood obesity?<br>• What are the best intervention strategies for improving physical activity in children of all ages?<br>• Once determined, how do we reduce the obstacles to the take up of such interventions?<br>• How do we address the disparities in obesity prevalence in Māori and Pacific children?<br><br>Otago has extensive expertise in paediatric obesity research including members of the Edgar National Centre for Diabetes and Obesity Research and researchers in the Department of Women's and Children's Health .<br><br>Good oral health during childhood also has huge implications for general health later in life. Otago has the only Dental School in the country and its researchers in the Sir John Walsh Research Institute have significant expertise in paediatric dentistry. A key issue that needs to be explored is the link between oral health and chronic health conditions later in life.<br><br>Asthma, allergy and infectious diseases<br>New Zealand's childhood asthma and allergy rates are among the highest in the world. Exposure of children to certain environmental factors early in life predisposes them to developing allergic reactions later in life. Studies to understand the causes and risk factors for allergy, and to investigate novel strategies to prevent allergy are crucial. One promising avenue being explored is probiotics. The Wellington Asthma Research Group, in collaboration with Fonterra, has shown protective effects against eczema using a probiotic. Such studies need to be extended to asthma and other allergic diseases and need to examine the potential of probiotics to prevent allergy not only in infants, but across the lifespan. |

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| | There is also scope for exploring probiotics use in preventing other conditions — i.e. strep throat infections that lead to the development of rheumatic fever. The long term influences of probiotics and breast feeding on gut microbiota and gut health (including inflammatory bowel diseases) is poorly understood. Otago has large sample sets collected from infants that provide a unique opportunity for correlation of probiotic interventions, breast feeding, microbiology and allergy data.<br><br>Parenting and family structure<br>The most salient environmental exposures that most people have during their early years is the family. Poor family environments (which come in various forms) impact negatively on multiple areas of function — with the corollary that salubrious environments and exposures promote optimal development. Research that promotes a better understanding of the underpinnings of well-being among children and families, and the contexts within which they live, is therefore important for obtaining better insight into what builds resilience, persistence, self-control, conscience and good conduct in our children. Research needs to focus on the biological embedding of early psychosocial experiences and how and why this impacts upon adult health and development, plus what interventions are most effective in mitigating risk and maximising capability.<br><br>Otago's Centre for Research on Children and Families is well-positioned to conduct research of this nature, as are the long running lifecourse studies investigating child health and development conducted by the Dunedin Multidisciplinary Health and Development Research Unit and the Christchurch Health and Development Study. These groups are key partners of the National Centre for Lifecourse Research (NCLR), headquartered at Otago.<br><br>Addiction in all of its forms (alcohol, drug, food, gambling and smoking) creates hardship and distress among families and reduces social and economic well-being. It is crucial that New Zealand works to identify the scientific mechanisms of addiction, as well as broader societal and environmental causes, in order to develop effective intervention strategies. Scientific evaluation and modelling of the impact of intervention approaches is also vital. Otago has longstanding expertise in addiction research within its National Addiction Centre and the Injury Prevention Research Unit. ASPIRE2025, a New Zealand wide partnership for a tobacco-free Aotearoa, is directed by public health researchers at Otago.<br><br>Suicide and suicidal behaviour, particularly among our young people, is a major social and health issue in New Zealand. Each act of suicide has a profound impact on families, friends, and even the wider community. Important questions for New Zealand include: What are the causes of our high rate of youth suicide, particularly among the Māori population? What are the most effective interventions to reduce suicidal behaviour in youths? The Social Psychiatry and Population Mental Health Research Unit at Otago is well placed to investigate these questions and is currently contracted by the Ministry of Health to develop, deliver and evaluate public health interventions to reduce suicidal behaviours. |

| Theme 2<br><br>**Affordable medicine for a modern society - The goal of this theme is to improve the health and well-being of New Zealanders through prevention, early detection and improved treatment strategies for significant chronic (cardiovascular disease, cancer, obesity, diabetes) and serious infectious diseases (rheumatic fever, childhood pneumonia, serious skin infections)** | |
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| **Importance to New Zealand** | The burden of chronic conditions on New Zealand is enormous and is escalating. Cancer is the country's leading cause of death with more than $500 million pa spent on diagnosis and treatment. Despite on-going scientific and medical advances, cardiovascular disease still kills more than one in three New Zealanders, and is responsible for more than 30,000 hospital admissions each year.<br><br>New Zealand has one of the highest rates of obesity and diabetes in the world. Approximately 7% of our population suffer from diabetes and a staggering 18.6% display an increased risk or 'pre-diabetes'. The prevalence of many chronic conditions is higher in Māori and Pacific Island populations and their prognoses are often worse, even after adjustment for co-existing clinical and socio-economic variables.<br><br>New Zealand has experienced a large increase (51%) in hospitalisations for serious infectious diseases over the last 20 years. They are the largest single cause of acute hospitalisations, so are a major driver of health care costs. Moreover, acute infections contribute to serious chronic disease, such as rheumatic heart disease, bronchiectasis and asthma. As for chronic diseases, infectious diseases are a major cause of health inequalities, with particularly high rates in Māori and Pacific populations.<br><br>Many serious infectious diseases are preventable, providing major opportunities for interventions to reduce rates of infections and improve health and well-being. |
| **Research components** | The aim is to develop both effective and affordable strategies, specifically via:<br><br>1. Prevention of the onset and progression of disease. The aim is to improve our understanding of the causes of disease, including those that are genetic but also the ways in which environment, lifestyle and diet contribute to disease development. Studies will identify those who are at high risk of certain diseases and provide personalised nutritional, medicinal and lifestyle approaches to prevention.<br><br>2. Early detection of disease, leading to better survival rates. The aim is to develop more effective and accurate tools for early detection and diagnosis including genetic predictors for those who are at higher risk, and more effective diagnostics and biomarkers to optimise therapeutic approaches.<br><br>3. Improving the success rates of existing and emerging treatments. The aim is to develop novel delivery tools and therapeutic strategies.<br><br>Chronic Conditions<br>The impact of cancer on the health of New Zealanders is significant and has major |

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| | consequences for the health budget. Improving screening and treatment approaches will lessen the impact of cancer on New Zealand society. A study with this broad aim is Otago's Burden of Disease Epidemiology, Equity and Cost-Effectiveness Programme (BODE³). This is an HRC funded programme, within which a subsidiary project focuses on the burden of cancer in New Zealand. The project is designed to provide us with a better understanding of the benefits, impact and cost-effectiveness of a large number of cancer control interventions. Findings from this study will lead to better health and economic outcomes for New Zealand.<br><br>Recent technological and genetic advances have provided the tools to bring about vastly improved cancer diagnostics, biomarkers and personalised patient treatment. An example of this is the success of Cxbladder — a urine-based detection test for bladder cancer developed and commercialised at Otago through Pacific Edge Ltd. There are many more opportunities for the commercialisation of other new and innovative diagnostic techniques and biomarkers.<br><br>Colorectal, lung, breast and prostate cancers are the big killers in New Zealand. Improving diagnostics so that these cancers can be detected and treated earlier with the most appropriate therapy will see the survival from these major cancers increase markedly. For example, it is expected that in the near future many tumours will be routinely sequenced and therapeutic approaches will be linked to the genetic profile of the tumour. Otago's Centre for Translational Cancer Research has current funding from the HRC and MBIE for projects into early cancer detection, and commercial links. A project under development to investigate colorectal cancer epigenetics has the potential to address the causes, and offer solutions to, New Zealand's exceptionally high colorectal cancer rate.<br><br>Cardiovascular disease is multifactorial in origin so improving our understanding of its underlying genetic, biochemical and physiological causes (with an emphasis on Māori and Pacific populations) is crucial to prevention. The development of genetic approaches and biomarkers to predict and diagnose onset of disease will allow for early intervention strategies to treat conditions before they become too serious. Work is also required to improve the monitoring and treatment of not only the cardiovascular disease itself, but also its precursor conditions. New Zealand has the capability to address these needs. For example, the University's Christchurch Heart Institute is an internationally renowned cardiovascular research centre. They have already developed a blood test to diagnose and monitor heart failure that now saves the lives of hundreds of thousands of people each year.<br><br>The majority of cases of obesity and diabetes are preventable. The ability to genetically profile an individual in order to tailor the most appropriate intervention, offers the potential not only to more effectively prevent or mitigate the condition, but would also create significant health system savings as it would avoid the costs associated with the administration of ineffective treatments in patients.<br><br>Clinical trials have shown that lifestyle changes can lower the risk of obesity and diabetes. However, what is not currently known is how to reduce the obstacles to the take up of such changes (the 'science of implementation') — i.e., how to encourage people to alter their lifestyle and behaviour to lower their risk of |

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| | diabetes and obesity, in ways that are both effective and sustainable?<br><br>Describing and preventing another obesity-associated disease, non-alcoholic fatty liver disease, is also essential. This condition is the next obesity-related epidemic on the horizon with the potential to incur huge healthcare costs. The Edgar National Centre for Diabetes and Obesity Research is at the forefront of developing innovative approaches to manage obesity and associated disease risk at all stages of life. It has a number of intervention studies currently underway including studies in Māori and Pacific communities.<br><br>This Theme would leverage Otago's significant genomics/genetics strength. Otago hosts New Zealand Genomics Ltd. The outputs from existing unique datasets held by the long running Otago-led lifecourse studies will become increasing relevant to studies of chronic disorders as the cohorts age. Additional valuable disease expertise is provided by The Centre for Free Radical Research and the Otago Gut Health Network and Otago's School of Pharmacy in terms of drug formulation and delivery mechanisms. There are important and understudied links between oral health and chronic conditions and Otago's School of Dentistry is well positioned to address these.<br><br>Infectious Diseases<br>New Zealand has its own particular mix of serious infectious diseases and the incidence of a number of these is on the rise, particularly in children. It is important to understand the pathogens involved in order to determine how to best prevent and treat infections. Technological advances now allow the complete genetic make-up of infecting microorganisms to be determined allowing the identification of important features that may be promoting high rates of infection. Genetic profiling may also allow for improvements in therapy to be identified and tested. Methods in use in both genetics and immunology can help identify people who are at special risk or who are especially resistant to potential pathogens. This valuable information could inform both treatment and prevention methods.<br><br>It is important for New Zealand to ascertain what is driving the increase in infectious diseases in this country, and what underlies the unusually high rates of infectious disease seen in Māori and Pacific populations. What is required are large intervention studies to provide high quality evidence on the causes and preventive strategies for infectious disease at the population level. One such example is the SHIVERS project – a large collaborative study between scientists at Otago and ESR. It aims to describe the burden and causes of hospitalised respiratory infections (such as influeNew Zealanda) and is funded by the US Centre for Disease Control and Prevention. Studies of this nature highlight the infectious disease expertise available at the University of Otago, from both a public health perspective and at the molecular level through the Webster Centre for Infectious Disease.<br><br>Input to this Theme at all stages would be provided by the University's Māori and Pacific Island Research Centres who have extensive expertise at undertaking research and intervention programmes within Māori and Pacific communities. |

| Theme 3<br><br>Aging Aotearoa | |
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| **Importance to New Zealand** | New Zealand's burgeoning aging population provides a profound challenge. Quality of life for the aged is widely recognised as an essential component of a first world country. The goal of this theme is to ensure 'healthy and productive aging' for our growing elderly population by preventing and delaying disease onset, minimising disability and dependency, and ensuring that the provision of health services is adequate for the increased need.<br><br>The social and financial implications for society will be profound if action is not taken to ensure quality of life for our aging population.<br><br>Life expectancy in New Zealand is increasing on average 2.5 years per decade and this increase has yet to show any signs of slowing. Currently 15% of our population is over 65 and this proportion is predicted to almost double in the next 20 years. The greatest growth is expected to be in older age groups, meaning that many New Zealanders will be surviving close to the limits of human lifespan, and suffering from the myriad of health issues associated with such advanced age.<br><br>The burden of chronic disease stemming from an aging population will be profound. Cardiovascular disease is predominantly a disease of the elderly. Rates of colorectal, prostate and breast cancer are high in older people, and other forms of cancers are on the rise (thyearoid, leukemia, lymphomas). Additionally, diabetes, fuelled by obesogenic environments, will have profound impacts on morbidity as well as mortality at older ages.<br><br>Neurodegenerative diseases and general cognitive performance will increasingly emerge as major health challenges. The aging of Māori and Pacific populations is particularly concerning as they have a poorer health status than other New Zealanders, especially in terms of obesity, diabetes and related disorders.<br><br>While advances in modern medicine have succeeded in prolonging life it is critical that such increased longevity is matched (preferably exceeded) by an increase in healthy life expectancy. Improving quality of life for the elderly — e.g. preventing, delaying and mitigating chronic diseases, will be as important to society as on-going reductions in mortality. For example, delaying the onset of dementia by even a year or two and/or slowing its progression would have huge positive financial and logistical implications for our health system. |
| **Research components** | A healthy mind<br>Implicit in the adage 'healthy aging' is a healthy mind. The second biggest health fear for New Zealanders is the loss of our memories as we age. There are many knowledge gaps surrounding the neurodegenerative disorders that affect the elderly so disproportionately — i.e. Alzheimer's and Parkinson's diseases. We do not know what combination of genes and environment predispose an individual to brain disease. We currently have no tests to confirm the clinical diagnosis of aging-associated brain disorders and no reliable biomarker to predict the onset of brain disease or to monitor its progression. More alarmingly, there are no therapies currently available to stave off the onset or arrest the progression of |

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| | these disorders, and current therapies for disorders such as Parkinson's disease are effective for only a short time period.<br><br>Scientists at the University's Brain Health Research Centre are engaged in a programme of research aimed at identifying predictive biomarkers and therapeutic molecules for Alzheimer's disease. In addition, the Centre has strength in other neurological disorders associated with older individuals including Parkinson's disease and stroke.<br><br>Productivity and quality of life in old age<br>Ensuring a healthy quality of life for the elderly means minimising morbidity, disability and dependency, however, how to achieve this remains a key knowledge gap. It is likely that innovative self-management and rehabilitation strategies for chronic conditions and disability are going to become increasingly important.<br><br>Old age is associated with an accumulation of chronic diseases, leading to recurrent hospital care, but also to the loss of independence and a need to be 'cared for' either at home or in residential facilities. A key knowledge gap is how New Zealand can develop and equip a health workforce able to deliver effective and sustainable health services to an ever growing elderly population? This need encompasses hospital staff, dentists, physiotherapists, pharmacists, GPs, and caregivers.<br><br>Maximising productivity in old age is crucial for the future for New Zealand. Issues requiring addressing include:<br>• What changes, if any, are needed in health services to focus more on quality of life as opposed to quantity of life?<br>• What can be done to ensure that increasing longevity is environmentally sustainable?<br>• What is the balance between population, economic and environmental well-being?<br>• What are the requirements for increasing retirement age?<br>• How do we capitalise on the skillset of the elderly and ensure their knowledge is transferred across generations<br><br>A key component of quality of life for the aged is good oral health. New Zealand has one of the highest rates of tooth loss (edentulism) in the elderly in the developed world and this condition impacts greatly on quality of life. Other areas for investigation include implant and denture research, improved food products for those with restored dentition, polypharmacy, and the links between oral health and chronic conditions in old age.<br><br>Otago also has key strengths in the above areas including the School of Physiotherapy, the Rehabilitation Teaching and Research Unit, the Injury Prevention Unit and general practice and public health researchers. Otago also hosts New Zealand's only Dental School, within which is has researchers who have significant expertise in gerodontology. |

| Entry ID | 455 |
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| **Lifelong Health for All People in New Zealand - "Improve and enhance lifelong health outcomes by considering WHO health determinants, a socio-ecological health perspective and the Treaty of Waitangi."** | |
| **Summary** | This challenge proposes to improve and enhance New Zealanders lifelong health outcomes, by taking into account specific cultural/socio-economic factors. Research will be focused on ensuring that young New Zealanders receive a healthy start to life (incorporating social determinants such as ethnic background, abusive environments, alcohol/drug use), developing and understanding of the factors which impact/determine healthy lifestyles, and developing means to ensure that health resources are accessible to all. |
| **Theme 1**<br><br>**A healthy start for all people**<br>**Goal: To ensure that all young people benefit from improved health and education. This will positively impact on long-term health and lay the foundation for sustainable participation in society** | |
| **Importance to New Zealand** | Health statistics for New Zealand children indicate that this is an area that needs to be addressed. Experiences during the early years provide a critical foundation for the entire life course. Early child development strongly influences basic learning and school success, which can impact on economic and social participation, as well as the lifelong health/wellbeing of the individual.<br><br>Science has a major part to play in informing work towards improved child health statistics. Health statistics for Māori children are particularly problematic; they have two to three times poorer health than non-Māori. Research will need to be consultative and focus on attitudes, behaviour and educational factors. Appropriate information on healthy behaviours for children, parents and others can lead to better health outcomes. This information needs to be informed by current research (including that which takes a longitudinal perspective), and should be presented in a way that is accessible, and seen as relevant, to the individual. Similarly, teaching, and educational interventions, can increase health and wellbeing within a community. Again, this needs to be based on current research and targeted appropriately so that it benefits all, including those from different cultural/language backgrounds.<br><br>Early and appropriate tools and interventions will need to address risk factors (nutrition, childhood illness, family violence, language weaknesses, early learning experiences, etc), and cognitive and social-emotional development. Research aimed at identifying these appropriate interventions will improve the future health and well-being of New Zealand as well as its economic and social foundations. |
| **Research components** | Key questions:<br>• Why are statistics on Māori life expectancy at birth eight to nine years lower than those for non-Māori? How can this gap and similar gaps in terms of socio-economic status and disability be reduced?<br>• What measurement and monitoring tools effectively identify successful child |

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| | abuse prevention strategies?<br>• How can we determine successful programmes that support vulnerable children and families?<br>• What strategies can we use to improve the mental health of refugees with complex needs?<br>• What are the most culturally effective ways to promote Māori health?<br>• What appropriate campaigns and targeted information/interventions programmes effectively reduce the health costs associated with alcohol and drug misuse?<br>• What measurement and monitoring tools effectively determine the inter-relationship between food, nutrition and physical activity? How might these tools influence findings indicating higher levels of obesity and sedentary lifestyle in New Zealand compared to other OECD countries?<br>• What are the important aspects of holistic health perspectives in early childhood education that impact on later learning and quality of life?<br>• Do appropriate motor development programmes in the early years promote active lifestyles?<br>• How can we develop effective interventions targeted at enhancing hearing, speech and language so that children can better engage in society?<br>• How can we develop effective interventions targeted at improving the literacy and numeracy of struggling young learners?<br>• How effective are 'health promoting schools' and parent education programmes at achieving healthy families? |
| **Theme 2**<br><br>**Health promotion and harm reduction**<br>**Goal: Increase health promotion approaches and develop more effective strategies to reduce harm caused by accident, injury or illness, interpersonal violence and the misuse of drugs and alcohol** | |
| **Importance to New Zealand** | Developing a fuller understanding of the complex interplay of factors that impact on healthy lifestyles and injury prevention, and determining how best to promote health and reduce harm, underpins health research. Evidence-based research enables New Zealand to develop more effective and efficient responses in health promotion and injury and illness prevention. Further scientific investigations that involve partnership with Maori will improve health outcomes.<br><br>Health promotion and education encourage people to maintain active healthy lifestyles. Socio-economic and cultural factors, language and education levels affect people's ability to achieve health. New Zealand recognises that there are significant costs at all stages of the health system of both accidental injuries and non-accidental injuries that occur as the result of domestic violence, child abuse and other forms of interpersonal violence. Many such injuries are preventable as they may be associated with lack of workplace safety, misuse of drugs and alcohol, and interpersonal violence.<br><br>Adverse events in New Zealand hospitals are high compared to the UK and US. Of the one in eight admissions resulting in adverse events, it is estimated that half are preventable. Equally seriously, the cost of avoidable adverse events amounts to 20 percent of public hospital expenditure. Injury prevention, suicide prevention |

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| | and crime prevention strategies increase safety and reduce the likelihood of individuals and communities suffering accidental and non-accidental injuries. |
| **Research components** | Key questions:<br>• What are the most effective injury prevention strategies in the workplace and the home?<br>• How can we develop technologies that allow patients with major injuries to recover faster and be more productive citizens?<br>• How does education and training contribute to more active, healthy lifestyles? How effective are sexuality education programmes at improving adolescent sexual health?<br>• How can we develop technologies that allow better diagnosis and care of acute and chronic illness?<br>• How effective are health promotion strategies at reaching and engaging Māori and diverse populations?<br>• How effective are anti-violence campaigns (e.g. 'It's not OK') in reducing the incidence of domestic violence?<br>• How effective are suicide prevention campaigns that are based on education and information dissemination?<br>• Will investment in early detection and screening tools for diseases such as cancer and diabetes reduce specialist health and hospital care and achieve better outcomes for patients?<br>• Does access to methadone maintenance programmes reduce incidence of criminal offending and improve the health outcomes of substance dependent people?<br>• What role does legislation play in deterring the abuse of alcohol and other substances? To what extent do criminal justice programmes address the causes of violent offending?<br>• How effective is New Zealand's care and protection system at keeping children safe?<br>• What are effective treatment responses to sexual offending perpetrated by young people and adults?<br>• How does diet, including micro-nutrients, contribute to psychological wellbeing and reduce chronic disease in children and adults? |
| **Theme 3**<br><br>**Accessible health resources for all**<br>**Goal: Promote strategies to achieve equity in the distribution of material resources and the provision of health services which are accessible, affordable and cost-effective for all regardless of socio-economic status, culture or geographic location** | |
| **Importance to New Zealand** | Significant inequalities in health exist between socio-economic groups, cultural communities and geographical regions. The primary causes are disparities in access to material resources (income, education, employment and housing). Differential access to health care services and differences in care for those receiving services also have a considerable impact on health status and mortality. Providing comprehensive, consistent access to health services in diverse rural populations presents challenges and although Māori visit their GP as often as |

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| | non-Māori they have lesser access to effective treatment.<br><br>Improving access to health resources means understanding the underlying factors that affect access and how those factors influence each other. Elucidating current successes and barriers would inform the development of strategies which ensure that all people have access to the material resources supporting health.<br>New Zealand is recognised internationally for its innovative achievements in health technology. Advancing research into technological solutions which can add value and efficiencies, improve quality and increase access to health care is central to improving health outcomes for New Zealand.<br><br>New Zealand health outcomes are low in part due to widening gaps in health status between different communities. In order to effectively improve health outcomes, emphasis should be placed upon vulnerable groups, such as Māori and Pacific people. Culture plays an important role in health because culture influences behaviours through customs, traditions, beliefs and values. Improving access to health resources for Māori means working in partnership with Māori and incorporating Māori models for health, such as Mason Durie's whare tapawhā. |
| **Research components** | Key questions:<br>• How can we ensure that all people have the material resources necessary to improve their health? What strategies can be used to improve health literacy so that people can make informed decisions about their health and health care?<br>• How can we use applied research to determine how the various characteristics of local neighbourhoods influence health outcomes and health-related behaviours?<br>• How can we best use technology to deliver health care when patients and care providers are not in the same physical location? How can we use augmented and virtual reality based technologies for education, training, assessment and rehabilitation? How can we develop technologies that support older people, those with reduced physical capability and those suffering mental illness to live quality independent lives? What cost-effective, mobile technologies and services would best support healthy outcomes for people living in poorly resourced communities?<br>• How can we build upon the successes of community-based care to deliver health care services that are appropriate, accessible and effective for Māori and Pacific people?<br>• What professional development and training is required to create a culturally competent health workforce?<br>• How can research into the reduction of socio-economic inequalities inform policies and improve population health and wellbeing?<br>• How can we provide security of access to health services and continuity of care for all?<br>• How can we provide affordable and appropriate housing that protects people from hazards and promotes good health? |

| Theme 4<br><br>Contextualizing health<br><br>Goal: To ensure that the social, cultural, economic, political and environmental contextualization of health are fully understood by evidence-based research that is disseminated in ways that effectively and efficiently address health enhancing practices and outcomes | |
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| **Importance to New Zealand** | This theme incorporates and addresses the social, cultural, economic, political and environmental factors as they impact on health and wellbeing in early years, health promotion and harm reduction, and accessible health resourcing. Science has a key role in providing baseline data and evidence to inform an understanding of the contexts in which health evolves and develops. Science can also provide the impetus for ensuring that the population is well informed in regards to these factors. Baseline information will provide much needed evidence for later development of public policy with the corresponding fostering of efficient and effective health-related initiatives. This work will involve collaborating with local government, government departments and environmental groups.<br><br>The work will also involve consultation in partnership with iwi, hapū, whānau and Māori governance bodies. On-going scientific research will need to ensure that such collaboration, policy development and programme provision keep pace with contextual shifts around the identified factors. For example, the development of research evidence will need to focus on the social, cultural, economic, political and environmental contexts. |
| **Research components** | Key questions:<br>• What measurement and monitoring tools effectively determine connectedness, sense of purpose and achievement, resilience and optimism within communities?<br>• What are social, educative and economic benefits for people engaging in the arts, leisure, recreation and sport?<br>• How can we best manage the interrelationship between recreation and care for the environment?<br>• How best might tangata whenua be empowered to determine personal and collective health needs?<br>• What strategies need to be developed to enable refugees, new migrants, people with disabilities and other minority groups to participate fully in communities?<br>• What research addresses the specific health needs of New Zealand's population at different times in the lifespan?<br>• What processes are required to attain baseline evidence of the importance of cultural identity, language, whānau, and whenua on health and wellbeing for culturally diverse populations?<br>• What specific activities need to be provided by communities to ensure that cultural customs, traditions and identities are enhanced and enriched? What specific benefits derive from this enhancement?<br>• What measurement and monitoring tools effectively determine key factors in work places that contribute to healthy outcomes for employers and employees?<br>• How can we develop economic and socially effective technologies to enhance personal and collective health? |

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| | • How can funding of high performance sport be maximized for community wellbeing?<br>• What impact do poverty, housing and geographical environments have on achieving healthy outcomes and practices?<br>• What health enhancing programmes best address the needs of communities affected by catastrophic events? |
| **Research Gaps and Opportunities** | Theme 1: Studies have investigated the long-term effects of early child development on later health and wellbeing. From these we know how early childhood factors can influence later life and society. However, there is still a need for further studies to show how specific areas of early intervention can impact on individuals and society.<br>For example, problems in literacy learning can impact on later access to health literature, and poor basic education skills and related language-based learning disabilities are a major challenge to public health and societal welfare. Further research is necessary to identify early interventions that can support later literacy use and improve wellbeing, reduce negative effects on self-esteem and behaviour, and impact on economic and social participation across different cultural and language groups.<br><br>There is an assumed link between food, nutrition, physical activity and obesity; however, measures for obesity and for physical activity patterns are problematic. Further research needs to be undertaken to develop more effective and valid measurement tools to provide accurate data and evidence. This will allow us to develop more effective interventions.<br><br>The potential benefit to cultural wellbeing, and the enhancement of language and cognitive skills, of being able to communicate and think effectively in two languages is another area that requires systematic research. This is particularly appropriate given New Zealand's bicultural focus and the teaching of Māori and English in schools. Investigations of the interaction between first and second language amongst immigrant populations in New Zealand should also form part of this research gap. |

# 5 Health Treatments

The submissions in this group are shown with their underpinning themes in the table below. Each submission follows in full.

**Table 5: Summary of proposed challenges and themes**

| Entry Id | Challenge | Themes |
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| **377** | Using bacteria to cure cancer by enhancing the patient's own immune response | Removed by request of submitter due to commercial sensitivities. |
| **387** | To develop effective new treatment for malignant melanoma, by leveraging New Zealand's expertise in melanoma research, drug and immune therapy discovery, and clinical trials | 1. To integrate the excellent research programmes already underway in New Zealand into melanoma biology and genetics, new drugs and immune therapy for melanoma, and melanoma signalling systems.<br>2. To develop effective new treatment for malignant melanoma, by leveraging New Zealand's expertise in biomedical research, drug discovery, and immune therapy<br>3. . To improve the access of New Zealand patients with melanoma to clinical trials of new treatment. |

| Entry ID | 377 |
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| **Using bacteria to cure cancer by enhancing the patient's own immune response** | |
| Removed by request of submitter due to commercial sensitivities. | |

| Entry ID | 387 |
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| **To develop effective new treatment for malignant melanoma, by leveraging New Zealand's expertise in melanoma research, drug and immune therapy discovery, and clinical trials** | |
| **Summary** | This challenge proposes to develop effective new treatment for malignant melanoma, by leveraging New Zealand's (pre-existing) expertise in melanoma research, drug and immune therapy discovery, and clinical trials. This will involve integrating research programmes across a number of both national universities/ institutes, incorporating research performed both nationally and internationally, as well as forming interdisciplinary research bonds (i.e. enlisting the use of computer scientists/bio-informaticians to analyse large datasets). |

| Theme 1<br><br>To integrate the excellent research programmes already underway in New Zealand into melanoma biology and genetics, new drugs and immune therapy for melanoma, and melanoma signalling systems | |
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| **Importance to New Zealand** | Malignant melanoma remains a major problem in New Zealand, with over 500 new cases per year, one of the highest rates in the world. Despite increasing sun awareness, and better early detection, over 150 New Zealanders still die of this disease every year – many in their prime.<br><br>In the last 2 years two new drugs have finally emerged that are showing promises for treating melanoma, showing that even advanced disease can respond to new therapy. However these new drugs only control the disease in a small minority of patients, so a major effort is needed right now to develop improved versions of these drugs, and/or new drugs that can be used in conjunction with them.<br><br>New Zealand has an outstanding track record in cancer research, and especially the development of new cancer drugs targeting cancers. We also have growing expertise at developing therapies that use the immune system against cancer – particularly useful at present since one of the new drugs turns the immune system against melanoma. We now have a huge opportunity to integrate this expertise to dramatically improve therapy for malignant melanoma, while continuing our national efforts in prevention and early detection. Success in this endeavour will also provide economic benefits to New Zealand, both in terms of reduced burden of disease, and export income from our discoveries. |
| **Research components** | This theme will link all New Zealand's research expertise in melanoma biology and genetics, to researchers skilled in drug discovery and the development of immune therapy. It will capitalise on existing networks focused on melanoma therapy, especially the patient-focused national melanoma network known as MelNet, the scientific network represented by the Maurice Wilkins Centre, and the clinician-based New Zealand Guidelines Group, bringing them together under a single national platform. All this expertise will focus on the most burning issue for New Zealand patients with melanoma, namely the development and clinical trial of effective new drug and immune therapy regimes that can increase their survival. Additional scientific "firepower" will also be brought to bear on this effort, regardless of the scientific discipline it comes from: for example, leading computer scientists will be enlisted to help our cancer drug designers understand the complex signalling systems within melanoma cells that allow them to escape from drug treatment, in order to improve the combinations of drugs we will use.<br><br>After a national meeting to plan this multi-disciplinary research programme (through a "sandpit" process) a research plan will be formulated, along similar lines to that outlined under Theme 2. This research programme will use unique New Zealand research strengths to advance therapy of melanoma, but will also dovetail with existing international melanoma research consortia, especially in Australia and the USA. New Zealand's participation in these consortia will leverage access to their resources, including improved access for New Zealand patients to clinical trials (See Theme 3). |

| Theme 2<br><br>To develop effective new treatment for malignant melanoma, by leveraging New Zealand's expertise in biomedical research, drug discovery, and immune therapy | |
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| **Importance to New Zealand** | As described under Theme 1, melanoma is a dreadful disease that is particularly common in New Zealand, and not decreasing with better awareness of the dangers of sun exposure. Although New Zealand has an outstanding history of developing new drugs (over 20 new drugs developed here have entered clinical trials, mostly for cancer) we have not previously targeted melanoma specifically. The time is now right to turn our attention to melanoma, because two recent drugs invented overseas have finally proven that even advanced melanoma can be cured with drug therapy.<br><br>Unfortunately these two drugs are only effective in a minority of patients - but when they work in individual patients they are spectacularly successful. The urgent challenges are to understand why these drugs work - and why they fail - and develop both new versions of these drugs, and new drugs that complement the existing ones. Since one of the new drugs (anti-CTLA4) works exclusively on the immune system, inducing immune attack on melanoma, we can also design new immune therapy for melanoma to combine with the new chemotherapy drugs; again New Zealand has an outstanding research record in melanoma immunology on which to draw for this challenge.<br><br>So this theme is important to New Zealand because it uses existing resources to attack a major health problem of concern to New Zealanders, at a time in history when it seems likely to succeed. Success would not only have health benefits, but major economic benefits as well. |
| **Research components** | Informed by the integrated approach to melanoma treatment under Theme 1, more effective therapy for melanoma will be developed, by investigating combinations of existing therapy that are beginning to show striking effects in small numbers of patients:<br><br>1. New Zealand patients who have responded to therapy will be studied to determine why their therapy worked where others failed, in order to guide development of new therapy. Examples include patients with long-lasting responses to new drugs targeted at the cancer cells (eg b-raf inhibitors), whose tumours will be studied at the molecular level; and patients with long-lasting responses to immune manipulation (eg anti-CTLA4 antibody, or cancer vaccines), whose immune responses to their tumours will be characterised.<br><br>5. New Zealand's drug discovery expertise will be deployed to develop new drugs that improve on, or complement, existing drugs (eg b-raf inhibitors). New targets will be identified in molecular pathways that are crucial to melanoma survival and growth, including using advanced computational methods (eg Bayesian network inference) to predict the "chokepoints" most likely to exert control of melanoma growth in combination with existing drugs.<br><br>6. New Zealand's immune therapy expertise will be deployed to develop new immune therapy (such as cancer vaccines and T cell receptor therapy) |

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| | targeting molecules that complement existing drug targets.<br>7. Conventional therapy, such as radiation therapy and surgery, will be re-examined for its ability to integrate into new combined therapy regimes (eg the timing of radiation therapy that provides maximum synergy with immune therapy). |
| **Theme 3**<br>**To improve the access of New Zealand patients with melanoma to clinical trials of new treatments** | |
| **Importance to New Zealand** | As described in Themes 1 and 2, melanoma remains a big problem for New Zealanders. Despite the release in 2010 of two new drugs for melanoma, that are effective in a small proportion of patients, patients in New Zealand are still very motivated to participate in clinical trials of new therapy. New Zealand has outstanding capability in clinical trials, and there is a strong desire in the clinical trials community to be able to offer more clinical trials to patients with melanoma. This theme is therefore important because it will increase clinical trials activity in New Zealand, and provide patients with the access to new therapy that they want. Clinical trials will also advance the testing of new therapies designed in New Zealand, and so will determine the ultimate benefit of these inventions to the health of New Zealanders, and also to the economy. |
| **Research components** | We intend to dramatically increase the range of new therapies being developed in New Zealand, and to make these therapies available to New Zealand patients through clinical trials. But we also intend to increase the number of clinical trials of new therapy developed overseas, by increasing New Zealand participation in the international research consortia that currently design and implement these trials. The major research components therefore involve connecting New Zealand's outstanding expertise in clinical trials to our leading scientists and clinicians, in order to offer New Zealand patients with melanoma an ongoing series of co-ordinated clinical trials that test the effectiveness of new combinations of therapy.<br><br>While many of these trials will involve drugs and immune therapies developed in New Zealand, the design of these trials will also test combinations of existing therapies with these new agents, including combining them with new surgical and radiotherapy techniques. Increased participation in international melanoma research consortia will provide increased access to clinical trials designed overseas, including multi-centre trials of the new drug combinations being developed to increase the effectiveness of existing drugs. As Themes 1 and 2 bear fruit, these results will also inform the design of new clinical trials within these international consortia, and open up opportunities for new therapies invented in New Zealand to be included in major international clinical trials. Hence although the research components required to progress this theme all exist within New Zealand, their integration will increase New Zealand's access to international activity in this space. |
| **Research Gaps and Opportunities** | The research gap – and the opportunity here – is that melanoma research in New Zealand is of excellent quality, but is not yet integrated. Neither is it focused on |

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| | the immediate issues of most concern to patients, namely how to rapidly improve the nascent therapies for melanoma that are beginning to show impact in small numbers of patients. This lack of integration means that as a nation we are currently missing opportunities to develop new combinations of melanoma therapy, for example combined chemotherapy and immune therapy, and we are also not as well connected to the major international melanoma therapy consortia as we should be, given our dreadful disease burden. Closing this gap by co-ordinating our approach to melanoma treatment will have tremendous benefits for New Zealand patients, and for the health system as a whole, by reducing the burden of disease, and also by improving standards of care through increased clinical trials activity. Such co-ordinated inter-disciplinary research will also open up opportunities for new drugs and immune therapy developed here to improve survival of our melanoma patients, and also have major impact internationally, ultimately becoming integral to the most successful treatment regimes for melanoma in the world. |
| **Grouping** | Acute disease |

# 6 Providing the Best Start to Life

The submissions in this group are shown with their underpinning themes in the table below. Each submission follows in full.

**Table 6: Summary of proposed challenges and themes**

| Entry Id | Challenge | Themes |
|---|---|---|
| 186 | To improve maternal and perinatal health in New Zealand and reduce inequalities in maternal and perinatal outcomes. To provide the healthiest start possible for all children in New Zealand | 1. Understanding the current challenges and identifying areas for improving maternal and perinatal health in the general population of New Zealand<br>2. Identify current barriers to accessing optimal maternity care including early booking with a lead maternity carer.<br>3. Managing congenital abnormalities in New Zealand through prevention and early detection<br>4. Understand and improve knowledge of rare and serious obstetric and neonatal conditions to reduce morbidity for new born infants and mothers. |
| 295 | An environment supportive of optimal growth and development of children; future health proofing | 1. Engagement and translation into public health<br>2. Evidence informed investment in future health<br>3. Engagement and translation into public health |
| 333 | Showcase the short and long-term positive impacts home-based Early Childhood Education has in providing for a strong, resilient nation that can reach its full potential, socially and economically. | 1. Understanding the importance of home-based ECE on the child - neurobiological research on the child's development to show how early attachments and experiences in a home-based environment lay the foundation for health, relationships and resilience<br>2. Understanding the importance of home-based ECE on society - improving education achievement to raise the standard of contributing members of society, leading to higher productivity, increased labour force participation, higher incomes & economic growth<br>3. Government policies are developed from a social and behavioural science background rather than a political perspective of the government of the day. |
| 340 | What Determines a Healthy Start to Life? | 1. To understand the interactions between the environment and early pregnancy events, which lead to pregnancy complications and adverse outcomes.<br>2. To understand the mechanisms that are involved when an individual's developmental trajectory is modified by environmental cues.<br>3. To understand the mechanisms that are involved |

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| | | when an individual's developmental trajectory is modified by environmental cues. |
| **348** | Raising children for a healthy society: How can we nurture, educate and socialize children so they emerge into adulthood as healthy, autonomous individuals able to contribute economically and socially, and equipped to raise a healthy new generation | 1. Understanding factors that pose risks to children's healthy development<br>2. Understanding resilience: why some children succeed, despite adversity and disadvantage<br>3. Understanding what works to boost children's healthy development |
| **376** | Healthy pregnancies for healthy lives | 1. How does a normal human placenta grow and work<br>2. Understanding why pregnancy complications occur<br>3. Predicting and treating placental diseases |
| **476** | Good start in life: Ensuring New Zealand is a great place to raise kids | 1. Healthy mothers, babies and infants for a healthy life<br>2. Healthy happy children<br>3. Maximising child potential |

| **Entry ID** | **186** |
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| **To improve maternal and perinatal health in New Zealand and reduce inequalities in maternal and perinatal outcomes. To provide the healthiest start possible for all children in New Zealand** | |
| **Summary** | Understanding the current challenges that face maternal and perinatal health outcomes will allow us to provide the healthiest start possible for all children. Areas which need to be addressed include- identifying current barriers to accessing optimal maternity care (incorporating social/demographic information into such study i.e. identifying barriers to receiving optimal care for those that live in areas of poverty/deprivation), and developing means to detect/prevent/manage the development of congenital abnormalities/diseases. |
| **Theme 1**<br>**Understanding the current challenges and identifying areas for improving maternal and perinatal health in the general population of New Zealand** | |
| **Importance to New Zealand** | In 2010 the New Zealand perinatal mortality rate was 10.8 per 1000 births and maternal mortality rate 17.8 per 100,000 births. This rate varies significantly by ethnicity, deprivation and age. The perinatal and maternal mortality rates do not take into account the serious injury or illness that can arise during pregnancy or birth. By identifying areas for improvement we can reduce the rates of perinatal and maternal morbidity and mortality in New Zealand and we can reduce the |

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| | impact these adverse outcomes have on families and the New Zealand health system.<br><br>One way to reduce the rate of morbidity and mortality during pregnancy and birth is to ensure that women receive adequate antenatal care including booking with a lead maternity carer (LMC) before ten weeks gestation. Booking with a LMC early in pregnancy allows them to identify any additional health care needs or potential risks to the pregnancy. Health care professionals can also take advantage of this time and the women's added incentive to improve their overall health and well-being by addressing nutrition, smoking and substance use. Improving maternal health will ensure that children born in New Zealand have the best possible start that we can provide and we can also reduce the number of children born with on-going health needs. If we optimise maternal nutrition and weight gain we can reduce the number of children and mothers who become overweight or obese. |
| **Research components** | • Identify current barriers to accessing optimal maternity care including early booking with a lead maternity carer.<br>• Explore models of care that women engage with early and which are cost effective and sustainable in the future.<br>• To explore ways of optimising maternal health prior to and during pregnancy. |
| **Theme 2**<br>**Identify current barriers to accessing optimal maternity care including early booking with a lead maternity carer. Explore models of care that women engage with early and which are cost effective and sustainable in the future** | |
| **Importance to New Zealand** | New Zealand has significant inequalities in health status and health outcomes and this is reflected in the health and well-being of our mothers and babies. In particular people living in areas of high deprivation and teenage mothers are over-represented in the perinatal and maternal mortality statistics. These groups of women also experience higher levels of morbidity during their pregnancies. Lack of engagement with maternity care is a contributory factor in these poor outcomes. If we can identify and overcome the additional barriers these women face when accessing and engaging with maternity services we could improve the outcomes of their pregnancies.<br><br>Teenage mothers in particular are overrepresented in adverse perinatal and maternal outcomes and are a group that needs additional support. These issues will increase in the future as areas with high levels of deprivation often have high birth rates and high numbers of teen pregnancies. Maori and Pacific peoples are over-represented in areas with high levels of deprivation. We need to ensure that health and healthcare is equitably distributed across New Zealand and amongst all ethnicities. Reducing inequalities by addressing issues with access and engagement with maternity care will lead to a reduction in perinatal and maternal mortality, improving the sustainability and equitability of the New Zealand healthcare system. |
| **Research components** | • Identify barriers to accessing care for women who live in areas with high levels of deprivation and for pregnant teenagers.<br>• Develop models of care that cater to the needs of women who live in areas with high levels of deprivation and the needs of pregnant teenagers. |

| Theme 3<br><br>Managing congenital abnormalities in New Zealand through prevention and early detection | |
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| **Importance to New Zealand** | There were 211 perinatal deaths due to congenital abnormalities in New Zealand in 2010. This figure represents only a small portion of the burden of congenital abnormalities in New Zealand as it does not include babies who died prior to 20 weeks gestation and those who survived with the abnormality. Some of the congenital abnormalities are amenable to prevention (up to 70% of neural tube defects can be prevented by increasing folic acid supplements, they can also be prevented by reducing maternal body mass index). While prevention is ideal early detection is also beneficial as it can reduce the distress to the parents and the impact on the health care system. If we can develop ways to prevent congenital abnormalities we can potentially save millions of dollars in health care and social services and give children lives without physical, psychological or educational impairment. |
| **Research components** | • Develop strategies for preventing the development of congenital abnormalities focusing on pre-conceptual care for women planning pregnancy and during pregnancy.<br>• Investigate the potential for detecting a wider variety of abnormalities earlier in pregnancy through screening and ultrasound. |
| **Theme 4**<br><br>**Understand and improve knowledge of rare and serious obstetric and neonatal conditions to reduce morbidity for new born infants and mothers** | |
| **Importance to New Zealand** | There are a number of obstetric conditions that are not prevalent but can lead to death or serious injury. One such condition is neonatal encephalopathy, each year in New Zealand approximately 80 babies born in poor condition (neonatal encephalopathy). Of the babies born only 70% survive and many of them have long term developmental delay and on-going morbidity. Our understanding of this condition and what can be done to prevent it occurring is limited.<br><br>Pregnant women also suffer a number of conditions during pregnancy and childbirth which may leave them permanently disabled. In some rare cases, mortality may occur. There are a number of conditions including amniotic fluid embolism, pulmonary embolism and stroke. Some women also have pre-existing problems such as rheumatic heart disease, breast cancer and other chronic diseases. Our knowledge of the best management in pregnancy is not well understood. In addition nearly 200 pregnant or post-partum women a year are admitted to intensive care units.<br><br>If we can improve our knowledge and understanding of these types of conditions we can work on reducing the morbidity and mortality they lead to. This would reduce the impact they have on the health system and reduce the on-going care needs of mothers and babies in the future. |
| **Research components** | 1. Identify the risk factors for perinatal morbidities and to explore whether or not there are preventable factors in the pregnancy and labours with a view to improving care. |

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| | 2. Researching rare or serious conditions in pregnancy, childbirth and the post-natal period.<br>3. Translate the findings from these studies into reliable evidence-based practice, to improve the safety and quality of maternity care in New Zealand. |
| **Research Gaps and Opportunities** | While we know that there are barriers to women accessing maternity care we have not yet found a model of maternity care that overcomes these barriers. We need further research to identify different models of care that suit the needs of pregnant women and in particular high needs populations such as pregnant teenagers and women living in areas with high levels of deprivation. This includes research into how to increase the knowledge of the importance of taking folic acid and booking prior to 10 weeks in women planning pregnancy and pregnant women. Research in this area could significantly improve the health of pregnant women and maternal and perinatal outcomes.<br><br>We also need to identify strategies for reducing the incidence of congenital abnormalities in New Zealand. Improvements to preconceptual care in New Zealand we could prevent congenital abnormalities from developing and evaluating the current screening process could help us identify them earlier. Establishing a register of abnormalities that includes all congenital abnormalities not just those identified after birth, will provide accurate data on prevalence of congenital abnormalities in New Zealand.<br><br>Improving our understanding of serious and rare obstetric and neonatal conditions would help us identify risk factors for these conditions that could be amenable to treatment. If we can prevent these types of conditions from occurring or offer evidence based treatment, we could minimise the serious injury and death they cause. This would reduce the immediate impact on the healthcare system and decrease the amount of long term care needed. |

| **Entry ID** | **295** |
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| **An Environment supportive of optimal growth and development of children; future health proofing** | |
| **Summary** | The goal is to provide an environment supportive of optimal growth and development of children. Themes include understanding how early life environment impacts on growth, development and future health, developing measures to model health and productivity outcomes for use as an evidence base for future health investment decisions, investigating the best ways to encourage communities to adopt health policy and practice |
| **Theme 1**<br><br>**Understanding across the lifecycle how the environment internal and external impacts on growth and development and future health** | |
| **Importance** | Our children are our future, their health and wellbeing determines our society |

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| **to New Zealand** | nature and direction |
| **Research components** | • Identify key early-life environmental impacts on growth and development including the role of epigenetics in different population groups<br>• Develop predictive models to measure the impact of environmental change on growth and development and future health |
| **Theme 2**<br>**Evidence informed investment in future health** | |
| **Importance to New Zealand** | Effective resource expenditure requires robust evidence rather than emotional, political or other well-meaning social agendas. |
| **Research components** | Develop new and use current measures to model the health and productivity outcomes in micro and macro environments and between sectors. |
| **Theme 3**<br>**Engagement and translation into public health** | |
| **Importance to New Zealand** | It is all very well saying ," Eat your vegetables" but how to make that happen effectively will determine the outcome of our children's future health |
| **Research components** | • Identify the best ways to engage with communities and industries in investing in and adopting evidence based policy and practice<br>• Build on national and international programmes that have demonstrated effectiveness and translate into the NZ environment.<br>• Develop innovative ways to measure sustainability , impact and return on investment |
| **Research Gaps and Opportunities** | See Research components under themes: Identifying the most sustainable and effective practices and designing enduring delivery mechanisms for child health |

| **Entry ID** | **333** |
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| **Showcase the short and long-term positive impacts home-based Early Childhood Education has in providing for a strong, resilient nation that can reach its full potential, socially and economically** | |
| **Summary** | This challenge aims to identify and showcase the short/long term positive impacts of home-based early childhood education. This will require neurological research to determine how such education impacts on infants' brain development, longitudinal studies of children in home-based education to determine how this has positively impacted society, and initiating government policies aimed at adapting/developing standardised early-childhood programmes which focus on delivering positive outcomes in both the short and long term. |

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| **Theme 1**<br><br>**Understanding the importance of home-based ECE on the child - neurobiological research on the child's development to show how early attachments and experiences in a home-based environment lay the foundation for health, relationships and resilience** | |
| **Importance to New Zealand** | Children will have higher self-esteem, reduced anxiety and reduced hormonal responses to stress. This in turn sets children up for a strong foundation for their health, relationships and resilience later in life as they become contributing members of society. |
| **Research components** | Focusing on the home-based environment and children that have participated in home-based care through the use of longitudinal studies, action research, surveys etc to better understand the positive impacts on the child.<br><br>Identify common factors and contributors that result in positive outcomes and use these to help inform future policy development and government spending. |
| **Theme 2**<br><br>**Understanding the importance of home-based ECE on society - improving education achievement to raise the standard of contributing members of society, leading to higher productivity, increased labour force participation, higher incomes & economic growth** | |
| **Importance to New Zealand** | There has been more generic research undertaken over the years which shows that children's participation in high quality ECE has benefits that are long-term and lasting. These include social and economic benefits, improved child wellbeing and learning outcomes as a foundation for lifelong learning, more equitable outcomes and a reduction of poverty and increased intergenerational social mobility. We expect these results would be reflective, and strengthened through the use of home-based ECE which uses smaller ratios of care/use of primary carers, individualised programmes and a greater degree of flexibility by using every day routines and experiences across cultures. Such actions results in higher returns for society. |
| **Research components** | Focusing on the home-based ECE service type and children that have participated in home-based care through the use of longitudinal studies, action research, surveys etc to better understand the short and long-term impact that home-based ECE environments have on infant's/children's brains and how that ultimately impacts on their behaviour/development as they grow into adolescence and adulthood and become contributing members of society.<br><br>Identify common factors and contributors that result in positive outcomes and use these to help inform future policy development and government spending. |
| **Theme 3**<br><br>**Government policies are developed from a social and behavioural science background rather than a political perspective of the government of the day** | |
| **Importance to New Zealand** | Re-orientation of early childhood programmes in the home to focus on prevention and intervention strategies that can be applied early in life where the maximum benefits can be gained. These will be more effective in altering outcomes and |

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| | reap more economic returns over the life course of the child. This will also enable more strategic alignment of Government spending and provide for a co-ordinated approach to national and cross-sectoral issues, including the health, justice and social sectors. |
| **Research components** | • Development of programmes and incentives that encourage child-focused educational activities with explicit attention to parent-child interaction patterns and relationship building in a safe and secure environment such as the home.<br>• Development of programmes for the most vulnerable in our society, focusing on the home and whānau as the bedrock of society and best providers for raising healthy children.<br>• Development of more effective and robust monitoring and evaluative tools to enable services to incorporate reflective practice, self-review and action research. |
| **Research Gaps and Opportunities** | Many of the government policies that have been developed to date derive from a political perspective rather from a social and behavioural science background. As noted by Gluckman [Gluckman, P., Improving the Transition: Reducing Social and Psychological Morbidity During Adolescence (Office of the Prime Minister's Science Advisory Committee, 2011)]: "there is considerable risk of relying on perception, anecdote or values-based discourse and over-riding the evidence base or generating solutions in the absence of data, particularly when other considerations come into play." Home based ECE education is the fastest growing in the provision of ECE services. This recognises the economic pressures and changing patterns of workforce participation.<br><br>More parents are looking for ECE services that cater for children from birth until five years old and offer all-day ECE services with flexibility to suit individual needs of culture, special needs, service hours and individualised programme delivery. Research and policy development to date has been too generic and focused more on centre-based ECE and general ECE outcomes. There is a need to look at the fastest growing ECE service type and showcase how it can better build a strong, healthy and resilient society. |
| **Comments** | While there is financial pressure on governments to become more efficient and effective in a period of strong fiscal constraint, the commitment to ensuring equitable access to quality ECE is too important to be one of the many cuts in government spending. Quality ECE has been recognised as a key Government priority for this term and should remain a key priority for successive governments.<br><br>In order to meet the Government's goals of having 98% of new entrants participate in ECE by 2016, it is timely for the Government to consider the impacts that home-based ECE has on infant's brains and how this impacts on broader social outcomes. Evidence shows that the early years of life have a significant impact on children's health, development and relationships throughout life. Secure attachments are an important predictor of resilience in later life including higher self-esteem, reduced anxiety and reduced hormonal responses to stress.<br><br>Many adverse developmental outcomes can be prevented when parents/primary |

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| | caregivers are provided with support and information that enables them to be optimally responsive to their infants and young children. Getting it right early in life can have significant benefits, including improving education achievement – leading to national benefits of higher productivity, increased labour force participation, higher incomes and economic growth. |

| Entry ID | 340 |
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| **What Determines a Healthy Start to Life?** | |
| **Theme 1**<br>**The goal of this theme is to understand the interactions between the environment and early pregnancy events, which lead to pregnancy complications and adverse outcomes** | |
| **Importance to New Zealand** | Increasingly, we understand that events in the first thousand days of life influence health throughout childhood and into adulthood. No time point is more important than that around conception, and in the first trimester of pregnancy. This time point is crucial to determine whether a pregnancy is successful, or complicated by miscarriage, foetal growth restriction (when a baby fails to thrive) or pregnancy diseases such as pre-eclampsia. Programming around conception and whilst the baby is in-utero is a major determinative of subsequent health; babies of pregnancies complicated by foetal growth restriction and/or pre-eclampsia suffer increased risks of later developing diabetes, hypertension, stroke and obesity. We need to increase our understanding of what environmental factors: food and nutrition, toxins, infection etc. exert crucial influences at this vital time point. |
| **Research components** | This theme will involve long-term observational studies – using cohorts of pregnant women (with long-term follow up of children through to adulthood) in an effort to understand the different environmental influences (nutritional, toxic, and infectious) that are associated with poor pregnancy outcomes and chronic disease in offspring. In addition, new technologies should be utilised – it is possible to quantitatively assess biological samples (hair, urine and blood) to perform metabolomics and proteomic analysis of micronutrients, toxins and markers of infection. Such hypothesis-generating experiments will augment observational studies and can provide objective, unbiased data. Environmental agents (in excess or deficiency) that are responsible for detrimental effects at this crucial early stage of life will be identified. |
| **Theme 2**<br>**To understand the mechanisms that are involved when an individual's developmental trajectory is modified by environmental cues** | |
| **Importance to New Zealand** | This theme focuses on developmental plasticity. We need to understand the basic molecular and cellular mechanisms that are involved when environmental components (nutrition, toxins, and infection) alter the developmental trajectory in early life. We need to understand how the environment interacts with genes, and how these interactions exert their later life effects. |

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| **Research components** | The placenta is likely to be key to interactions between genes and the environment. The placenta is a key interface between the mother and her developing baby and is the site of transfer of vital gases and nutrients. In pregnancy complications, the blood supply to the placenta, or the structure and function of the placenta is compromised. We need to understand more about the placenta and how the placenta responds to environmental influences. The science of placental epigenetics is likely to be crucial, as are interactions between the placenta and the growing baby. In order that we can influence early life events, we need to understand the mechanisms by which the environment influences early life development. |
| **Theme 3**<br><br>**How can we influence early life events, to improve human health?** | |
| **Importance to NZ** | Increasingly, we are understanding that events in the first thousand days of life influence health through childhood and into adulthood. No time point is more important than that around conception, and in the first trimester of pregnancy. This time point is crucial to determine whether a pregnancy is successful, or complicated by miscarriage, foetal growth restriction (when a baby fails to thrive) or pregnancy complications such as pre-eclampsia. Programming around conception and whilst the baby is in-utero is a major determinative of subsequent health; babies of pregnancies complicated by foetal growth restriction and/or pre-eclampsia suffer increased risks of later developing diabetes, hypertension, stroke and obesity. |
| **Research components** | New Zealand leads the world in research into questions of growth and development. In this theme, we need to utilise our world-leading expertise to develop intervention strategies. This theme will involve clinical trials to test new interventions to modify environmental effects, i.e. to mitigate the impacts of plastic responses. Interventional strategies may involve nutrition – to the mother, particularly in early pregnancy, or to the baby through therapies which increase blood flow to the placenta. Studies of the mechanism by which interventions exert any benefit will be key adjuncts to the clinical trials. |
| **Research Gaps and Opportunities** | The critical mass of expertise in New Zealand, including that concentrated in the Centre of Research Excellence: Gravida, is a highly significant advantage to attaining this goal. |

| **Entry ID** | **348** |
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| **Raising children for a healthy society: How can we nurture, educate and socialize children so they emerge into adulthood as healthy, autonomous individuals able to contribute economically and socially, and equipped to raise a healthy new generation** | |
| **Summary** | This challenge proposes to obtain a better understanding of factors that protect children from adversity and allow them to develop normally despite the presence of |

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| | risk in order to provide opportunities to identify public policy interventions that boost children's healthy development and reduce the emergence of problems with high social and fiscal costs. |
| **Theme 1**<br><br>**Understanding factors that pose risks to children's healthy development** | |
| **Importance to New Zealand** | Most social problems with high fiscal costs, including crime, family violence and child maltreatment, have deep roots early in life, as do many health problems that have a social dimension, including poor mental health and substance abuse. Gaining a better understanding of factors that lie at the roots of these problems would allow the development of public policy that not only reduces human misery, but also significantly reduces the need for remedial social spending. Cost-benefit analyses of selected early intervention programmes based on evidence of this type show high rates of return on investment. |
| **Research components** | Identify factors that pose risks to different dimensions of child development, including cognitive development, social adjustment, schooling achievement, conduct and mental health.<br><br>Identify interactions between multiple risk factors and multiple dimensions of development Identify interactions between risk factors and status variables, in particular, age, ethnicity and socio-economic status Identify the nature of the contribution that genetic, epigenetic and environmental factors make to children's development and the ways in which these factors interact |
| **Theme 2**<br><br>**Understanding resilience: why some children succeed, despite adversity and disadvantage** | |
| **Importance to New Zealand** | Gaining a better understanding of factors that protect children from adversity and allow them to develop normally despite the presence of risk will provide opportunities to identify public policy interventions that boost children's healthy development. Again, this will help to reduce the emergence of problems with high social and fiscal costs. |
| **Research components** | Identify factors that help to boost children's development in the face of specific threats to their well-being, including poverty, family instability, sub-optimal parenting and community disadvantage Identify the mechanisms through which these factors help to protect development |
| **Theme 3**<br><br>**Understanding what works to boost children's healthy development** | |
| **Importance to New Zealand** | This would help to ensure that our current public outlays on programmes aimed at protecting children's development and well-being are effective and cost-efficient. This would help both to reduce social expenditures and to improve social outcomes. |
| **Research components** | Understanding the performance of intervention programmes and other strategies to avert risks to children's well-being and promote their healthy development both in New Zealand and overseas Develop and trial new interventions and other |

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| | strategies aimed at averting threats to children's well-being and boosting their development |

| Entry ID | 376 |
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| **Healthy pregnancies for healthy lives. 6000 New Zealand babies/year have a poorly functioning placenta resulting in small babies, preeclampsia or miscarriage. To ensure every Kiwi starts a long, healthy life we must predict and fix these placental disorders** | |
| **Summary** | This challenge proposes to ensure that all New Zealand babies are given the optimal start to life through a healthy pregnancy. The targets for research include better understanding human placental development, the causes of pregnancy complications, and the ways in which to predict/treat placental disorders. It will involve the study of human foetal development, as well as the complex molecular and cellular interactions which govern this development, allowing the identification and development of novel therapies. |
| **Theme 1**<br>**How does a normal human placenta grow and work?** | |
| **Importance to New Zealand** | Understanding how diseases of the placenta occur requires that we understand how a normal placenta develops and functions. Without this knowledge we cannot make significant progress in understanding, preventing or treating these diseases. |
| **Research components** | We currently know very little about human placental development because human placentas are very different to placentas of most animals. This is especially important because most pregnancy disorders that occur near the end of pregnancy are a result of how the placenta was established (wrongly) very early in pregnancy. Therefore, we need to study how human placentas form during the first weeks of pregnancy. |
| **Theme 2**<br>**Understanding why pregnancy complications occur** | |
| **Importance to New Zealand** | During pregnancy there is an interaction between two individuals that does not occur in any other setting physiological or disease setting. The placenta and fetus must be supported by the mother for 9 months and the mother and fetus potentially have competing interests. 5000-6000 New Zealand babies are affected by diseases of pregnancy that are primarily due to poor placentation including miscarriage, small babies (Intrauterine growth restriction), preeclampsia and preterm birth. Preeclampsia is a disease caused by the placenta that causes potentially fatally high blood pressure (hypertension) in the mother and resultant multiorgan failure eg liver, kidney. Preeclampsia is a particularly important disease as the only cure is delivery of the placenta and fetus to prevent maternal death. This results in preterm birth for many babies that has life-long adverse consequences for the baby. Women who develop preeclampsia are at highly likely |

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| | to develop cardiovascular disease in later life. Therefore, studying the causes of preeclampsia may help to understand the causes of cardiovascular disease in women. |
| **Research components** | The placenta/fetus is the only naturally occurring tissue (organ) transplant since the baby is genetically related to both mother and father. During pregnancy there is an interaction between two individuals that does not occur in any other setting physiological or disease setting. How does the fetus avoid maternal immune rejection? It is likely that many fetus cannot avoid maternal immune responses adequately and that this leads to miscarriage or preeclampsia. How does the fetus subvert the maternal blood supply to ensure that adequate nutrients and oxygen reach the placenta? This process involves placenta (foetal) cells growing into the uterus and transforming small maternal blood vessels into large "pipes" failure of this transformation is thought to underlie preeclampsia and intrauterine growth restriction (small babies).<br><br>Understanding these complex molecular and cellular interactions that occur between the mother and baby in detail will allow us to understand why pregnancy complications occur. Without this knowledge we cannot hope to treat these placental disorders. |
| **Theme 3<br>Predicting and treating placental diseases** | |
| **Importance to New Zealand** | Small babies, pre-eclampsia and miscarriage have been affecting the lives of pregnant women and their babies for thousands of years, yet we still have no way of effectively treating these disorders. Being born small as a result of placental disease has lifelong consequences including an increased risk of obesity, cardiovascular disease and developmental delay. Finding a way to predict and treat placental diseases is important to New Zealand in order to stop the spiralling costs of these disorders to the New Zealand health system. This can only be achieved by breaking the cycle before birth where it begins by developing new ways to predict pregnancies that will suffer from placental diseases so that we can treat these dysfunctional placentas before the baby is permanently affected. |
| **Research components** | Early prediction of the diseases, before the major symptoms have manifest is essential to developing therapies for any placentally-mediated disease. Discovery platforms such as proteomic, genomic and metabolomic comparisons of normal and diseased pregnancies are likely to lead to identification of new screening tools for placental diseases. Because every individual is slightly different such studies will require very large populations and will require international collaboration. Preliminary studies along these lines are currently underway internationally and may produce results in the near future. The challenge will then become to identify new therapies. Before clinical trials of any new therapies can be considered in pregnant women those therapies will need to be extensively tested in model systems. Since the human placenta is quite unique it will be essential to develop in vitro models employing human placentas to robustly test potential therapies. |
| **Research Gaps and** | 1. How does the human placenta form during the first days following |

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| **Opportunities** | fertilisation and implantation. Knowledge of the cell populations involved and how they interaction to produce a fully functional placenta during the first days after implantation is virtually non-existent.<br>2. We currently have very limited ability to accurately predict pregnancies at risk of placental diseases. This is currently a major research focus internationally that is likely to yet new knowledge in the near future which will provide opportunities for research into novel therapies.<br>3. Therapies for placentally-mediated diseases are currently very limited. New Zealand has a scientific workforce with diverse skill set (ranging from computer modelling to in vitro testing) that is well positioned to develop human placental models that can be used in the testing of new therapies. Given that current international research efforts are likely to identify effective new tools to identify pregnancies at risk of placental diseases in the near future it is important to position our research efforts to meet the next challenge of developing and testing new therapies for these conditions. |

| **Entry ID** | **476** |
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| **Good start in life: Ensuring New Zealand is a great place to raise kids** | |
| **Summary** | This challenge proposes to ensure that all New Zealand babies are given the optimal start to life. The targets for research include identifying factors in the pre-natal environment that enhance susceptibility to certain disease (i.e. obesogenic environments), and developing proactive, preventative strategies to deal with these factors. Further research will aim to reduce child abuse rates by identifying effective strategies to prevent child abuse and its consequences (including educational and behavioural interventions), and to maximise childhood potential by developing, monitoring and adjusting strategies to enhance educational achievement/outcomes. |
| **Theme 1**<br>**Healthy mothers, babies and infants for a healthy life** | |
| **Importance to New Zealand** | Intervention before and during pregnancy and in early childhood is critical, as the motivation of parents is high and the potential beneficial effects are long term. The goal of this theme is to understand the interactions between the environment and early pregnancy events, which lead to pregnancy complications and adverse outcomes; to understand the mechanisms that are involved when an individual's developmental trajectory is modified by environmental cues; and to use this information to influence early life events, to improve human health. |
| **Research components** | 4. Identifying lifestyle and nutrition interventions for women before, during and between pregnancies that reduce the risk of obesity and other diseases in their children and develop strategies for women entering pregnancy with problems such as obesity and diabetes that will improve health outcomes in the next generation |

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| | 5. Identifying culturally-appropriate nutritional strategies for children from weaning to two years to optimise life-long dietary habits and health. 4.1.3 Developing simple, effective interventions to prevent common causes of early brain injury including preterm birth, perinatal asphyxia, hypoglycaemia and head injury<br>6. Establishing a national collaborative research grouping to link existing child and maternal health research and development programmes, fill critical gaps and interface with health delivery services<br>7. Long-term observational studies of cohorts of pregnant women (with long-term follow up of children through to adulthood) to understand the different environmental influences (nutritional, toxic, infectious) that are associated with poor pregnancy outcomes and chronic disease in offspring, utilizing new technologies such as metabolomics and proteomics to detect these environmental influences.<br>8. Utilising New Zealand's world-leading expertise in growth and development to develop intervention strategies involving clinical trials to test new interventions (for example, by modifying maternal nutrition or placental blood flow) to ameliorate possible early environmental effects. |
| **Theme 2**<br><br>**Healthy happy children** | |
| **Importance to New Zealand** | Reduce the incidence of child abuse by 25 % by 2025 (or similar) Reduce the incidence of childhood communicable diseases (by 25% by 2025 or similar) Improve New Zealand's ranking with respect to child poverty measures to top decile of countries by 2030 (or similar) Increase participation rates in early childhood education |
| **Research components** | 1. Identifying key contributors to childhood and family resilience in New Zealand communities and how they can be reinforced<br>2. Identifying effective strategies to prevent common childhood communicable diseases and their consequences (includes nutritional, vaccine and other healthcare strategies but also educational and behavioural interventions)<br>3. Identifying effective strategies to prevent child abuse and its consequences (including educational and behavioural interventions) |
| **Theme 3**<br><br>**Maximising child potential** | |
| **Importance to New Zealand** | Increase the educational achievement statistics of children in schools from low SES communities to equivalent to those from high SES communities by 2050 (or similar). Increase in employment rate of school leavers from low decile neighbourhoods to equivalent to those from high decile areas by 2050 (or similar) |
| **Research components** | 1. Identifying relationships between housing, health, family culture and structure on educational achievement and outcomes for children to establish empirically supported understanding of causal factors of poor educational achievement and failure to transition from school to employment<br>2. Developing, monitoring and adjusting interventions to enhance |

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| | educational achievement for children who are not well-served by current education provision.<br>3. Developing, monitoring and adjusting health, housing and home interventions to enhance successful transition from school to productive work and lives |
| **Research Gaps and Opportunities** | As we head towards a time when the majority of our population will be middle-aged and older, it becomes imperative that we address quality of life and independence for older citizens. Assisted living technologies (ALTs) can make a major difference to older adults with disability, helping them to effect daily living tasks without help, or better manage chronic conditions and reduce hospital admissions. Access to ALTs can mean that elderly people can remain in their own home longer, or live with the support of relatives rather than in residential care.<br><br>The Ministry of Health payments to DHBs for aged residential care have quadrupled over the last five years, reaching $900M in 2012 and are projected to be in excess of $1 billion by 2014, clearly this is not sustainable. The speed with which information technology is being integrated into our daily lives means that utilisation of ICT is rapidly becoming fundamental to full and active participation in society. Many older people have not acquired the requisite skills and this can be both frustrating and isolating. We need to ensure that older people are afforded the opportunities to keep up with developments, so they can actively participate and contribute in the workplace and their communities for longer. Integral to ageing with dignity is being afforded respect and not being denied opportunities purely on the basis of age.<br><br>Currently, ageism in our society curtails these fundamental rights, and we need research to establish how we can learn from other cultures and change the prevailing attitudes in New Zealand. Access to public buildings and transport is another vital area where research is needed to ensure that we plan appropriately for this demographic change. Our environments must enable and not disable older adults. |

# 7 Managing an Ageing Population

The submissions in this group are shown with their underpinning themes in the table below. Each submission follows in full.

**Table 7: Summary of proposed challenges and themes**

| Entry Id | Challenge | Themes |
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| 184 | To better understand the nature of ageing populations on New Zealand society in terms of social cohesion and the equitable and ethical provision of services. | 1. To analyse the nature of the pressures on the provision of health services brought about by ageing and changes in technology and impact these changes will have on the health status of New Zealanders. |
| 223 | To improve the health of the New Zealand's population by reducing the impact of the country's greatest health issues. To identify the potential impact of dementia for New Zealand's aging population and how this can be best addressed and managed | 1. Research into causes and treatment of dementia<br>2. Research into New Zealand based services models to improve this so that more people can remain at home for longer and continue to contribute actively in their families and community |
| 288 | New Zealand successfully manages the transition to an older population | 1. The goal is to understand the causes of endemic issues (such as early onset diabetes) and to identify actions that can help minimise these issues, particularly for high risk sectors of the population. |
| 327 | Understanding demographic change in New Zealand (rates of fertility, natural growth and structural/numerical population ageing) migration (internal, immigration, emigration) and the economic implications, including skills supply/demand and labour market matching. | 1. Understanding population change<br>2. Monitoring and managing migration<br>3. Anticipating skills supply and demand factors and labour market matching<br>4. Managing the size and distributional impacts of population change |
| 332 | Older New Zealanders are assured high levels of quality of life by achieving optimum health, economic security and meaningful participation | 1. Understanding the key barriers and facilitators to successful ageing and their trajectories across older adulthood.<br>2. Identify the projected demands of an ageing population on this country's ability to continue to provide retirement and health care services at current levels, and ascertain ways to ensure that the QOL of its citizens can be maintained. |

| Entry Id | Challenge | Themes |
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| | | 3. Enhancing the positive contribution of older adults and their social inclusion in our communities. |
| 342 | Older people live independently longer and at lower cost | 1. Understand the causes of endemic issues (such as early onset diabetes) and identify actions that can help minimise these issues, particularly for high risk sectors of the population.<br>2. Develop technologies that support those with reduced mental capability (due to ageing for example) to live independently for longer<br>3. Develop technologies that support those with reduced physical capability due to loss of mobility or dexterity to live independently for longer and to be more productive contributors to society<br>4. Develop technologies and processes that enable time high quality medical care at reduced cost |
| 406 | Adding Healthy Independent Years to the Lifespan of New Zealanders | 1. Understanding and promoting positive ageing.<br>2. Protecting acuity and memory in the ageing brain.<br>3. Ageing with dignity: independence and better quality of life for older New Zealanders. |
| 470 | Managing the health and labour force challenges of population ageing | 1. Age related illness<br>2. Healthy ageing<br>3. Adaptation of health and social services infrastructure<br>4. Palliative care. |
| 473 | Enhancing the quality of life, independence and contribution to New Zealand of older people | 1. Improving the well-being and independence of an older population<br>2. Improving health outcomes for an older population<br>3. Meeting the economic reality of an older population<br>4. Enhancing engagement in society of elderly New Zealanders |

| Entry ID | 184 |
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| **To better understand the nature of ageing populations on New Zealand society in terms of social cohesion and the equitable and ethical provision of services** | |
| Summary | This challenge proposes a research programme into the pressures on NZ health services due to an ageing population and the effects of other social/demographic changes on the provision of health services and ultimately the health of New |

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| | Zealanders |
| **Theme 1**<br><br>**To analyse the nature of the pressures on the provision of health services brought about by ageing and changes in technology and impact these changes will have on the health status of New Zealanders** | |
| **Importance to New Zealand** | Access to quality health services for all citizens is an important facet of the modern state. The doubling in the number of those aged 65 years and over by 2036 coupled with a halving of the 'dependency ratio' (the number in the workforce supporting this older age category) will have major impacts on the nature of the way interact and organise our lives. The changes in the age profile of New Zealand's population will present a number social and (especially) ethical challenges with regard to defining the optimal patterns of resource distribution across the health sector while also generating debates around various models of social justice.<br><br>The clear benefits to be gained from this evaluation is first, the generation of more robust information that can be used to reduce cost pressures on the health sector through the more prudent allocation of resources and second, better health for New Zealanders with less health disparity between Maori and other New Zealanders. The economic benefit resulting from the reduction in health disparity will be considerable while at the same time reducing the cost pressures on the health system across the board. |
| **Research components** | The research challenges in respect of this context will involve unravelling the effects of a number of social and structural changes impacting on the health system in particular and NZ society in general of which ageing is only one element. Key questions relating to other dimensions that are all in need of robust research and analysis include: the effect of changes in socio-political explanatory frameworks for health status on population health; the effects on health status of structural changes and organisational rearrangements within the health system; the impact of increasing income inequality on health status and the impact of the softening of the emphasis on social inequality on health policy; the changes in the health status of New Zealanders associated with the development of neo-liberal philosophies and the effect of the trend towards the use of 'fast policy' and policy based evidence rather than evidence based policy. |

| **Entry ID** | **223** |
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| **To improve the health of the New Zealand's population by reducing the impact of the country's greatest health issues. To identify the potential impact of dementia for New Zealand's aging population and how this can be best addressed and managed** | |
| **Summary** | Dementia is one of New Zealand's leading health issues (and is a significant economic burden), therefore research is needed into both its causes and treatments (the proposed areas of this research are not specified). |

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| **Theme 1**<br><br>**Research into causes and treatment of dementia** | |
| **Importance to New Zealand** | Around 50,000 people in NZ have dementia. This number is forecast to rise to around 150,000 by 2050 as the population ages. The cost is huge - around $1b in 2011 - and will also rise as numbers increase. This is clearly unsustainable for the country, and dementia has a devastating impact on the people affected and their families. Anything that can be done to better treat the symptoms and/or reduce the impact of this disease will benefit NZ and people affected by dementia. |
| **Research components** | This is a matter for the clinicians and researchers |
| **Theme 2**<br><br>**Research into NZ based services models to improve this so that more people can remain at home for longer and continue to contribute actively in their families and community** | |
| **Importance to New Zealand** | The 50,000 people with dementia are supported by carers, family and community. Many spend their final time in specialist residential care which is disruptive and expensive. In 2008 it was estimated that around $60m could be saved if the shift to residential care was delayed for three months. Achieving this requires significant investment in community and home based services and more research is needed into what services will have the best impact and how they should be delivered. |
| **Research components** | A matter for the clinical researchers |

| **Entry ID** | **288** |
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| **New Zealand successfully manages the transition to an older population** | |
| **Summary** | This challenge proposes a research programme to investigate ways to successfully manage the economic transition to an older population, specifically in areas such as workforce participation by older people, funding of retirement income and intergenerational fairness |
| **Theme 1**<br><br>**New Zealand successfully manages the transition to an older population** | |
| **Importance to New Zealand** | Like many western countries, New Zealand is facing a permanent "ageing" of its population. The size of the productive workforce is likely to shrink while the costs of retirement income will increase. This will happen as the country faces other fiscal pressures, some also associated with ageing - such as in health and long term care. There is an intergenerational transition to be negotiated, and if this cannot be done successfully, New Zealand faces a future of diminishing economic wealth and greater levels of poverty in old age. |
| **Research components** | 1. How to raise levels of achievement in the so-called "tail" of young learners in the school system<br><br>2. Ways to boost and maintain levels of participation in the workforce by older people<br><br>3. The optimal balance between private and collective savings and taxation as economically efficient means of funding retirement income.<br><br>4. The ideal trajectory for transitioning between the current and future economy, taking into account demographic change and ensuring fairness between |

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| | generations |
| **Research Gaps and Opportunities** | 1. We still don't know how to consistently get engagement in schooling by the underachieving 20% or so. There is relative shrinkage in the younger-aged cohort and an additional risk that the future working-age population will not have the human capital needed to boost productivity and economic growth<br><br>2. At older ages and as longevity increases, older people who are able to continue working will need to continue to do so. This will provide benefits to the individuals concerned and to the economy as a whole. However we don't fully understand the factors that block or enhance older workers' participation.<br><br>3. The economics of funding retirement income are complex and still not fully understood. We don't know enough about saving behaviour and wealth accumulation and need to find out more. Then we will be better able to plan for appropriate policies and programmes to boost the economy while also ensuring that New Zealanders of all ages enjoy a good standard of living as the population ages. |

| **Entry ID** | **327** |
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| **Understanding demographic change in NZ (rates of fertility, natural growth and structural/numerical population ageing) migration (internal, immigration, emigration) and the economic implications, including skills supply/demand and labour market matching** | |
| **Summary** | This challenge aims to understand the sources of demographic change within New Zealand, in order to understand how this change impacts the economy (including skills supply/demand etc.). Understanding the drivers/impacts of population change will require the development of complex models and metrics that identify and anticipate interactions such as- how declining fertility and population aging interact with labour markets, housing markets, various sources of equity (cultural, inter-generational), healthcare etc. Research will also focus on devising ways to monitor/manage migration. |
| **Theme 1**<br><br>**Understanding population change** | |
| **Importance to New Zealand** | New Zealand is undergoing significant demographic change, with implications for entry and exit cohorts of the labour market, regional growth/decline, fertility/natural growth and structural and numerical population ageing. Over the next few decades, these changes will impact on intergenerational transfers, equity, the talent pool available to New Zealand and the opportunities for individuals and communities in relation to services, employment and well-being. |
| **Research components** | It is important to develop metrics for identifying and anticipating the impacts of declining fertility and population ageing on factors such as education and skills needs, the labour market, the housing market, health care, the welfare state, equity between sub-populations, generational equity, infrastructure and the environment. The need is for both complex modelling and data on the aspects and impacts of population change on various communities regions and the country. |

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| **Theme 2**<br>**Monitoring and managing migration** | |
| **Importance to New Zealand** | Migration - internal, immigration, emigration - has had a significant impact on the shape of the New Zealand population and the nature of the talent pool available. In the future, with declining fertility, population ageing and regional imbalances, the role of migration will become even more important in meeting future population and economic challenges. |
| **Research components** | There is a need to develop a comprehensive spatial map of projected migration flows, covering both internal and international migration, the impact on Māori in terms of iwi in mana whenua and mata waaka locations, as well as the impacts on individual/community identity and social cohesion. There will be significant impacts on infrastructure and the environment of the changing ethnic composition of the country and its regions, Maori displacement, age composition and the regional distribution/impacts of immigration/emigration. |
| **Theme 3**<br>**Anticipating skills supply and demand factors and labour market matching** | |
| **Importance to New Zealand** | The population changes identified in themes 1 and 2 have a range of implications for skills supply and demand and the need to ensure efficient and effective labour market matching, especially given changes to the sectorial and regional mix of industries and occupations. |
| **Research components** | It is important to develop an understanding of the projected spatial, generational and ethnic characteristics of human capital stocks and flows as they relate to future labour supply and how sectorial and regional labour demand patterns change. Scenario building of future labour market supply/demand is important for anticipating and responding to changes at the sectorial and regional level. |
| **Theme 4**<br>**Managing the size and distributional impacts of population change** | |
| **Importance to New Zealand** | Declining fertility, population ageing and migration all have implications for human capital supply and demand, especially at a regional level and in relation to population profiles of these regions. |
| **Research components** | It is important to develop more precise metrics for anticipating and interpreting the size and distributional impacts of spatial population shifts associated with declining fertility, population ageing and migration and to develop scenarios that encompass the social, economic, political, cultural, environmental and infrastructural impacts of population change, including challenges provided by sub-replacement fertility, ageing, depopulation and urban growth, as well as the importance of skills requirements in meeting New Zealand's future economic needs. |
| **Research Gaps and Opportunities** | New Zealand lacks much of the information required to understand and anticipate some of the population changes which are currently underway and which are going to shape New Zealand over the first half of this century. It is important to ensure that there are the scientific skills to collect the required evidence, and to |

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| | model it in ways that help anticipate future changes. Given the diversity of New Zealand's population, and the importance of recognising tangata whenua issues, the research and modelling needs to address and involve these diverse communities. The need is for the research to respond to and engage the key agencies which will be responsible for policy development and implementation, including local, regional and national government agencies, private sector representatives and organisations, iwi/Maori groups and NGOs/community organisations. |
| **Comments** | Names were removed to protect individuals' privacy[OIA: 9(2)(a)] |

| **Entry ID** | **332** |
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| **Older New Zealanders are assured high levels of quality of life by achieving optimum health, economic security and meaningful participation** | |
| **Summary** | This challenge proposes to ensure that older New Zealanders are assured high levels of quality of life by achieving optimum health, economic security and meaningful community participation. Research will aim to understand and identify the key factors (both positive and negative) that determine successful aging through multi-faceted research across physiological, behavioural, societal, and economic areas etc. The predicted demands of our aging population also need to be assessed, in order to implement policy frameworks pro-actively able to deal with these. Lastly, research will focus on ways in which to integrate and maintain elderly participation and contribution in our communities. |
| **Theme 1**<br>**Understanding the key barriers and facilitators to successful ageing and their trajectories across older adulthood.** | |
| **Importance to New Zealand** | Both the World Health Organization and United Nations have identified population ageing as one of the most important trends of the 21st century. Ensuring successful ageing for all is now one of the world's greatest challenges. A primary strategy for doing so is to enhance both general and health related quality of life (QOL) among this age group. Tackling this challenge requires a clear understanding of the factors that both hinder and enhance QOL; their establishment patterns, support structures, and temporal trajectories. These factors exist across multiple domains and include health state and care (including physical and mental health wellbeing), social integration and support (including meaningful social participation), economic security and opportunity (including work to ensure adequate levels of nutrition, housing, heating), goods and services, and accessibility to them.<br><br>Understanding the complex interactive roles these factors have on QOL require our immediate attention as New Zealand already has one of the highest rates of life expectancy after 65 in the world and is expected to see the proportion of those in this age group double by 2040. Despite equitable access to quality healthcare, this country has high rates of age-related disability and disease, including depressive state. Older Māori and Pacific Islanders remain at particular |

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| | risk for premature death and poor health outcomes. Poor physical and mental health among New Zealand's rapidly expanding older adult population comes with an unacceptably high (and increasing) cost, so strategies to reduce this cost in addition to increasing QOL among this age group are essential. |
| **Research components** | Improve our understanding of key factors that both hinder and enhance general and health related QOL among this age group; their impact on personal health outcomes, as well as, their establishment patterns, support structures, and temporal trajectories. These factors include health state and health care, eating habits and diet quality, social integration and social support, economic security and economic opportunity, goods and services and accessibility to them, and their interaction.<br><br>Identify undesirable health outcomes across older adulthood, develop early detection indicators, and identify physiological, behavioural, social, economic and environmental factors which exacerbate these conditions.<br><br>Identify areas of intervention where potential facilitators for healthy outcomes may be enhanced or barriers to healthy outcomes are removed. This includes assessing the use of current, and developing new, facilitative technologies (ranging from clothing and personal environment design, social and physical habitat design, food and exercise dynamics) to provide meaningful models of support and intervention directed purposefully at QOL.<br><br>Implement institutional, social and individual interventions aimed at reducing potential barriers and enhancing potential facilitators to QOL in older adults where applicable, and the assess outcome of these interventions. |
| **Theme 2**<br><br>**Identify the projected demands of an ageing population on this country's ability to continue to provide retirement and health care services at current levels, and ascertain ways to ensure that the QOL of its citizens can be maintained.** | |
| **Importance to New Zealand** | Currently, New Zealand's universal pension and health insurance systems provide its older population with the lowest rates of poverty and highest rates of perceived health in the OECD. However, rapid population ageing is expected to result in increased economic dependency ratios and constrain existing workforce capacity and wealth production. Increasing retirement rates are expected to strain existing pension funds, while demands on healthcare for an older population with higher propensity for disability and long-term care have the potential to increase health related costs exponentially. Continued universal coverage for an expanding older population could require New Zealand to undertake one of the highest age-related spending increases in the OECD. Compounding pension provision concerns is the reality that New Zealanders have historically poor rates of personal savings and, when combined with existing tax laws which effectively de-incentivising post-retirement work, many citizens will have no income streams to supplement their state-provided pensions.<br><br>With a wave of baby boomer retirements over the coming two decades there are now serious concerns that New Zealand's health and pension systems are simply not viable in their current form. One way to reduce the negative health and |

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| | economic consequences associated with ageing by increasing the proportion of health productive years we live. New Zealand, like the rest of the world, needs to identify the resource demands of an ageing population and ascertain whether alternative approaches can reduce or offset these resource demands while maintaining or enhancing the quality of life of its citizens. |
| **Research components** | Develop our knowledge of the health, social and economic resource demands an ageing population will make on New Zealand in light of current practices in order to establish the basis upon which public policy designed to reduce these demands may be implemented and evaluated.<br><br>Assess interventions designed to increase general and health related quality of life (e.g., facilitative technologies, social marketing, and medical procedures) against the potential health, social and economic resource demands of ageing population to determine their contribution to reducing these demands over time. |
| **Theme 3**<br><br>**Enhancing the positive contribution of older adults and their social inclusion in our communities** | |
| **Importance to New Zealand** | The World Economic Forum recently identified older adults as one of the world's most valuable untapped resources, and their accrued social capital (i.e., knowledge, skills, and experience), retirement wealth, comparatively good health, enthusiasm for work beyond retirement, and community volunteer contributions represent a combined resource set with the potential to tackle some of New Zealand's most significant social, economic and health issues.<br><br>The Ministry of Social Development's 2011 Business of Ageing report identifies the potential of older adults as a substantial target market for age-related assistive and medical technologies, general consumer goods, and trustworthy local investment products. Similarly, the social inclusion and integration of older adults has the potential to drastically reduce community isolation, foster community leadership, and engender positive inter-generational exchange with and by older adults.<br><br>The World Health Organization maintains that enhancing the social and economic integration of older adults (and their quality of life) requires maximising positive participation factors (e.g., accessibility, affordability, degree of cross-generational appeal, and range of participatory events), and reduce negative factors (e.g., stigmatisation and social exclusion). Older adults thus represent an economic and social resource on which to institute real social innovation; a new approach to ageing based on working with (rather than for) older adults in order to resolve shared economic, social, and health issues is needed. Such an arrangement may in itself lead to the answers required to increase our community-health while decreasing the demands of an ageing society on our shared health, economic and social resources. |
| **Research components** | Identify the innovation, knowledge and skills-base of our older adults, and explore mechanisms through which these vital resources may be utilised to tackle key social, economic and health issues facing New Zealand now and in the future. |

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| | Explore pathways for enhanced social and economic participation of older adults in our communities, and the degree to which current ageing-friendly policies are effectively meeting this challenge.<br><br>Clarify the potential that an elder-focussed consumer market creates for New Zealand industry, and the degree to which we need to re-focus our economic approaches in order to adequately meet this opportunity.<br><br>Determine the extent to which increased participation of older adults in community and national affairs leads to enhanced general and health related quality of life in this population, and the contribution it makes in reducing the health, social and economic resource demands of an ageing population to New Zealand. |
| **Research Gaps and Opportunities** | Much like our international counterparts New Zealand is at the crest of a population ageing wave the likes of which we have never before encountered, and we are have little research or evidence for us to successfully navigate this issue. We have an inadequate understanding of the wider social, economic and health ramifications of population ageing (both for the individual or the country as a whole), the degree to which social, economic or health interventions might mitigate these ramifications, and which combination of existing social, economic and health states provides for the best quality of life. Despite favourable rankings on some international indices of quality of life we also rank poorly on other factors crucial for supporting older New Zealanders, and this is particularly evident for older Maori who die earlier and in poorer physical and economic health than other New Zealanders.<br><br>The challenge of building our understanding of the pathway to successful ageing requires substantial cross-disciplinary collaboration and engagement from leaders and researchers in areas as diverse as medicine, economics, technology, public health, social and political science, governance, and environmental planning. A collective approach to a goal of such global importance is an aspirational outcome that New Zealand has both the research expertise and the social will to fulfil. Achieving successful ageing for all New Zealanders is a challenge on an international scale, and will establish New Zealand as a science and policy innovator in an area many have so far failed to address. |

| **Entry ID** | **342** |
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| **Older people to live independently longer and at lower cost** | |
| **Summary** | This challenge proposes to develop technological solutions enabling New Zealanders to live independently for longer, at lower cost. Research will focus on understanding the causes of endemic issues (such as diabetes, asthma) which impair quality of life/independence, and devising ways in which these can be diagnosed and treated more efficiently. Technologies will be developed that allow for better care and increased productivity of the mentally impaired (i.e. due to age-related memory decline), or those with reduced mobility/dexterity. An important aspect is translating basic research into applied methods to help the elderly, and developing processes that enable quality medical care at reduced |

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| | cost. |
| **Theme 1**<br><br>**The goal is to understand the causes of endemic issues (such as early onset diabetes) and to identify actions that can help minimise these issues, particularly for high risk sectors of the population** | |
| **Importance to New Zealand** | New Zealand needs productive, healthy people to contribute to its activity, particularly as part of the workforce. Diabetes and asthma are increasing in New Zealand at epidemic rates. According to Diabetes New Zealand over 208,000 New Zealanders have Type 1 or Type 2 diabetes and another 50 people are diagnosed every day.<br><br>For asthma the figures are higher, with approximately 800,000 New Zealanders being affected by asthma, chronic obstructive respiratory disease or other respiratory conditions, according to the Asthma Foundation. Healthcare costs approximately 10% of gross domestic product (GDP) in New Zealand, with 1% of GDP spent on Type 2 diabetes alone. These costs are set to climb as more New Zealanders are diagnosed and treated for these chronic illnesses. There are opportunities for New Zealand to improve the efficiency and effectiveness of its spend on medicine.<br><br>Earlier and better diagnosis will mean people are aware of their illnesses earlier so their care can be better planned and managed. Increased personalised care will mean people receive personalised drugs or personalised methods of care which may be enabled by new technologies or biomedical engineering. Personalised care will result in better treatment outcomes, thereby resulting in better patient outcomes and better use of health funds. |
| **Research components** | Research is needed to develop technologies to better diagnose diabetes so it is diagnosed earlier. Coupled with this, research is needed to enable better care of those with Type 2 diabetes so they can live longer and have more productive lives. Research is also needed to develop technologies and systems that enable better diagnosis and care of asthma, particularly in children, so these people can have higher life quality and lead more productive lives. Finally, there needs to be significant research into translational research methods. Specifically, to develop standardised templates, approaches or methods to translate research and science across the engineering-medicine boundary and into outcomes for patients. This inability is a major hurdle in achieving better care. |
| **Theme 2**<br><br>**The goal is to develop technologies that support those with reduced mental capability (due to ageing for example) to live independently for longer** | |
| **Importance to New Zealand** | The New Zealand population is aging. Approximately 600,000 New Zealanders are currently aged over 65 years of age. This figure is set to forecast to 1.2 million in 2036 and 1.5 million in 2061. Illnesses such as dementia are more likely to afflict older people and it is therefore reasonable to expect that the number of people affected by these illnesses will increase over time.<br><br>According to Alzheimers New Zealand over 48,000 New Zealanders have |

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| | dementia, up from over 40,000 in 2008. These figures are expected to increase further, with over 147,000 New Zealanders expected to be afflicted with dementia by 2050. The costs of dementia are significant – over $954 million was sent on dementia in 2011. Better management of illnesses such as dementia is important in ensuring New Zealand's healthcare funds are well spent.<br><br>Another very significant factor affecting New Zealanders is mental illness. The Mental Health Foundation of New Zealand estimates almost 1 out of 2 people will experience some form of mental illness in a lifetime. These people are more likely to suffer other chronic physical conditions, be at higher risk of suicide and face discrimination. Improved diagnosis, monitoring and treatment of mental illness is important as a means of giving sufferers improved quality of life, helping sufferers to lead more productive lives and help these people contribute to their community and nation. |
| **Research components** | Research is needed to develop technologies that enable aged people to live independently for longer and have more productive lives. Multi-disciplinary research teams may be needed to ensure technologies developed meet the needs of users (aged people and health care professionals) and utilise the best knowledge available. For mental illness two streams of research are needed. Firstly, research is needed to develop technologies and systems that enable better monitoring and care of mental illness. IPENZ understands this area of medicine is currently devoid of technology. A second strand of research would develop technologies and systems to enable those suffering mental illness to live more productive lives. Such technologies and systems must be able to be used or followed without mental health sufferers having to suffer further discrimination and stigma from other members of society. |
| **Theme 3**<br><br>**The goal is to develop technologies that support those with reduced physical capability due to loss of mobility or dexterity to live independently for longer and to be more productive contributors to society** | |
| **Importance to New Zealand** | A large number of New Zealanders are affected by accidents and other events that result in them having reduced physical capability. According to Statistics New Zealand in 2006 an estimated 660,300 New Zealanders or 17% of the population had some kind of disability. Individuals with disabilities can face difficulties in their endeavour to have a "normal" life. For example, individuals can have difficulty in returning to the workforce following an accident and difficulty in remaining in their homes following an accident. Reduced physical capability can also be a result of older age or a specific ailment such as arthritis which afflicts more than half a million people and which, according to Arthritis New Zealand results in 25,440 New Zealanders not being able to work each year. Providing better support for people with physical disabilities will enhance individuals' quality of life, improve the contribution these individuals can make to society and improve both social and economic outcomes at the national level. |
| **Research components** | Research is needed to develop technologies that support people with reduced physical capability due to the loss of mobility or dexterity to live independently |

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| | for longer and be more productive contributors to society. Research is also needed to develop technologies that allow patients with major injuries (such as spinal injury) to recover faster and be more productive contributors to society. |
| **Theme 4**<br><br>**The goal is to develop technologies and processes that enable time high quality medical care at reduced cost** | |
| **Importance to New Zealand** | New Zealand has limited funds for healthcare. Currently, healthcare costs approximately 10% of gross domestic product (GDP) in New Zealand and this is set to rise as more people age and life expectancy rises. There are opportunities for New Zealand to improve the efficiency and effectiveness of its spend on medicine. Technology and processes that are intuitive and designed with a multi-disciplinary team is one means of improving outcomes for patients and ensuring funds are well spent. There are three areas where increased efficiency is needed. Firstly, general practice which is in need of systems and technologies to deliver more efficient management of care. Secondly, emergency and critical care, which IPENZ understands costs 10% of all healthcare costs but which serves only 0.5% of all patients. Finally, surgical care which comprises a significant fraction of healthcare costs but for which waiting lists continue to grow. |
| **Research components** | There are a number of research components to this theme. Firstly, in relation to general practice, research is needed to develop technologies that enable the provision of general practice more productively and affordably to the same standard of care. In relation to emergency and critical care, research is needed to develop technologies to personalise care in critical care to improve outcomes for patients and decrease the costs of treatment and rehabilitation. Research is also needed to develop technologies to improve the productivity of diagnosis and care in both critical and emergency care. Finally, in relation to surgical care, research is needed to develop technologies and systems that improve the productivity and care of surgical services. The goal must be to reduce the social and indirect economic costs of those on waiting lists and who are less productive awaiting care and recovering from treatment. |
| **Research Gaps and Opportunities** | Overall, there is an opportunity to ensure technology developers (engineers and others) are better linked up with healthcare providers so that technology solutions are integrated and efficiently used. This is vital if healthcare spend is to be efficient and of high quality. |

| **Entry ID** | **406** |
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| **Adding Healthy Independent Years to the Lifespan of New Zealanders** | |
| **Summary** | This challenge proposes to develop an understanding of factors that influence aging, in order to ensure and promote a positive, healthy lifestyle for aging New Zealanders. Multi-faceted research is required to determine the factors that influence a 'healthy aging' phenotype (i.e. biology, genetics, socio-economic circumstance, lifestyle), which will allow practices to be adopted that |

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| | promote/encourage these factors. Further research is needed in order to better manage the negative health outcomes associated with age (i.e. chronic disease, memory), with a focus on personalised medicine and promoting independence. |
| **Theme 1**<br><br>**Understanding and promoting positive ageing** | |
| **Importance to New Zealand** | "There are many factors that affect how well a person ages - related to their genes, early development, socio-economic circumstances and their lifestyle. In Westernised societies, advancing years are often accompanied by increasing illness and frailty. Studies of the elderly in countries like Japan show that this link between ageing and increasing morbidity is not inevitable. Worldwide, developed countries are putting major resources into studying intrinsic and extrinsic factors that give rise to a healthy ageing phenotype. We now have powerful tools to do this, as technological advances allow us to study the genome, proteome and metabalome with much greater ease and established longitudinal studies allow us to identify gene-environment interactions that were previously only guessed at. Once we understand what characterises the healthy ageing phenotype, we must devise ways to intervene early when deviations from this become evident.<br><br>Ischaemic heart disease and stroke are the major causes of premature death and disability-adjusted life years lost in New Zealand. Recent studies have found that, while our incidence of stroke has declined over the past 20 years, the rate of decline is over four times slower than in other countries. Over the same period, stroke incidence in Māori and Pacific peoples increased – and they have significantly worse outcomes in terms of cognitive impairment, dementia and economic self-sufficiency. Over a third of deaths in New Zealand are caused by cardiovascular disease, and about 80% of these cardiovascular events are thought to be preventable – as are the majority of the cases of diabetes that place such a burden on our health services. The combined effects of the epidemic in chronic diseases, ageing and the increasing proportion of the population that are the worst affected chronic diseases, Māori and Pacific people, is creating what can only be described as a crisis for new Zealand in coming decades. |
| **Research components** | 1. Understanding the genetic factors that mediate ‘good’ or ‘poor’ ageing, with a view to developing screening measures & interventions.<br><br>2. Better management of chronic conditions in older adults, with a focus on personalised medicine and better integrated models of care<br><br>3. Understanding bone biology and strengthening the skeleton to prevent avoidable fractures and degeneration of joints, with a focus on maintaining mobility in later life<br><br>4. Rehabilitation from strokes & falls, with emphasis on novel methods & translational research. |
| **Theme 2**<br><br>**Protecting acuity and memory in the ageing brain** | |
| **Importance to New** | Dementia literally translates from Latin as ‘loss of mind’. It is one of the most |

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| **Zealand** | devastating illnesses associated with ageing, robbing sufferers of their memories, their independence and, too often, their dignity. Our ageing population means that the number of people with dementia is projected to quadruple over the next forty years. Alzheimer's disease currently affects more than 40,000 New Zealanders, and a quarter of those aged 80 and over. Due to decades of research, the mystery of how memories are stored and preserved in the human brain is finally being unravelled. This research has led to the identification of promising new treatments for dementia and better understanding of how we can make the brain more resilient to the effects of ageing. In New Zealand, we are fortunate to have two neuroscience research groups that are at the forefront of their field internationally and have made substantive discoveries in recent years that may foreshadow major breakthroughs in the prevention, treatment and management of dementia in the foreseeable future. |
| **Research components** | 1. Understanding how memories are stored and preserved, developing new tools to predict and assess memory loss, and interventions and treatments to preserve and prolong memory recall.<br><br>2. Understanding, preventing and treating Alzheimer's disease, and better predicting the course of the illness in those affected.<br><br>3. Genetic predisposition to dementia and the mechanisms through which protein plaques are deposited in the brain, and the means to mediate or reverse this process.4. Study of the value of continuing education in maintaining healthy brain function in ageing populations and the design of feasible interventions to keep mentally active for senior citizens in New Zealand. |
| **Theme 3**<br><br>**Ageing with dignity: independence and better quality of life for older New Zealanders** | |
| **Importance to New Zealand** | As we head towards a time when the majority of our population will be middle-aged and older, it becomes imperative that we address quality of life and independence for older citizens. Assisted living technologies (ALTs) can make a major difference to older adults with disability, helping them to effect daily living tasks without help, or better manage chronic conditions and reduce hospital admissions. Access to ALTs can mean that elderly people can remain in their own home longer, or live with the support of relatives rather than in residential care.<br><br>The Ministry of Health payments to DHBs for aged residential care have quadrupled over the last five years, reaching $900M in 2012 and are projected to be in excess of $1 billion by 2014, clearly this is not sustainable. The speed with which information technology is being integrated into our daily lives means that utilisation of ICT is rapidly becoming fundamental to full and active participation in society. Many older people have not acquired the requisite skills and this can be both frustrating and isolating. We need to ensure that older people are afforded the opportunities to keep up with developments, so they can actively participate and contribute in the workplace and their communities for longer. Integral to ageing with dignity is being afforded respect and not being denied opportunities purely on the basis of age.<br><br>Currently, ageism in our society curtails these fundamental rights, and we need |

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| | research to establish how we can learn from other cultures and change the prevailing attitudes in New Zealand. Access to public buildings and transport is another vital area where research is needed to ensure that we plan appropriately for this demographic change. Our environments must enable and not disable older adults. |
| **Research components** | 1. The development of assisted living technologies (ALTs) to support older citizens, with a particular focus on those suffering from dementia and recovering from strokes and falls.<br><br>2. Study of the uptake of ALTs and ICTs in older populations, with emphasis on understanding and eliminating barriers to uptake in Māori and Pacific populations.<br><br>3. Cost-effectiveness studies of intensive rehabilitation to return people to their own homes with support services versus subsidised, long-term, rest home care.<br><br>4. Research aimed at reducing disabling environments and negative societal attitudes to older citizens, allowing people to age with dignity and participate productively in the workforce and their communities for longer. |
| **Research Gaps and Opportunities** | We are very fortunate in New Zealand to host two internationally renowned longitudinal studies, the Dunedin Multidisciplinary Health and Development Study and the Christchurch Health and Development Study. Longitudinal studies combine genetic, socio-demographic and environmental data and are a powerful vehicle for studying ageing, and the foetal/childhood origins of adult disease. We are also fortunate to have the Bone Biology Research Group, which has made major advances on the prevention and treatment of osteoporosis, and continues to do so. Their work has also had a major international impact. |
| **Grouping** | Aging and Health (chronic disease and aging) |

| **Entry ID** | **470** |
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| **Managing the health and labour force challenges of population ageing** | |
| **Summary** | The goal is to manage health and labour force challenges due to NZ's ageing population |
| **Theme 1**<br><br>**Age related illness** | |
| **Theme 2**<br><br>**Healthy ageing** | |
| **Theme 3**<br><br>**Adaptation of health and social services infrastructure** | |
| **Theme 4**<br><br>**Palliative care** | |
| **Comments** | Measurable outcomes include, improved awareness of and attitudes to healthy ageing, reduced skills gaps, increased retirement equity among different |

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| | communities |

| Entry ID | 473 |
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| **Enhancing the quality of life, independence and contribution to New Zealand of older people** | |
| **Summary** | This challenge proposes to improve the independence and well-being of New Zealand's aging population. Research components will focus on reducing the proposition of elderly in residential care by promoting active societal engagement, improving health outcomes for the elderly through medical research and creating positive physical environments for aging, and developing proactive strategies to deal with the economic realities of New Zealand's aging population by maintaining elderly engagement with the economy (reducing the net cost of supporting an older population). |
| **Theme 1**<br><br>**Improving the well-being and independence of an older population** | |
| **Importance to New Zealand** | • Reduce the proportion of older people living in residential care (by 50% by 2050 or similar)<br>• Positive measures of well-being and independence |
| **Research components** | • Identifying how society's perceptions of the elderly can be changed to value them and recognise their potential and real contributions to their communities<br>• Developing approaches to ensure older people are actively engaged in community life, political and social engagement |
| **Theme 2**<br><br>**Improving health outcomes for an older population** | |
| **Importance to New Zealand** | • Improvements in quality of life indicators for older people Increase life expectancy<br>• Reduce mortality and morbidity in older people (by 25% by 2050 or similar)<br>• Reduce costs of hospital care and residential care for older people as a % of GDP |
| **Research components** | • Identifying and understanding diseases of aging, how they develop, and identify specific interventions to reduce their incidence and prevalence, including for sensory disorders that limit older people's ability to participate in society<br>• Developing novel health workforce interventions to improve the health of the elderly<br>• Determining how to create a physical environment that supports positive ageing (housing design, transport, accessible public spaces)Identifying and implementing practices that will improve adherence of the elderly to effective treatments<br>• Researching innovative technologies (such as telemedicine, robotics, mHealth etc) to maintain independent living into old age<br>• Identifying nutritional solutions for successful ageing |

| Theme 3<br><br>Meeting the economic reality of an older population | |
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| **Importance to New Zealand** | Increase the economic participation of older people thereby reducing the net cost of supporting an older population |
| **Research components** | • Identifying new ways of providing financial security for the elderly<br>• Identifying new ways of maintaining their engagement in economic activities |
| **Theme 4**<br><br>**Enhancing engagement in society of elderly New Zealanders** | |
| **Importance to New Zealand** | Proportion of older people actively engaged in learning new approaches and technologies to support their on-going engagement with society |
| **Research components** | • Identifying barriers to social engagement by the elderly and effective measures to address these<br>• Identifying options to support people in preparing for old age (eg engaging in lifelong learning)<br>• Developing technology-based solutions for age specific issues and for enhancing the ability of older people to engage with technology |
| **Research Gaps and Opportunities** | New Zealand's population is ageing, and older people face significant barriers to good health, economic wellbeing and social engagement. Older people are also an underutilised resource of experience, wisdom and leadership who can contribute positively to New Zealand's prosperity and wellbeing. To enhance the life satisfaction and fulfilment of the elderly, and to increase their net contribution to New Zealand, will require innovative, research-led solutions to enable older people to remain independent, healthy and engaged in society for much longer than is currently the case. |