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SUMMARY

In the report we have divided our impacts into chapters that each tell a different piece of our impact story. Each chapter can stand alone, but all chapters are needed to tell the story of how the HRC contributes across the full value chain, from generating the fundamental knowledge needed to germinate ideas right through to the clinical testing of innovations in our health system. The content is summarised below.

**Chapter 1: Backing the best – our role, investment systems and processes**
Some of the important work we do to support the health research sector in New Zealand can be overlooked, such as the robust processes that help us to make sound and fair investment choices, our role in ensuring that health research is both ethical and safe, and our statutory responsibility to set the health research priorities for government investment.

**Chapter 2: Transforming lives – better health for New Zealanders**
HRC supports a broad portfolio of research that has had a major impact on the health and quality of life in New Zealand and in many cases, internationally. The range of issues we cover with our annual funds is impressive. As we celebrate 25 years of serving New Zealand this year, many of the programmes of research we first supported a quarter of a century before are producing landmark achievements from our sustained investment.

**Chapter 3: Better health delivery – providing innovation to elevate healthcare and health outcomes**
HRC has a crucial role in ensuring that our health services are informed, of the highest quality, efficient and cost-effective. Our processes ensure that research evidence is robust and all the health delivery research we fund is commissioned in conjunction with clinicians and end-users, often in partnership with DHBs. This makes us a crucial resource for health service planners and managers in this country. In 2014/15, we distributed $11.5M to 46 teams across the country to conduct research that will improve health delivery. We have a major focus on translating research into practice, evidenced by the fact that 43 per cent of our on-going contracts are classified as translational research.

**Chapter 4: Making a world of difference – collaborating across national boundaries**
International collaborations provide our researchers with a wider range of facilities and resources and allow them to conduct research at a global level, participating in innovative projects and cutting-edge activity with leaders in their field. HRC has formal partnerships agreements with Australia, Canada, the EU, the US, China and the e-Asia Programme. We represent New Zealand in the Human Frontiers Science Program and our Chief Executive is a member of the Heads of International Research Organisations. The researchers we support often have an international reputation in their field and are linked in with global research networks. In our 2014 funding round, 61 per cent of contracts identified at least one international collaborator.
Chapter 5: Netting economic returns – how we deliver across the value chain
HRC has a crucial role in delivering the full innovation value chain from improved health and social outcomes to boosting GDP. Not only does our research benefit the nation by keeping our population healthier, happier and more productive, it underpins a more efficient and cost-effect health system and generates direct economic returns through commercialisation of discoveries. Sustained support of top teams since our inception in 1990 has meant we have taken fundamental discoveries all the way from patent to patient. We have many more exciting innovations in our discovery pipeline that will feed New Zealand’s future successes in the global health market, as well making a real difference to patients and their families. HRC is the only funder supporting clinical trials of novel drugs and biologics in patients, a crucial cog in our commercialisation machinery.

Chapter 6: Investing in people – our innovating research workforce
Our researchers are the engine that drives advances in New Zealand’s health and productivity. Our top teams are internationally recognised, whilst our emerging researchers are poised to become the next generation of research leaders. HRC trains and supports the health research workforce, monitoring to identify critical strengths and gaps. We provide a detailed analysis of this workforce annually, 1391 named individuals in 2014/15. We help build careers and critical capacity through our career development awards, and are the only agency directly addressing Māori health research capacity through culturally appropriate processes, ring-fenced funding and targeted awards. We have made major gains in this regard, with 12 per cent of researchers on current contracts identifying as Māori.

Chapter 7: Dreams we can deliver – discoveries on the horizon
We can live in a nation where we stop the epidemic of rheumatic fever that is crippling generations of our most vulnerable children, prevent asthma from ever developing and control aggressive cancers, like malignant melanoma. HRC funding over decades has built the capacity to make such dreams a reality. Our innovative Explorer Grants encourage health scientists to push the boundaries of science and provide us with their most exciting ideas. Scanning the horizon, we have tried to predict the advances that will have revolutionised healthcare in 2050 and see that much of what we have funded over the last two decades will be driving and supporting these changes.

Chapter 8: HRC’s value proposition – balancing issues and managing risks
Our current portfolio of research is making a critical impact where New Zealand’s burden of disease is greatest. Half of our investment is focused on research on the needs of our people, which cannot be undertaken overseas. Our research underpins nearly half of the medical technology contracts currently supported by MBIE. HRC investment in, and monitoring of, the health research workforce means that we have the capacity to meet the needs of our unique population. Our opportunities increase the chances of attracting the best ‘research-active’ health professionals and academics to live and work in New Zealand. We can prove the quality and value of our investment. Despite the real risks and impacts we face from budget restrictions, we have continued to provide a broad range of high-quality and cost-effective services. We can always do better, and the things we want to work on include better alignment, developing a collective vision for health research and improving the translation, uptake and application of knowledge and innovations our investment generates.
Chapter 1: BACKING THE BEST – our role, investment systems & processes
TO MAXIMISE THE IMPACT ACHIEVED THROUGH OUR HEALTH RESEARCH INVESTMENT WE NEED FRAMEWORKS AND PROCESSES THAT ATTRACTION, IDENTIFY AND SUPPORT ‘THE BEST’ RESEARCH AND RESEARCHERS

Our place in the health research community

The Health Research Council of New Zealand

The HRC was established under the Health Research Council Act of 1990. With our mission and vision of ‘benefitting New Zealand through health research’ and ‘improved health and quality of life for all’, HRC is dedicated to making a meaningful difference to the health and wellbeing of New Zealanders, our healthcare system, and our economy.

Providing leadership in health research

The breadth and diversity of health research is reflected in the number of research funders, given the size of the funding pool (approximately $200M in 2010/11)\(^1\). Although the HRC is the government’s specialised health research purchase agency and has the statutory responsibility to fund health research in New Zealand, we receive a relatively small proportion of the overall funding – estimated to be in the region of 15 per cent.

HRC plays a central role in this health research funding community, co-ordinating and aligning with other funders, allocating stable funding for health research, and providing the systems and oversight required to ensure that the health research environment in New Zealand is equitable, ethical and safe.

In addition to distributing funds for health research, our Act also requires us to advise our Minister on national health research policy, promote and disseminate the results of health research, and foster the health research workforce. We therefore consider our role to include providing leadership and sharing good practice. To this end we:

- maintain detailed data on our own health research investment;
- maintain links and exchange knowledge and best-practice protocols with other international health research funding agencies;
- undertake work to understand the health research landscape, which is used to develop our own frameworks (e.g. our Research Investment Streams – RIS) and work to support strategic decisions on health research for New Zealand;
- monitor collective coverage of the health research landscape by New Zealand funders, noting areas of niche investment and expertise - such as we have in supporting, clinical, public health, health delivery, and Māori and Pacific health research - as well as identifying critical gaps;
- actively work to attract, support and retain the best clinicians and health researchers in New Zealand;
- track how our investment impacts on the health research workforce and

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\(^1\) Getting the Most out of Health Research for New Zealand: HRC 2012.
build this information into our strategic decisions;

- reward excellence through our Liley medal for the publication with the most research impact and our Beaven medal for outstanding translational research;

- ensure research is ethical and safe by acting as a hub for information on research ethics, providing links to national and international ethics information, accrediting ethics committees, considering applications on appeal and publishing ethical research guidelines;

- provide advice on the safety and merit of research involving gene technologies and independent data monitoring of large-scale clinical trials to safeguard participants (the HRC’s Gene Technology Advisory Committee and Standing Committee on Therapeutic Trials).

- Undertake work on policy issues that affect all funders such as data sharing.

## A robust framework for health research in New Zealand

The HRC’s core role is to target investment to create the maximum value and meet the country’s current and future health needs. We draw on our experience, our knowledge of the current and likely future health needs of New Zealanders, the goals and priorities of the Government, our networks and relationships, and the collective international health research context to develop systems and frameworks that deliver the evidence and develop the skills that New Zealand needs.

Creating and implementing the best strategies, frameworks, systems and processes is a constantly evolving process. There are many different, often competing, components that need to be supported, grown, incentivised and/or leveraged to achieve the best results. This requires specifically targeted, tailored approaches that are designed to achieve the best outcome.

Our research investment is structured through our Research Investment Streams (RIS), which encompass all areas of human health and development, and healthcare delivery. Our four RIS are:

- Health and Wellbeing in New Zealand;
- Improving Outcomes in Acute and Chronic Conditions in New Zealand;
- Research for New Zealand Health Delivery, and
- Rangahau Hauora Māori.

The importance of keeping people well, productive and independent, alongside concerted efforts to combat acute and
Our mission: New Zealanders will be healthier tomorrow because of work we do today

HRC at a glance

**Investing approx. $75M per annum in health research**, using stringent peer-review processes that maximise the value from the taxpayers' investment.

**Using the HRC’s Partnership Programme** to join with agencies nationally & internationally & maximise $, utility & reach of health research.

**Targeting research towards the needs of our most vulnerable populations, & developing specialist capacity in Māori, Pacific, children & youth, & older adults research.**

**Continuously developing & refining health research strategy for New Zealand.**

**Maintaining systems that contribute to an ethical & safe research environment (HRC Ethics Committee, Standing Committee on Therapeutic Trials).**

**Gathering accurate data on our investment, gaps, emerging issues, workforce & risks & running an evaluation programme, including a triennial bibliometric survey of NZ health research publications.**

**Communicating the latest on health research in NZ with stakeholders & developing research IT systems for applicants to streamline processes & facilitate data-sharing.**

**Attracting & retaining the best researchers & clinicians in New Zealand through our major programme of career development awards.**

**Māori investment processes, systems & committees to support our portfolio of indigenous research, career development & capacity building.**

**Advising Government on health research priorities & new health technologies (Gene Technology Advisory Committee).**
chronic conditions and to improve the quality and sustainability of the healthcare system are supported both by international investment trends. These areas of focus also reflect what is important to health research stakeholders and end-users, including the Ministry of Health (MoH) and the Ministry of Business, Innovation and Employment (MBIE). Underpinning our funding philosophy is the fact that **New Zealand has a unique opportunity to support distinctive approaches to addressing the health needs and aspirations of Māori, and to build the capacity needed to work with our indigenous population in order to improve health outcomes and achieve health equity.**

The RIS framework was introduced in 2010 and was developed on the basis of extensive consultation involving focus groups and interviews with 302 participants, along with an online process that elicited 87 written submissions. The stakeholder input received through this process was used to make revisions to the final funding model, including raising the level of budget caps from what was initially proposed and providing greater flexibility by ensuring budget allocations for each RIS were indicative rather than fixed.

Each RIS has an Investment Signal which identifies the scope, priorities, goals and research qualities or characteristics associated with the stream, and encourages researchers to have an improvement and change-orientation focus, **with a defined pathway for achieving knowledge transfer, and a skilled fit-for-purpose research team.** The importance of engagement of stakeholders and end-users is also explicit in each document.
the signal, and have impact in relation
to the specific knowledge, health and
economic goals identified for each
stream.

Our innovative funding models and
investment streams

Given our relatively limited funds, we
have become skilled in making creative
use of funding partnerships and
innovative funding mechanisms to
efficiently address our diverse goals.

Over the course of a year, we typically
offer in excess of 30 different funding
opportunities, including our core Annual
Funding Round, mission-led requests for
proposals and a range of career
development awards. A summary of our
investment pools and mechanisms is
provided in Annex B.

Researcher-led innovation

The Annual Funding Round is our major
opportunity to support studies proposed
by our research community. Through this
process, we see the work that our high-
performing teams are really passionate
about and the areas where they feel that
they can make the biggest contribution. It
is also an opportunity to fund ideas and
innovations that the broader health and
science sector have not yet conceived of
and, additionally, to support links with
international teams that have been forged
independently of our processes.

We invest approximately 70 per cent
of our annual funds in supporting the best
ideas and teams that are contributing
to the four key outcomes embodied by
our RIS – keeping New Zealanders
healthy and well (30-35 per cent
of funds), improving outcomes for those
with acute and chronic conditions (35-
40 per cent of funds), improving the
quality, efficiency and cost-
effectiveness of healthcare (20 per cent
of funds) and improving health
outcomes for Māori (10 per cent of
funds).

Feasibility Studies

The situation often arises in health
research in which there is strong evidence
to justify a large, potentially expensive,
study to gather much needed evidence -
but vital practical information is needed
before the study can be designed in a
robust way. Before the HRC created this
funding opportunity, the research team
would often fail to convince assessing
committees that their methodology was
sound and so would not have been funded.
Now we provide funds specifically so that
investigators can demonstrate the
feasibility of a major piece of research.

Explorer Grants

Explorer grants are a unique approach to
funding research and have been included
in an evaluation of best-practice
funding mechanisms by the University
of Melbourne. The HRC launched them in
2012 to address the concern that
assessing committees were risk-averse in
making funding recommendations,
meaning that truly innovative and ground-
breaking opportunities were being
missed. We now supply specific funding
opportunities for research at an early
stage that is transformative, innovative,
exploratory or unconventional – and has
the potential for major impact. The
resulting applications are assessed ‘blind’,
so that the reviewers do not know who is
behind the idea and are not influenced by
the track record of the team. These grants
are all about the ideas that cause
innovation to flourish. More information
about the research we have supported
through these grants is provided in
Chapter 7, Dreams We Can Deliver, p81.
Mission-led research

Because the Annual Funding Round is researcher led, gaps in investment can develop that may need to be addressed. Our aim is to fill these through the Partnership Programme.

We invest approximately 10 per cent of our available funds in mission-led research, primarily through our Partnership Programme - which delivers research that meets the needs of policy-makers and those involved in healthcare delivery.

Our partnership model allows us to pool our resources with those of our funding partners so that the research we’re able to support is more substantive than each agency could afford to commission alone. Having multiple agencies involved increases the utility and uptake of the resulting research. **The HRC can offer expertise and processes that are not available to many of our partners,** meaning that the projects commissioned are more likely to be robustly designed and deliver value for the investment.

**We currently partner with more than 30 government and non-government agencies, including national and international government ministries and departments, health charities, healthcare providers (such as DHBs) and PHOs.**

In the 2013/14 year, **we leveraged $1.61 in funding from partners for every dollar invested by the HRC.**

**Rapid response research**

We can respond swiftly to urgent and emerging issues employing fast-track processes to commission research, as we did for the H1N1 Virus and Christchurch Earthquake partnerships.

### Recent partnerships

**Canadian Institutes of Health Research (CIHR)**

New Zealand and Canadian researchers will explore ways to better care for older people with high health needs in the community in a 5-year collaboration between the HRC and the (CIHR). The value of the partnership is $3.7M (HRC investment of $1.2M and CIHR investment of $2.5M).

**Health Innovation Partnership (HIP)**

A joint venture between the HRC and the National Health Committee (NHC), the HIP provides a joint investment of $8.75M for research on the efficacy and cost-effectiveness of health technology. The findings will provide evidence to inform the NHC’s recommendations on prioritisation of health system technology (see Chapter 3, Health Innovation Partnership, p44).

**Rapid response:**

**H1N1 Virus Partnership**

A rapid-response joint venture between the HRC and the Ministry of Health was formed to quickly advance knowledge of the influenza A (H1N1) virus. The value of the partnership was **$1M.**

HRC was able complete the funding process in 6 weeks. This included international peer review undertaken in collaboration with the Medical Research Council in the UK.

**Career development**

A strong health research sector depends on a highly skilled, experienced workforce that can deliver quality research and drive innovation. We have a critical role to play in sustaining the health research sector, retaining critical research capability, and
creating attractive career paths for our researchers. We target approximately 20 per cent of funds into identifying and growing emerging research talent, bridging vulnerable stages in research career paths, training and engaging clinicians and decision makers in research, and ensuring we have the capacity and capability for Māori and Pacific to identify and address health priorities and issues within their own communities.

Because practising clinicians are often best placed to identify research questions and apply research findings, we place emphasis on providing research opportunities for clinicians and involving them in academic research teams, bridging the gap between discovery and delivery. Offering research opportunities for clinicians not only improves the design and uptake of research, but is a vital tool in attracting the best practitioners to our health institutions and universities. Those clinicians wishing to build and maintain a reputation in their field must have a research profile and will select their job opportunities accordingly.

**Emerging Researcher First Grants**

These awards are designed to support emerging researchers who are seeking to establish independent careers in health research and have not previously held a competitive research grant of more than $100K. They are assessed separately to our annual funding round applications, to maximise the opportunity to launch promising but inexperienced individuals on a research career.

**Vision Mātauranga**

We actively promote the ideas and principles of Vision Mātauranga and work to achieve a better future for New Zealand through unlocking the innovation potential of Māori knowledge, resources and people. We do this through the direct support provided for Māori health researchers (the Rangahau Hauora Māori RIS and Māori career development awards), and also through our innovative Ngā Kanohi Kitea Project Grants and Rangahau Hauora Awards.

**Developing Māori capability and knowledge is the prime focus of our Ngā Kanohi Kitea Community Grants.** They provide an opportunity for iwi, hapū and community groups to investigate a well-defined area of Māori health need or gain, with an initial payment of $10,000 over three months to assist them in preparing the full application for a Ngā Kanohi Kitea Full Project Grant. If successful, they receive up to $200,000 over 18 months.

The Rangahau Hauora Award is for Māori active in their community, and with no prior research training, to undertake practical research training on a large research project. The award is worth $12,000 for up to six months research training.

**Encouraging translational research**

Ensuring that the best value is gained from the knowledge and products produced through our funded research is a key priority. We expect researchers to justify their knowledge translation approach in proposals. They need to demonstrate understanding of their end-user audience and how best to tailor communication to their needs.

In areas where we know integrated knowledge translation is required, we are proactive in ensuring that research users are fully engaged in the research process. We regularly build requirements into Requests for Proposals and assessment
Chapter 1: – Backing the best – our role, investment systems and processes

criteria for stakeholder engagement, multidisciplinary teams, rolling dissemination plans and governance/expert advisory committees (often including national-level decision makers and end-users). End-users are often part of our application assessing committees.

Our New Zealand Health Delivery research is a noteworthy example of our proactive knowledge translation approach. To be funded, researchers must demonstrate:

- a focus on identifying opportunities for improvements in health delivery;
- service-user, clinical, health provider, support worker, community or population collaboration/partnership throughout the research, and
- strong collaborative and strategic alliances with health service providers.

Another example is provided by Ngā Kanohi Kitea (NKK) grants where a user-led approach builds knowledge translation into the fabric of the research.

We also support knowledge translation through annual Māori and Pacific health research conferences which provide opportunities for stakeholders, including policy makers, philanthropic leaders, researchers, and students to share knowledge and build alliances for future research.

**How we balance our investment**

One of the most complex issues we face is how to balance our investment across health needs, critical gaps, health disparities and vulnerable populations. Identifying where the best return on our investment can be achieved is a complex task and a core responsibility for the HRC. Determining the balance involves three sets of complimentary drivers.

1. **Where in the health and disability sector can we make the biggest difference** (spanning prevention, diagnosis, treatment, rehabilitation and service configuration)?

2. **Where does New Zealand have significant research capability**, or where can capability be swiftly generated?

3. **Where does the health and disability system, or New Zealand more generally, have the ability to capture and realise the value?**

Other considerations with respect to balance of the investment include:

- health versus economic benefits;
- the amount invested at each stage of the research continuum to best feed the innovation pipeline (basic through to experimental development);
- the relative levels of support for biomedical versus clinical, public health and health delivery research, and
- the balance of investment in internationally recognised areas of strength and unique capability versus core health and wellbeing needs and issues for New Zealand.

Human health is itself a very broad and complex domain. We also have to consider how much research should focus on particular health issues (e.g. diabetes versus cardiovascular disease) and how much to focus on prevention versus treatment. Demographics and the current and future health needs of our population - particularly children, older adults, Māori and Pacific - are also critical considerations.

There is also the question of what funding opportunities and processes help us to achieve the 'right' balance, the best value, and the most important outcomes. What
Factors HRC considers when balancing the research investment
should the balance be between short-, medium-, or long-term research contract opportunities? How much should we invest in top-down and bottom-up research, i.e. mission versus researcher-led? How much of our investment should support research projects versus individuals, career development, international collaborations, partnerships with end-users etc.? What should the balance be between high-risk potentially high-return and novel research, versus more conservative research that has a higher likelihood of achieving the stated aims? With respect to the sustainability of New Zealand’s health research system, what should the balance be regarding senior, mid-career and emerging researchers?

There is also the wider environment and the work that needs to be done to ensure the right supports, drivers and incentives are in place (at a political, public, business and institutional level) to enable the strategy and the processes to be successful.

A core principle for the HRC is to provide leadership, signal clear direction, and ensure stability in the sector so that strong research platforms and areas of core capability can perform at their best – and we work hard to ensure we are agile so we can effectively respond to emerging opportunities, proactively identify and target support to meet current and future priority health needs, and build capability where new evidence, skills and approaches are needed.

Getting the balance ‘right’ is a constant and ongoing challenge – one that involves continuous, incremental improvement.

Continuous improvement in Investment processes

Gaining maximum impact for the taxpayer’s research dollar

Ensuring that research proposal assessment and contracting is equitable, free from conflict of interest, and identifies the best ideas is key to maintaining the trust and support of the health research community and forms a major part of our work.

“We can always do better. Funders need to constantly assess their processes and outcomes.”

Professor Warwick Anderson, Chief Executive, National Health & Medical Research Council, Australia,

Assessment through the Annual Funding Round, takes about nine months in total, involves approximately 240 expert committee members, and a further 450-500 specialist reviewers. Applications are assessed by expert peer-reviewers on scientific quality, the track record of the research team and the potential for impact. The impact criterion assesses the extent to which the proposed research meets the goals of the Investment Signal, the degree of health and economic benefit, and the planned pathway to ensure uptake of results.

Our investment processes are regularly reviewed to ensure they are fit for purpose, efficient, and meet best-practice standards. Process upgrades range from implementing new grant types to improving application and assessment processes. Options for change are identified from sources both internal and external to the HRC.
We regularly engage with other research funders, both national and international, and take an active part in the debate around ensuring that investment processes are efficient and equitable for researchers - and provide the greatest benefit to research users. Recent issues have included: new funding models, potential for bias in peer review, score normalisation, and online systems to support researchers.

We also engage with our research community. Following each Annual Funding Round, the Secretariat hosts a Joint Research Committee (JRC) meeting to evaluate the success of the round and identify process improvements. The Joint Research Committee comprises all three of our Statutory Research Committees for Biomedical, Public Health and Māori Health, and our standing committee on Pacific health. These are the committees that make the funding recommendations to the Board when the review process is complete.

As a result of our engagement with the research community, we have reviewed, and in some cases changed, our own systems. A few of our innovations are unique internationally. As previously mentioned, we have introduced Explorer Grants to address the acknowledged risk of penalising high-risk/high-reward research in a peer-reviewed contestable funding processes.

The largest change to our investment process is the introduction of Expressions of Interest (EOIs) for projects to the Annual Funding Round – making it a two-stage process. The goal was to reduce transaction costs to researchers and the burden on reviewers. We worked closely with the Marsden Fund to leverage their knowledge in this area and successfully introduced EOIs in 2010.

We have also introduced a new system for online submission of research proposals and in 2015 we will also be introducing a new progress reporting system. This will reduce the burden on researchers and enhance our ability to mine research reports to gather impact information.

Other recent process improvements include streamlining Conflict of Interest rules and introducing a College of Experts. The College of Experts was established in 2012 to advise on the formation of assessing committees and contribute to the robust assessment of applications. Membership is both national and international and appointment is for a period of three years, to provide continuity in the support and advice we are receiving.

To assure ourselves of the quality of our systems we have also undertaken or commissioned the following reviews: an external review our score normalisation system (2014). An internal review on the impact of our peer-review process.

The analysis of the peer-review process found that independent scoring of Expressions of Interest by assessing panel members is effective for identifying the bottom third of proposals, but not the proposals that will go on to be successful in receiving funding. The review also addressed concerns that individuals with key roles in the assessing committee process might unduly influence the final outcome. This was found not to be the case.

However, given how vital our peer-review process is to attaining the best outcomes and value from our investment, this is an area of our business that requires continual scrutiny. As such, we are currently undertaking an end-to-end examination of our grant assessing
processes - from signalling to feedback - which includes looking at how we comprise committees to ensure we are engaging the right expertise to make the best decisions.

We are also considering a range of innovative funding models for our Programme grants with the goal of optimising research translation and uptake from these high-value research contracts. Specific Programme Extensions are being considered with the idea of encouraging and supporting teams to take the research to the next level, through providing specific opportunities to move the research down the pipeline or involve a broader range of expertise.

The ideas include:

- **Innovate Programme Extensions:** applied research that trials a new treatment, technology or intervention arising from a HRC Programme.
- **Accelerate Programme Extensions:** taking existing programmes to the next level by involving other research disciplines, clinicians or stakeholders.
- **Consortia Programmes:** taking a trans-disciplinary approach to major health issues, or bringing together research teams with stakeholders to drive knowledge translation.

Further work will be undertaken to refine these ideas (and integrate them with National Science Challenge approaches) over coming year.
Chapter 2: TRANSFORMING LIVES –
better health for New Zealanders
**Tackling the Areas of Greatest Need**

The Ministry of Health produces a detailed analysis of the burden of disease in New Zealand in terms of disability-adjusted life years (DALYs) - which integrate fatal and non-fatal impacts into a measure of health loss. We aim to fund research in areas where burden of disease is greatest and where the best opportunities for impact lie in terms of prevention and improving screening, diagnosis and treatment. This includes research to mitigate changes in New Zealand’s burden of disease profile as our population changes (e.g., increasing incidence of non-communicable diseases and an aging population).

Table 1 shows that HRC is investing most heavily in the conditions that are causing the greatest burden of disease for New Zealanders, cancer and cardiovascular disorders. While this partly reflects the direction we give to the research community through our Investment Signals, it is also reflects the fact that the best researchers are tending to work in the areas where they can make the greatest difference.

Greater investment is also seen in areas in which we have particular research strengths. The investment in

**Table 1.** The ten top causes of Disability adjusted life years (DALYs) lost in New Zealand and HRC’s five-year investment in research to understand, prevent and treat them.

<table>
<thead>
<tr>
<th>Condition</th>
<th>DALYs</th>
<th>HRC 5-Year Investment ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cancers</td>
<td>167,149</td>
<td>52,522,538</td>
</tr>
<tr>
<td>Vascular disorders</td>
<td>166,863</td>
<td>48,277,053</td>
</tr>
<tr>
<td>Mental health</td>
<td>106,398</td>
<td>12,404,040</td>
</tr>
<tr>
<td>Musculoskeletal disorders</td>
<td>87,225</td>
<td>8,792,164</td>
</tr>
<tr>
<td>Injury</td>
<td>76,269</td>
<td>8,250,722</td>
</tr>
<tr>
<td>Neurological disorders</td>
<td>65,293</td>
<td>28,673,287</td>
</tr>
<tr>
<td>Respiratory disorders</td>
<td>60,276</td>
<td>12,722,251</td>
</tr>
<tr>
<td>Infant conditions &amp; birth defects</td>
<td>50,338</td>
<td>29,599,228</td>
</tr>
<tr>
<td>Endocrine disorders</td>
<td>38,780</td>
<td>8,594,768</td>
</tr>
<tr>
<td>Reproductive &amp; gestational disorders</td>
<td>33,618</td>
<td>11,399,069</td>
</tr>
</tbody>
</table>

Greater investment is also seen in areas in which we have particular research strengths. The investment in

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3 Total investment from 2009-2014.

4 HRC supports several top researchers in this area. The condition contains some contracts also related to infant conditions and injury.

5 HRC supports several top researchers in this area.

6 Includes Diabetes.
conditions and birth defects reflects the fact that we have built world-class capacity in these areas (see the results of our Bibliometrics Study 2014, Measuring Up, Chapter 8, p27). We also have a strong focus on infant and child health.

In this chapter we provide a range of evidence for the health and social impacts of our research. Chapter 5, Netting economic returns from health research for New Zealand deals specifically with the economic returns.

**Maintaining Wellness**

*Each year, we make a considerable investment in research on staying well. In 2013/14, our total commitment to health and wellbeing research was $107M (32 per cent of our budget) and $24M was distributed to research teams during the year.*

Enhancing health and wellbeing and preventing impairment and disease is ultimately the best strategy to reduce demand on the health system. By better understanding how social and environmental factors affect health, and identifying incentives to help people act in ways that promote health, causal factors for poor health can be identified and addressed.

Research that aids understanding of life processes is also vital in preventing disease. Our wellbeing portfolio includes fundamental biomedical research on physiology and cell biology, both in people and in bacteria and viruses. If we can understand how viruses work, and infections spread, we can design vaccines and public health protocols to control infections rates.

It is becoming increasingly obvious that the earlier that you can intervene to promote a healthy life-trajectory, the
Chapter 2: Transforming lives – better health for New Zealanders

better. For this reason, we have increasingly invested in understanding how conditions in the womb affect the developing body and set genetic switches that will impact profoundly on health as the child grows to maturity and beyond. This research is showing us that maternal behaviour, such as the calories consumed, the amount of exercise taken and smoking are all ‘programming’ the fetus for life outside, and programming that is not suited to their eventual life conditions may be the basis for chronic diseases in later life.

Reproductive health enhances wellbeing across the life course, as does research that gives children a healthy start to life, helps older adults to age well, improves the independence of people with disabilities, and establishes cultural models of wellbeing.

Our wellness research portfolio is diverse, ranging from studies of fundamental biological processes (human and pathogenic) to developing interventions to promote wellness. A key focus is New Zealand’s top five health risk factors, diet, obesity, smoking, high blood pressure and physical inactivity. These risk factors account for about 40 per cent of the DALYs in New Zealand\(^7\). Our total investment in research in these areas was $42.5M in 2013/14, with $8M distributed across 36 contracts during the year.

**What has been achieved?**

Our research teams have achieved some outstanding results which have provided both health and economic benefits to New Zealanders\(^8\).

\(^7\) [http://www.healthmetricsandevaluation.org GBD Profile: New Zealand.]

\(^8\) Before 2011 contracts were not tagged to the health and wellbeing RIS. Therefore, only 2011 and later contracts are included in this analysis.
Chapter 2: Transforming lives – better health for New Zealanders

Spotlight on:
Designing for Action

HRC’s research portfolio investigating health and urban design has made significant advances in identifying how to weave physical activity into the fabric of our lives. There is more to do, but New Zealand is looking and acting very differently because of this work.

HRC investment in research based at Auckland, Massey and AUT universities has provided **proof that walkable neighbourhood design improves health through the accumulation of physical activity during day-to-day tasks**. The first definitive evidence that an increase in destination access, street connectivity and dwelling density is associated with increased physical activity, highlighting the potential for improving health through walkable neighbourhoods. Ongoing funding is now investigating ‘Kids in the City’ extending child health outcomes of interest to independent mobility and well as physical activity.

Our teams are linked through the **International Physical Activity Network** a global (22 country), network supporting joint research. Several are involved in the **New Zealand Centre for Sustainable Cities**, which provides evidence for innovative solutions to the economic, social, environmental and cultural development of our urban centres.

Our researchers have assisted the **Christchurch Earthquake Recovery Authority** with the Greater Christchurch Area Regional Growth Strategy – providing information about the implications of retaining city limits in the Christchurch area over the next 50 years. They have informed the work of the **Auckland City Council** in designing a more compact city through the Auckland Plan. The research findings helped the **Whangarei District Council and Mania PHO** in their efforts to become a UNICEF designated Child Friendly City. Researchers have also linked with **MBIE’s Natural Hazards Research Platform** to share knowledge and data. Further funding has been provided by **Housing New Zealand** to develop walkability and accessibility indices for the Auckland City area for the application of the Tamaki Transformation Project.

**SEDENTARY FACTS**

- 86 per cent of New Zealanders live in cities

- Physical activity has decreased due to urbanisation, and industrialisation

- Children are less active and on reaching adolescence, physical activity decreases a further 60-70 per cent

- Inactivity is a major modifiable risk factor for diabetes and heart disease

- Estimates show that at least 2,600 New Zealanders die prematurely each year due to physical inactivity.
In the 2013/14 year alone, they achieved the following impacts.

- **150** peer-reviewed publications – 12 contributions to policy (including advice on energy efficiency, alcohol and tobacco policy, housing policy, child health, and human parechovirus 3, which can cause severe illness in young children).
- **52** consultations/provision of professional advice, including nationally to the: Families Commission; Ministry of Social Development, Glenn Commission; Ministry of Health; ACC; ECCA; Office of the Children’s Commissioner; District Health Boards, MBIE, and Prime Minister’s Science Advisory Group. Internationally to the: Royal Children’s Hospital Melbourne; Singapore Health Services; Pasifika Medical Foundation; Nuffield Foundation; The Economist Intelligence Unit; National Institute of Ageing USA, and the Avielle Foundation.
- **24** health advisory committee contributions (6 international and 18 national).
- **2** products - a rental housing warrant of fitness and an innovative stop smoking intervention: http://wero.me

**Confronting Cancer**

Cancer is now the single biggest cause of health loss (mortality and morbidity) in New Zealand. The health, social and economic burden of cancer is enormous because it affects so many people, has such a significant impact on their lives and requires expensive drugs and treatments. However, cancer is a complex disease and achieving what is possible poses significant challenges. It includes over a hundred diseases with different causes and treatment options.

The HRC funds more research on cancer than any other single health issue. Our research portfolio ranges from basic cell biology to prevention, diagnosis, treatment and care. Our biggest area of research is on treating cancer (four cancer-related clinical trials are ongoing).

Between 2006 and 2014 our investment was, on average, 14 per cent of the Annual Funding Round budget (approximately $8.1M per year). Our total commitment to ongoing contracts was $39.3M in the 2013/14 year, and we distributed $9.2M to research teams on 31 contracts in the financial year alone.

We also release regular requests for proposals through the Partnership Programme in the areas of primary cancer prevention, managing breast, bowel and prostate cancer, and assessing cancer testing technology (see Health Innovation Partnership, p44).

In the first instance, prevention is the most effective way of dealing with cancer. Therefore, our portfolio of research includes cancer prevention, primarily focused around reducing smoking rates and occupational risk (see Impact: NZ-Carex, p23).

The challenging nature of cancer research means that progress is typically incremental. We now understand from fundamental research into tumour biology, that a tumour is as complex as the person it grows in. Just as an individual has a certain genetic makeup, so does their tumour. Altered copies of genes in the patient or their tumour can affect response to treatment.

In addition, tumours vary in terms of their blood supply and other factors that impact on drug delivery and resistance to therapy. Consequently, not every study achieves the expected results. However, breakthroughs in this area can achieve step changes in individual health, whilst
Spotlight on: Curbing cancer

HRC research has enabled us to better understand the causes of cancer and improve screening, diagnosis and treatment.

Mechanism found causing kidney cancer in 2-yr-olds

HRC has given decades of support to the Otago Cancer Genetics Laboratory, resulting in significant breakthroughs in understanding the causes of breast, colorectal, bladder and gastric cancer. They are developing commercially available cancer detection and management tools, one of which can detect bladder cancer in urine with just a single cancer cell. One major impact of our funding was finding the mechanism for a rare kidney cancer in small children – Wilm’s tumour - that usually develops between the ages of two and three years. This was published on the front page of Nature. (25 HRC contracts over 20 years, value: greater than $12M)

Research contributing to early detection is saving lives and reducing the costs of treatment

Our research has proven the value of breast and cervical cancer screening programmes, and we have partnered with DHBs to identify barriers to cancer detection in primary care. Another focus is on identifying inequalities in in access to screening and primary care services. (10 HRC contracts over 25 years, value: greater than $5M). We supported the Otago University Public Health Institute to undertake several innovative ‘big data’ studies that provided vital cancer survival trend information. They are now working closely with the Ministry of Health and others to build a tool for rapid assessment, health impact and cost-effectiveness, of cancer prevention and control interventions. (20 HRC Contracts over 14 years, value: greater than $25M)

More targeted, less toxic treatments

HRC has invested heavily in the Auckland Cancer Society Research Centre and the creation of anti-cancer drugs that are activated in the parts of tumours with poor blood supply that conventional drugs can’t reach. They have filed over 100 patent applications and eight drugs have gone to clinical trial. Over 1000 peer-reviewed journal articles have cemented their international reputation. Their work is commercialised through Pathway Therapeutics and Proacta Inc. (32 HRC Contracts over 24 years, value: greater than $31M).
Chapter 2: Transforming lives – better health for New Zealanders

bringing economic benefits to New Zealand through reducing the opportunity cost of cancer to individuals and their families, the cost of treatment to the healthcare system, and by providing products to be taken to market.

Our research teams have achieved some significant results in the 2013/14 year including:

- 2 US Patents awarded for drug development;
- progress on a new, improved cancer vaccine for clinical trial;
- an experimental drug developed with HRC funding and abandoned due to toxicity is now re-entering clinical trials, and
- knowledge-transfer: 35 peer-reviewed publications, 6 keynote lectures, conference presentations in Australia, United Kingdom, Chile, Puerto Rico, China and the United States.

Tackling Heart Conditions

New Zealand has a high burden of cardiovascular disease, which leads to a significant individual and societal impact in terms of morbidity and mortality. HRC therefore makes a significant investment in research in this field. **Between 2006 and 2014, we invested over $100M in research on heart conditions**. Our total commitment was $57.6M in the 2013/14 year and we distributed $11.4M to research teams on 31 contracts.

A major public health research achievement arising from HRC funding was produced by Professor Rod Jackson, and his team at University of Auckland who developed the PREDICT cardiovascular disease risk prediction system (see Impact: Predict, p26). More information on

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**NZ-CAREX**

HRC supports vital resource for industry on occupational cancer

The Centre for Public Health Research (CPHR) at Massey University has shown that **occupational cancer is a significant issue for New Zealand, accounting for 200-400 deaths per year**. They have proved that **occupational cancer risk is higher for meatworkers, sawmill workers, joiners, furniture makers, cleaners, farmers, pesticide sprayers, and firefighters**.

For over 25 years, supported by the HRC and others, CPHR has undertaken research to help understand the incidence and causes of occupational cancer.

**Their ongoing HRC Programme ‘Building Research in Occupational Health in New Zealand.’ has enabled them to build a NZ-specific information system on occupational exposure to carcinogens, NZ-CAREX, now available for use by industry.** An additional HRC Partnership Programme grant has enabled CPHR, ACC and the Department of Labour to work together to explore occupational risks and address gaps in what we currently know.

CPHR’s knowledge is in significant demand by government and industry. They have provided advice to the Ministry of Health, Department of Labour, ACC, the Asthma and Respiratory Foundation of New Zealand, Marsden Fund, The Wellcome Trust, the Cancer Society of New Zealand, and the New Zealand Fire Service. **They have also undertaken research for the US National Institutes of Health and International Agency for Research on Cancer.**

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9 Includes research on nutrition, physical activity and obesity.
Spotlight on: Healthier hearts

HRC research has produced major advances in understanding the biology of the heart, improving treatment and outcomes for patients, and optimising the management of heart disease within the hospital system.

Wireless heart pump is a life-saver

Heart pumps must be powered by electricity and, up to now, this meant passing cords directly through the patient’s chest wall. These make the patient vulnerable to infections, which are fatal in forty per cent of cases. The wireless heart pump is a major breakthrough, using magnetic fields instead of wire cables to transfer power. Patients can be mobile again, and the technology generates no heat, a major problem with previous models.

(HRC ref: Simon Malpas, 10/433)

Clinical tests based on discovery of diagnostic markers

Research on understanding novel peptides discovered in heart failure has led to clinical tests that identify the existence and severity of heart failure much earlier, to guide fast and appropriate treatment. The international impact of this work is shown by the fact that the published standards were ranked in the top one per cent of all articles in the field worldwide.

(HRC ref: Mark Richards, 10/439)

Unnecessary admissions for chest pain halved

A new fast-track cardiac diagnostic tool provides clinicians with the means to cut down the number of unnecessary hospital admissions for chest pain. The number of patients discharged early can be safely increased from 10 to 20 per cent. One in five patients can be discharged within 2 hours. The tool has been adopted by hospitals in Queensland and Hong Kong.

(HRC ref: Martin Tan, 10/439)
the economic returns from PREDICT is given in Chapter 5, and the potential impact on the way that medicine is practiced in the future is provided in Chapter 7.

Our research teams are internationally recognised for the advances they have made, particularly in the areas of diagnostics and prognostic markers, computer modelling of heart function and new technology in heart failure. In the 2013/14 year, 23 research collaborations were formed, 12 of them international (with clinicians and scientists in Singapore, the US, the UK, Ireland, Sweden and Australia). These collaborations illustrate that our teams are both contributing to and benefiting from the global efforts to improve outcomes in heart disease.

Researching in partnership with clinicians is critical to ensuring that findings reach the bedside. The majority of the researchers we fund in this area are clinicians, most of whom are practising. We have a strong record of establishing partnerships for cardiovascular research, bringing together policy-makers and clinicians to work together with our internationally recognised researchers. Recent partnerships are shown below, with current research initiatives below.

- **New Zealand Health Delivery RIS:**
  - New echocardiography reference ranges for Aotearoa, and
  - Recovery from obesity.

- **Health Innovation Partnership – Ischaemic Heart Disease**
  - Improving care processes for patients with possible acute coronary syndrome, and
  - Cost-effectiveness of fractional flow reserve in myocardial infarction.

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**PREDICT Decision support for clinicians**

The HRC has invested over a decade of funding into the development of algorithms and software to be used to prevent cardiovascular disease (CVD) - PREDICT, developed by Professor Rod Jackson and his team at the School of Population Health, University of Auckland.

PREDICT CVD Risk Assessment is a web-based decision support system, designed to help primary care practitioners evaluate patient CVD risk. The system extracts information from a patient’s medical record, uses it to estimate CVD risk then provides personalised risk-reduction recommendations for the patient.

PREDICT simultaneously captures the patient data in an anonymised format for research purposes and now contains over 150,000 individuals who are taking part in an international study of CVD risk. Consequently, PREDICT is becoming one of the world’s largest CVD cohort studies.

The PREDICT system is now used by 80 per cent of Auckland and Northland PHOs and has been adopted in other areas of New Zealand and internationally.

In a few years, it will be possible to develop a risk profile on over a third of New Zealand adults, as well as up-to-date information on their management.

“The easiest way to make research relevant to practice is to generate research from within everyday practice. That’s what I have been doing for the last 10 years and is what makes PREDICT unique.”

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Professor Rod Jackson
Managing minds – research provides tools to intervene

The Department of Psychological Medicine, University of Otago has an international reputation in the areas of health and development and mental health and addictions. The team has held two long-running, large-scale HRC Programme contracts and have made a significant contribution to knowledge in the area of mental health.

The Christchurch Health and Development Study:

The team’s findings on the link between early conduct problems and later difficulties, including crime, mental health problems, substance abuse and suicide, have been used by government agencies to develop policies and interventions (e.g. Early Start and Family Start).

Mental Health Clinical Research funded by the HRC from 2004-2010 produced:

89 peer-reviewed publications, many in top journals.

International linkages: extensive international collaborations, including the UK, USA, Australia and Italy.

The team’s findings on personality and personality disorders have influenced international understanding, and been included in the rewriting of classifications of personality disorders for ICD-11.

Clinical trials of two anorexia nervosa treatments, supportive clinical management (SSCM) and appetite-focused cognitive behaviour therapy (CBT-A) have attracted considerable international attention and SSCM is being included in other international trials.

Rheumatic Fever Partnership
— The significance of rheumatic heart disease detected by echocardiography

Pacific Health Partnership
— Chewing the facts on fat! What does that say about me?
— A lifestyle intervention model to address obesity & type 2 diabetes in Pacific

Supporting Mental Health

Sixteen per cent of New Zealand adults (20 per cent of women and 13 per cent of men) have been diagnosed with a common mental disorder at some time in their lives\(^\text{10}\). Rates are significantly higher for Māori and Pacific peoples and those living in deprived areas.

Mental disorders, as a group, are the third-leading cause of healthy life lost for New Zealanders. For women, anxiety and depression are the leading cause of health loss.

Having a mental health condition is also linked to higher rates of physical illness and death. Suicides and accidents do contribute to this, however, rates of cardiovascular disease and cancer are also higher amongst those with mental health issues. This is due to increased rates of discrimination and social deprivation. All this means that those with mental health issues are more likely to be high users of the health system.

We fund a broad base of research relevant to maintaining and achieving good mental health. This includes research on wellbeing in childhood, mental health maintenance, and understanding and managing mental health conditions.

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\(^{10}\) 2012/13 New Zealand Health Survey. In, Mental Health Foundation: Quick Facts and Stats 2014.
Spotlight on: Healthy minds

The HRC brings together clinicians, policy-makers and researchers in partnerships that result in evidence-based advances in mental health treatments.

HRC-funded research improves mental health services for prisoners

This HRC/Waitemata DHB partnership brought together Northern District Health Boards Support Agency, the Auckland Forensic Psychiatry Services, Midland Forensic Health Services and the University of Auckland, to evaluate a new ‘best practice’ model of care for delivery by prison in-reach teams. The study has enabled the implementation of the model across Northland and Midland regions resulting in a significant increase in serious mental illness detection in these areas (in some prisons detection is now 50 per cent higher).

(HRC ref: Robyn Dixon, 10/819)

HRC funding means NZ is the only country in the world able to quantify the impact of earthquakes on health

When the Christchurch earthquakes hit, roughly half of the participants in the Christchurch Health and Development Study were elsewhere, making them the perfect control group to assess the health effects of the earthquake on the other half - who lived through it. The vast amounts of data on the 1200 middle-aged residents who have been part of the study since birth, means the research team can now use HRC funding to create the first accurate study of the impact of earthquakes on physical and mental wellbeing. HRC also formed a partnership with the Canterbury Medical Foundation to fund Canterbury DHB, the Mental Health Foundation and researchers to understand how health and other services can work with communities after a disaster, and prepare for future disasters. They found that ‘engaged communities’, with existing infrastructure, were better able to cope with the earthquake and identified ways in which more connected, resilient communities can be encouraged through the rebuild.
Between 2006 and 2014 we invested over $30M in research on mental health. Our total commitment was $9.6M in the 2013/14 year and we distributed $2.5M to research teams on 7 contracts.

In the 2013/14 year, our researchers published 36 articles in peer-reviewed journals and presented at 23 conferences around the world, including Japan, Israel, Australia, Switzerland and Germany.

They influenced policy by providing advisory services to the Ministry of Social Development (MSD); the Suicide Prevention Advisory Group; the Families Commission; the Early Start Project; the Youth Horizons Trust; the Incredible Years Working Group (MSD); the Glenn Commission, and the World Health Organisation.

The Christchurch Health and Development Study team alone have formed 17 collaborations including with the National Drug and Alcohol Research Centre in Australia, and two UK and four US universities.

Significant results this year include the fact that the HRC-funded study team at AUT have been approached by the New Zealand Police about sharing their web-based partner violence tool, isafe.

Protecting our Vulnerable Populations

New Zealand has a unique and diverse population and our geographic and demographic characteristics present us with challenges that mean we cannot rely solely on health research conducted in other countries to meet our needs.

A cornerstone of our funding strategy has been to build capacity for, and monitor the level of investment in, quality local research that addresses health challenges in our priority populations: Māori, Pacific peoples, older adults, and children and youth. As such, we have developed specific funding opportunities for many of these groups, particularly career development awards.

Our investment in our priority populations is significant. Between 2006 and 2014, $284M has been spent on research. In the 2013/14 financial year, 47 per cent of the funds spent through the Annual Funding Round and Partnership Programme was relevant.
Chapter 2: Transforming lives – better health for New Zealanders

Māori Health Research

We have built and sustained a consistent level of investment in Māori health research that contributes to He Korowai Oranga (Ministry of Health, 2002) and the Hauora theme of Vision Mātauranga. Our Māori health research is expected to build an evidence base that contributes to Māori health gains. Gains are achieved through high-quality Māori health research that upholds rangatiratanga and utilises and advances Māori knowledge, resources and people.

Our sustained investment over 25 years means that we lead the world in indigenous research. The importance of Māori health research at the HRC is reflected by Māori representation at Board level and the establishment of a Māori Health Committee, a statutory committee of the HRC. We have a range of targeted investment initiatives including:  

- Researcher-led research: The Rangahau Hauora Māori Research Investment Stream;  
- Mission-led research: Ngā Kanohi Kitea Community Grants and  

In addition to providing research funding, we build capacity through targeted writing workshops for Māori health researchers provided in Māori environments. We publish a quarterly Pānui newsletter, and host the biennial Māori health research conference, Hui Whakapiripiri, which provides the Māori health research workforce with an opportunity for collaboration and cooperation on issues related to Māori health. The 2014 conference was ‘Research aspiration, inspiration and innovation, Ma te ara auaha he kauanuanu te oranga a te tangata’.

Through HRC investment, our Māori research teams have achieved a lot in the 2013/14 year alone, as detailed below.

- They have published over 130 articles relevant to Māori health in peer-reviewed journals.  
- They have formed national and international collaborations, e.g. Te Atawhai o te Ao has formed collaborations with five United States organisations (universities and private institutions).  
- Disseminated their research findings to a range of end-users, including hospital staff, public health specialists, and the public;  
- Provided international advisory services or policy support relevant to Māori health to: the United Nations, the National Medical Research Council of Singapore, the World Health Organisation, the Olympic International Committee, and the Children’s Health Research Centre of Canada, and  
- Provided national advisory services or policy support relevant to Māori health to: the Ministry of Social Development, District Health Boards, the Families Commission, the Heart Foundation, the New Zealand Nurses  

11 Our innovative funding models and investment streams, Vision Mātauranga, p10 for more information.

12 The HRC’s 5-year Māori research Programme.
Spotlight on: Advancing Māori health

The HRC is recognised internationally as a leader in indigenous health research. Working with Māori communities, we have developed culturally appropriate research models and processes, and fostered Māori research capacity and capability. Our Māori researchers partner with their communities to advance their health and wellbeing and built databases of indigenous health knowledge.

Improving antenatal services for young Māori mothers

_E Hine_, a study by Otago University researchers, provides insight into the lives of young Māori mothers. This group experiences significant health disparities. The Ministry of Health and District Health Boards have used _E Hine_ to review their pregnancy services and target increased investment in areas of need. "_The E Hine study tells us that young Māori pregnant teenagers present early in their pregnancy for care and that there are systems issues that prevent them getting to the next steps in their care. These results have led to the Government investing in extra funding for the first comprehensive assessment in pregnancy_" (Minister Tony Ryall, 2014).

Innovative, holistic mental health tool for Māori

_Hua Oranga_ is a tool for measuring Māori mental health, developed by researchers at Massey University with HRC support. The tool measures wellbeing, looking at gains in mental, physical, spiritual and social health. It aims to align treatments for mental health issues with Māori cultural expectations. Now used in clinical settings, _Hua Oranga is an important example of knowledge translation_. Leveraging the data generated by clinicians using _Hua Oranga_, Te Rau Matatini have developed an online version of the tool that enables collection of data entered by health service providers. The information is used to provide accurate, timely, and comprehensive Māori mental health service data.

**DISPARATE FACTS**

- Māori are significantly more likely to lose a loved one through hospitalisation and premature death.
- Māori experience disproportionate rates of abuse, violence and neglect.
- Māori are more likely to experience traumatic life events such as job loss, disability and extreme poverty.
- Māori are more likely to receive a government benefit, live without access to a motor vehicle and live in crowded housing.
Several research teams made submissions on new laws or amendments, particularly the Smoke Free Environments Amendment Bill.

Our Nga Kanohi Kitea (community-driven research) has provided tangible benefits for the communities involved - such as the Utakura river project proving the link between river health and community health, which has played an important role in improving water quality in the Utakura Valley (see Impact: Ngā Kanohi Kitea on the next page).

Working with Hokianga kuia and Kaumātua to recall and record ancient Māori practices of healing and pain management has provided information to inform novel approaches to Māori health practice.

An analysis of the health priorities for the Rolleston whānau is enabling them to manage their own whānau health and has resulted in a model that can be adopted by other whānau.

Our longest running Partnership, the Māori Health Joint Venture with the Ministry of Health, has identified several areas where health outcomes for Māori can be improved, including: access to palliative care, oral health, and sexual health services. Research on improving cancer services for Māori is ongoing. Other achievements by our Māori research teams are presented in our ‘spotlight on advancing Māori health.’

**Integrating Neuroscience, Tikanga and Mātauranga Māori**

Dr Melanie Cheung is among the first biomedical researchers to bridge the gap between indigenous values and biomedical research through her use of tikanga in her experimental protocol for growing cells from post-mortem brain tissue.

The HRC has supported Dr Cheung’s work at the interface of indigenous and western scientific paradigms through PhD and Post-Doctoral Awards, and she is now a Principle Investigator on a HRC Project.

Dr Cheung works closely with a large Taranaki Māori family with Huntington’s disease (an inherited neurodegenerative disorder). The research protocols present a challenge to Māori beliefs about the tapu nature of the head and brain. She worked with kaumatua and kuia (elders) to develop culturally respectful laboratory practices using karakia (incantations). This innovative practice was featured in *Science* (2007) and ABC’s *All in the Mind* radio show (2008).

Dr Cheng works with Professor Richard Faull and his team at the University of Auckland’s Centre for Brain Research.

**Pacific Health**

The term ‘Pacific peoples’ encompasses a range of cultures, languages and world views as diverse as they are valuable. Pacific New Zealanders make major contributions to New Zealand, from the economy to the arts, and form a significant proportion of our population.

For a number of reasons, Pacific peoples in New Zealand experience significant health challenges. A number of disabling medical conditions are more prevalent in Pacific populations, such as rheumatic fever, diabetes, and cardiomyopathy. At the
Chapter 2: Transforming lives – better health for New Zealanders

The words of Whaea Ngarimu, a kuia (elder) during a kōrero (conversation) on the health of Utakura River, encapsulate the aspirations that lead this community to apply for HRC funding. The Utakura Valley, a 30 km catchment encompassing a number of small rural Māori communities, runs between Lake Ōmāpere and the south-eastern Hokianga. Lake Ōmāpere, and its only outlet the Utakura River, have been too polluted for locals to eat fish from or to swim in for many years.

The study, led by Te Taiao o Utakura at Mokonui a Rangi Marae, aligned existing water research, done by NIWA, with new health research to better understand the impacts of water quality on the health of the community. The project includes catching tuna from the Lake Ōmāpere to test for heavy metals, as well as studying invertebrate populations in the river as a marker of river health.

The study provided an opportunity to strengthen manawhenua knowledge, capacity and capability. The work has had significant impact, both for the community and beyond. The relationship between the river and health was shown: “If you can’t get kai from the river you have to go somewhere else, if you can’t swim in the river you don’t do that activity anymore. If you take the river out of the picture, people’s lifestyles have to change, often to the detriment of their wellbeing.”

The research findings are playing an important role in improving water quality in the area. Plans are in place for carp control measures and reinstating wetlands. Te Roopu Taiao o Utakura is now recognised as an expert group and has been consulted about a variety of local environmental issues. The research team has worked with local schools providing students with research experience and knowledge of environmental health. The research has been presented at conferences, through mainstream and Māori media, and developed into a documentary for Māori TV.

Ngā Kanohi Kitea

“Working for the river will lift the health of the people”
Whaea Ngarimu

A partnership between HRC, Te Roopu Taiao o Utakura, local iwi, Landcare and NIWA
HRC, we work hard to tackle these health issues, aiming to engage Pacific researchers and communities in identifying useful and workable solutions.

We provide leadership and support to the Pacific health research community in New Zealand and internationally. Our dedicated Pacific Research Committee provides advice about research priorities and workforce development. We regularly publish Pacific health research guidelines and newsletters.

More recently, we hosted the inaugural International Pacific Health Conference (November 2014). This was a significant opportunity to convene over 300 Pacific health policy-makers, philanthropic leaders, researchers and students from New Zealand, Australia, the Pacific Islands, the United States, and beyond.

To support the development and retention of Pacific health researchers, in 2014 we implemented the ‘Sir Thomas Davis Te Patu Kite Rangi Ariki Health Research Fellowship’. The fellowship supports high-quality Pacific research. It provides up to three years’ support for a researcher whose field has the potential to contribute to both the health and economic goals for the government’s investment in research, science and technology.

We make a significant investment in Pacific health research. Between 2006 and 2014, we invested $81M in 66 Pacific health research contracts. In the 2013/14 year, our total commitment was $48.7M (14 per cent of Annual Funding Round and Partnership Programme research was relevant to Pacific peoples). We distributed $11M to researchers on 45 contracts.

Through our International Relationships Fund we have also committed to a significant US-NZ Partnership researching non-communicable diseases (NCD) in the Pacific. Contracts have been awarded to develop an NCD observatory to monitor, research and evaluate NCD’s in the Pacific, and for Pacific tobacco-control research.

In the 2013/14 year alone, our researchers have:

- published 56 Pacific-relevant peer-reviewed papers;
- disseminated Pacific-relevant research through national newspapers and radio, and internationally in one instance - in the US magazine, *The Atlantic*, and
- provided advisory services to the Health, Safety and Quality Commission, Le Va, the National Suicide Prevention Programme, the

Dr Gerhard Sundborn: 
Pacific health researcher

Heart surgery gave Dr Sunborne’s mother a new lease of life and inspired his own health research career.

Dr Sundborn has devoted his career to understanding Pacific health challenges and why Pacific peoples are less likely to access healthcare services. The HRC has supported both his career development, through doctoral and postdoctoral awards, and also his research. His work as Co-Director of the Pacific Island Families Study, a HRC-funded longitudinal study following Pacific children, has provided an evidence base for a wave of culturally relevant, appropriately targeted, public health interventions. The research team regularly communicates with key Pacific health professionals, advocates and policy-makers (in the Pacific community, health policy and clinical practice).
Children and Youth

The antecedants of many adult diseases lie in childhood, and are perhaps laid even before we are born. We focus on children because they are the most vulnerable members of our society, but also because we know that the life-long benefits of a healthy childhood, learning healthy behaviours, are immense.

The Government has set child health priorities to target action in areas of need. We have focused our investment towards these priorities as well as building a comprehensive portfolio of research relevant to the health of young New Zealanders.

Between 2006 and 2014, we invested over $100M in 91 research contracts. In the 2013/14 year, our total commitment was $51.1M (21 per cent of the research funded through the Annual Funding Round and the Partnership Programme was relevant to children and youth). We distributed $12.7M to researchers on 41 contracts.

In the 2013/14 year alone, our researchers published 64 articles in peer-reviewed journals, disseminated their work to the public through media (print, radio and television) and to health professionals through professional forums and conferences. They provided expert advice to a range of organisations including: the Health Promotion Agency, the Heart Foundation, the Asthma Foundation, the Auckland Council, the Tasman District Council, the Australasian Royal College of Physicians, the Ministry of Health and the National Health Board.

More broadly, our sustained investment in child and youth health has achieved the following major outcomes in recent years:

- the **successful trial of a new rotavirus vaccine** has the potential to reduce hospitalisations and save newborn lives in New Zealand and worldwide;
- **classroom support tools for the 25 per cent of Pacific 11-year-olds with hearing impairment** have been developed;
- a **low-cost treatment for neonatal hypoglycaemia** has been successfully developed and trialled;
- **road safety research has supported an increase in the legal driving age and the Safe Teen Driving campaigns**;
- The New Zealand wing of the international BOOST Trial has **identified target levels of oxygen**

HRC-funded publications in the area of Paediatrics and Reproductive Health have a major impact internationally, with some journal articles in the top 1 percent of papers worldwide for relative impact. The research we supported in this area, between 2004-2009, out-performed that of any other New Zealand funding sector that we looked at, both in terms of the proportion of peer-reviewed articles ranked in the top 20 percent for impact in the world and in the relative citation rate.

**HRC Bibliometrics Study 2014**
Chapter 2: Transforming lives – better health for New Zealanders

Spotlight on: Safer babies

Three babies in every 1000 live births survive each year because of HRC-funded research – twenty years ago these babies would have died from sudden unexplained death in infancy (SUDI). At current birth rates, that’s 200 babies a year.

Ground-breaking HRC-funded research provides clues about SUDI

The New Zealand National Cot Death Study, led by Professor Ed Mitchell in the late 1980s identified three modifiable risk factors for SUDI: sleeping babies on their stomach or side; smoking, and bottle feeding.

The research team provided a strong evidence base that drew the attention of major stakeholders in child health in New Zealand and internationally. Five of the papers produced by the team were cited a total of 1357 times in peer-reviewed articles, illustrating the influence the research has had.

The research formed the basis of a ground breaking New Zealand Cot Death Prevention Programme in 1991, the first of its kind internationally. The campaign changed the way New Zealanders viewed safe sleep for infants. The fall in SUDI in New Zealand was dramatic, mortality rates halved in two years. Other countries followed our lead and launched their own campaigns.

The lives of tens of thousands of children world-wide have been saved as a result of this research. In New Zealand alone, more than 3000 Kiwi children’s lives were saved from 1990 to 2008.

Our researchers continue to work to reduce SUDI rates, particularly where disparities are evident, such as amongst Māori infants. HRC currently funds research on further reducing SUDI and, in partnership with health providers, on the use of Wahakura and Pépi-pods which support safe bed-sharing for vulnerable families.
Chapter 2: Transforming lives – better health for New Zealanders

saturation to improve survival of pre-term babies, and

- a breakthrough treatment for amblyopia/lazy eye has been developed.

Older Adults

Research on ageing well and remaining healthy, productive and connected with the community is the focus of governments around the globe as the proportion of adults living to old age rises rapidly. In New Zealand, the number of people living to advanced age will grow from 1 per cent to 8 per cent by 2050.

Over 85 year-olds are the fastest growing population group in New Zealand. If the population ages well, there are many benefits for families and communities in having elders with more free time to become involved with community projects and youth. However, if the population ages poorly and becomes increasingly reliant on health and disability services, the pressure on our health system will be unprecedented.

The HRC funds a broad range of research on aging well. Our research portfolio ranges from studies on issues such as healthy housing, to studies on treatment and rehabilitation for conditions more commonly associated with older adults (such as stroke). It also includes biomedical research to understand the basis of these conditions (e.g. neurological conditions and macular degeneration).

Between 2006 and 2014, we invested more than $66.5M in 31 contracts (including four Programmes) on aging well. In the 2013/14 year, our total commitment was $8M with $2.2M being

**LiLACS NZ**

LiLACS NZ is a HRC-funded longitudinal study, started in 2010 by a team of Māori and non-Māori investigators at the School of Population Health, University of Auckland. The principal aims are to determine the predictors of successful advanced ageing and understand the trajectories of health and wellbeing in advanced age.

The goals are to help people to plan better for their own health and wellbeing in later life, to allow older New Zealanders to share their wisdom with future generations, and to inform the development of local and national policies to benefit older people.

Headed by GP Professor Ngaire Kerse, the research has identified predictors of quality of life, physical function, disability, depression and cognition in those in advanced age.

The Ministry of Health and the Ministry of Social Development have used the results of the study to inform policy in areas such as transitions in care, balancing formal and informal care, falls and injuries and service inequalities.

A dynamic micro-simulation model of older people and their consumption of health and social care has also been developed. The model can be applied to policy questions enabling scenario testing for the implications of a potential policy change, such as on the burden and the balance of care. It has been packaged in a purpose-built, open-source decision tool. Interest has been expressed in the tool by the Ministry of Health, the Ministry of Social Development, and the Treasury.
distributed to researchers on three contracts. 13.

In the 2013/14 year our researchers have:

• published 157 peer-review papers relevant to ageing well;

• disseminated relevant research through national newspapers, radio and print media, including North and South and the Listener (one team’s findings presented by the BBC World Service);

• provided 45 expert advisory/policy services, including for the Health, Quality and Safety Commission, the Green Building Council City Councils; the Families Commission, ACC, and the Regional Northern Health of Older People Strategy;

• participated on a range of working groups on health issues and service improvements relevant to older people;

• provided submissions on several proposed Bills or Amendments, and

• worked with service providers on interventions for older people such as: expanding day-care services for older people to support social connectedness after the Christchurch earthquakes and working with the Selwyn Foundation to reconnect older people with their communities.

13 This is, in fact, an underestimation of our investment as the analysis only includes those studies directly related to aging, further investment is made in research on a range of health conditions relevant to older adults.
Chapter 3: BETTER HEALTH DELIVERY - innovation to elevate health care and health outcomes
THE QUALITY OF HEALTHCARE AND HEALTHCARE DELIVERY IS DETERMINED BY THE EXTENT TO WHICH IT IS UNDERPINNED BY RESEARCH EVIDENCE. WE PROVIDE THE EVIDENCE ON HOW STRATEGIES FOR PREVENTION, CARE AND TREATMENT CAN BE MOST EFFECTIVE AND MAKE THE GREATEST DIFFERENCE. IN THIS WAY, WE CONTRIBUTE TO AN INFORMED HEALTH SYSTEM THAT PROVIDES SERVICES OF THE HIGHEST QUALITY

**Improving health delivery**

An evidence-based health system relies on knowledge gained from well designed and conducted research. The issue for many decision-makers involved in resource and service allocations is that they do not have the necessary skills to determine the quality of the evidence that they are constantly bombarded with. This is where the HRC has a really key role in what we call 'health delivery' research funding - producing evidence to deliver real-world impact.

**HRC health-delivery research focuses on improving the efficiency, cost-effectiveness and, ultimately, sustainability of our healthcare system.** This is becoming increasingly important, given the projected increases in demand on services due to our ageing population and the escalating incidence of chronic conditions - particularly obesity, diabetes, cardiovascular disease and cancer. In 2013, The Treasury showed that Crown spending on health per capita had increased 412 per cent since 1950, whereas GDP had increased just 144 per cent over the same period. This is a massive increase and clearly unsustainable.

Health delivery research provides evidence to improve the efficiency, cost-effectiveness, quality and delivery of health and disability services in New Zealand. Much of the research we fund will make a direct or indirect contribution to this goal. However, to meet the HRC’s formal definition of ‘health-delivery’ research, it must be taken-up and used within five years of funding commencing. The number of our contracts that are that close to delivering impact is smaller.

HRC invests in health-delivery research both through our Annual Funding Round and through our Partnership Programme (where health-delivery contracts constitute approximately 30 per cent of spend). In the 2013/14 year, our total commitment to health-delivery research was more than $42M, including all the out-years of on-going contracts. Over $11.5M was distributed to 46 research teams during the financial year alone. Further investment was made through our clinically based Career Development Awards.

Our processes ensure that the research we fund is of the highest quality. All advancements in productivity, performance, organisation, sustainability, cost-effectiveness, equity, and the quality and efficacy of care and support.

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14 Health projections and policy options for the 2013 long-term fiscal statement. New Zealand Treasury, November 2012
15 A wide range of healthcare delivery improvements are within scope, such as
HRC health-delivery research is commissioned in conjunction with clinicians and end-users, often in partnership with DHBs. This makes the HRC a crucial resource for health service planners and managers in this country.

Our health-delivery research portfolio is diverse, ranging from developing new technologies to designing strategies to implement effective interventions. The key commonality among our health-delivery studies is that **collaboration and co-ordination with the public sector is integrated into the research. Studies are predominantly mission-led and therefore stakeholders are engaged from the outset.** This approach provides mutual benefits, the researcher has a clear pathway for the uptake of their findings and health organisations have an opportunity to establish and develop a research culture that supports knowledge translation.

We have focused on three key aspects of our health delivery research:

- translating research;
- contributing to improving cost-effectiveness, and
- bringing experts together to contribute to ‘team health’.

**Knowledge to action: translating research**

We track our research against strict criteria to identify studies with a core focus of research translation, to achieve tangible health and economic benefits. **While this generally involves translating findings to practice, we also identify research that represents a significant progression along the value-chain. Translational research is not limited to the most applied end of the spectrum (see ‘From patent to patient’).**

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**Revolutionising management of neonatal hypoglycaemia around the world.**

Professor Harding a neonatal paediatrician and Dean of Research at the University of Auckland, has provided the first evidence-based strategy to treat neonatal hypoglycaemia, a common metabolic condition that affects up to 15 per cent of otherwise healthy babies.

Neonatal hypoglycaemia poses a significant burden on the health system as it frequently leads to neonatal intensive care unit (NICU) admission and may cause long-term brain damage.

The research team showed that **oral dextrose gel massaged into the inside of the baby’s cheek is effective in reversing hypoglycaemia, halving NICU admissions and improving rates of breast-feeding. The treatment is cheap and easy to administer, costing roughly $2 per baby.**

A randomised controlled trial investigating the efficacy and cost-effectiveness of dextrose gel for prevention of hypoglycaemia and its consequences is now being undertaken.
We take research from basic discoveries at the level of a cell to interventions that change communities. In the 2013/14 year, 100 (43 per cent) of our on-going contracts were translational. Of these, 64 per cent involved the experimental development of products, systems or services.

The following are just a few examples of how our researchers have translated their findings into practical improvements in health service delivery:

- the development of training for health practitioners on comorbidity and cancer and how to manage this to achieve healthcare-delivery outcomes;
- the development of training for Auckland District Health Board staff on palliative care - training has resulted in increased time devoted to palliative care in the University of Auckland nursing curriculum;
- a redesign of diabetes services in the Capital and Coast District Health Board (CCDHB) through the Integrated Care Collaborative process - the new model of care has been incorporated into the Diabetes Care Improvement Plan approved by CCDHB and associated Public Health Organisation Boards and the Ministry of Health;
- evaluation of Waikato District Health Board’s, Supported Transfer and Accelerated Rehabilitation Team (START) programme showing it achieved reduced hospital stays and risk of re-admission - increased time spent rehabilitating at home through START reduced costs for DHBs over six months;
- HRC-funded research was referred to in the Smoke-free Environments (Tobacco Plain Packaging) Amendment Bill in March 2014, and
- the WERO: Team Stop Smoking Challenge intervention, the roll out of which has been funded by Ministry for...
Spotlight on:
Bones - Bench to Bedside

Two decades of HRC-funded research has both increased our understanding of bone disease and resulted in the development and patenting of a new drug, 10,000 times more potent than those previously available.

The Bone Research Group, at the University of Auckland, is one of the best models of translational research in New Zealand. Led by Professor Ian Reid, the multidisciplinary team’s research ranges from molecular studies of bone growth and animal models of disease to drug development and clinical trials of treatments. Their research has increased our understanding of bone cell biology and this knowledge has led to ground-breaking treatment approaches to protect the skeleton.

“The strength of the team is the mix of clinical and biomedical expertise, meaning that information flows between the laboratory and the clinic”, says Professor Reid.

The team works closely with ‘big pharma’, guiding drug development and undertaking clinical trials.

They have worked with major pharmaceutical companies - Merck and Novartis - to develop Zoledronate, a drug used to reduce bone loss that is 10,000 times more potent than the agents that first became available in the 1960s. This new drug has revolutionised the treatment of osteoporosis and effects a cure in 98 per cent of patients with Padget’s disease. In Professor Reid’s clinic alone, the number of patients with Padget’s disease has reduced from over 1000 to just 100 or so.

Through these trials, they also made another important discovery - that commonly prescribed calcium supplements increase the risk of heart attack by 27 per cent. This has had a significant impact on clinical treatment. Their paper reporting this was ranked in the top 1 per cent worldwide for impact in their field in 2008.
We have a number of exciting ongoing studies, the results of which are likely to lead to significant changes in clinical practice.

Early findings from a study comparing kidney failure rates in intensive care patients given fluid therapy with 0.9 per cent saline versus Plasma Lyte 148 are attracting worldwide interest. The researchers expect that the results will be incorporated into major international clinical guidelines within 12 months of study completion.

Other research on ventilation in intensive care has enabled development of ventilation software that optimises mechanical ventilation and prevents pressure damage to the patient's airways. If trials are successful, the product can easily be incorporated into New Zealand ICUs and has commercialisation potential.

**Improving cost-effectiveness**

New Zealand's health expenditure (as a proportion of GDP) is expected to rise from 9.4 per cent in 2006 to almost 16 per cent by 2026, which would account for approximately 40 per cent of core government spending. Health research has a critical part to play in 'bending the curve' in health expenditure. As such, we place significant emphasis on funding research that contributes to a more efficient, cost-effective health system. Some of our research explicitly includes a cost-effectiveness analysis while for other projects, improved cost-effectiveness is a benefit realised alongside improvements from a clinical perspective.

Impacts with potential cost-benefits range from generating evidence to improve clinical best-practice (diagnosis, treatment and management), to reducing patient recovery time and related service utilisation, and increasing the quality, productivity and efficiency of health services delivered with existing resources.

Thirty-three per cent of our current total investment contributes to improving health service efficiency and effectiveness. Our investment is

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16 Temple: Capital Investment Specialists ‘New Zealand’s addiction to healthcare: Diagnostic, trends and initiatives to manage cost growth’ August 2009.
increasing. In 2014, we had 51 contracts ($52M) in this area (14 contracts include a dedicated cost-benefit analysis). This represents 61 per cent of our investment in active contracts in that year.

Our researchers have achieved some outstanding results and their research findings have been translated into tangible gains to our health system, including the following examples.

- **A new ‘fast-track’ pathway for patients presenting with chest pain in ED** has been developed. Based on a blood test procedure, the new process has enabled 1 in 5 patients to be discharged within 2 hours, avoiding unnecessary admissions and reducing stress to families.

- **A new electronic transient ischaemic attack/stroke decision support tool** for general practitioners is already proving valuable. Using the tool was shown to reduce unnecessary treatment.

- **A refined model of care, co-ordinating health and social services**, for high intensity health service users has been implemented at Counties Manukau DHB - relieving pressure on urgent care services (the model now has long-term DHB funding).

- **A new training intervention for Clinician Performed Ultrasound practitioners** to provide skills to support rural patients and reduce hospital admission numbers will help address some of the issues faced by patients and clinicians in rural communities.

- **A new Joint Clinic for Osteoarthritis** has been developed in collaboration with Southern DHB, funded by the National Health Board. The focus is on optimising treatment effectiveness and cost-effectiveness.

Beyond these completed contracts, we have a number of promising new research projects underway. For example, researchers investigating **performance improvement in New Zealand emergency departments** (with Auckland DHB) have already contributed to work developing **indicators for acute care** being undertaken by the Ministry of Health. Our Health Innovation Partnership also has active contracts with a cost-effectiveness focus.

### The Health Innovation Partnership

The Health Innovation Partnership, between the National Health Committee (NHC) and the HRC, seeks to gather evidence to further improve the health and quality of life of New Zealanders, while supporting cost-effectiveness within the health sector.

The HIP is co-funded by the HRC ($2 million) and the NHC ($3 million), yielding a total budget of $5 million.

“We’re really excited by the chance to work with the HRC in a new partnership that will support robust NHC recommendations. This fund will also allow us to bridge the gap between research and the practising clinician.”

Anne Kolbe, Chair of the NHC

To date, eight contracts have been funded. These focus on treatments for ischaemic heart disease and chronic obstructive pulmonary disorder, and the research will generate evidence on effective health technologies and pathways for treatment.
The teams will also identify how new technologies can help put knowledge into action to provide more effective health services. The first tranche of studies commissioned offer exciting possibilities for determining the most cost-effective treatments to improve the lives of New Zealanders, including:

- avoiding unnecessary interventions, morbidity and reduced quality of life for those unlikely to benefit from treatment (improved assessment of elderly patients with co-morbid conditions);
- evaluating the implementation of a new accelerated diagnostic pathway for suspected acute coronary syndromes;
- identifying where low-risk COPD patients can be safely treated at home avoiding the risks and cost of hospitalisation;
- identifying new technologies to reduce days of hospitalisation for high-risk patients with Chronic Obstructive Pulmonary Disorder (COPD);
- evaluating the efficacy of stenting additional narrowed arteries in heart attack patients;
- developing guidelines for Epidermal Growth Factor Receptor (EGFR) gene testing for lung cancer patients, and
- comparing air- and oxygen-driven nebulisers on carbon dioxide levels and acidosis in COPD patients to optimise treatment.

**Team health: working together**

Changes in health systems and technologies are providing options for treating and managing more patients outside the hospital setting.

To gain the most from these exciting possibilities for improving patient care...
HRC’s Team Health

Our Organisations

New Zealand Organisations: District Health Boards; Primary Health Organisations; Medical Centres & General Practices; New Zealand Liver Transplant Unit; New Zealand Blood Service; Medical Research Institute of New Zealand; Diagnostic Laboratories; Pharmacies; Consultancies; New Zealand Universities: University of Waikato; Otago Polytechnic; Victoria University; Massey University; University of Otago; University of Auckland; University of Canterbury; UNITEC; Auckland University of Technology; Te Runanga o Ngati Pikiao Trust; REKA Trust; Nga Uri o Te Ngahere Trust; Ngaitai Iwi Authority; Te Whariki Manawahine o Hauraki; Te Arawa Lakes Trust; Tu Kotahi Maori Asthma Trust; Scion Research; Gillies McIndoe Research Institute; Malaghan Institute of Medical Research; Donald Beasley Institute; National Heart Foundation of NZ; ESR Communicable Disease Group; International Organisations: Centre for Alcohol Studies, Ministry of Public Health, Thailand; NHMRC Clinical Trials Centre; Centre for Research in Environmental Epidemiology, Spain; MicrocombiChem e.K, Germany; Turning Point Alcohol & Drug Centre, Australia; International Universities: Oslo University, Norway; Kanazawa University, Japan; Sahmyook University, South Korea; Hong Kong University; Laurentian University, Canada; Australian Universities: University of Queensland; University of Sydney; The George Institute for International Health; University of Melbourne; Australian Hospitals: Prince of Wales Hospital; Princess Margaret Hospital; Royal Children’s Hospital; Austin Hospital; Sir Charles Gairdner Hospital; Royal North Shore Hospital; Princess Alexandra Hospital; The Alfred Hospital; Nepean Hospital; Royal Victorian Eye & Ear Hospital; St George Hospital; Royal Brisbane & Women’s Hospital; Australian Research Institutes: Peter MacCallum Cancer Institute; Queensland Children’s Medical Research Institute; Douglas Hanly Moir Pathology; Murdoch Children’s Research Institute; UK Universities: University of Sheffield, University of Stirling, University College of Dublin; University of Bristol; Nottingham University; London School of Hygiene & Tropical Medicine; US Hospitals & Institutes: National Cancer Institute; Mayo Clinic; Ben Taub General Hospital; US Universities: University of Alabama; The John Hopkins University; University of California, University of Illinois, Harvard University, Yeshiva University; Oregan Health Sciences University.

Our people

Anesthetists; Audiologists; Biochemists; Bioengineer; Biostatisticians; Cardiologists; Cell Biologists; Chemists; Clinical Directors; Consultants; Data Managers; Dentistry; Dieticians; Economists; Electrical Engineers; Emergency Medicine Specialists; Endocrinologists; Environmental Health Officers; Epidemiologists; Gastroenterologists; General Practitioners; Geriatricians; Geneticists; Gynecologists; Hapu; Health Economists; Hepatologists; ICU Specialists; Immunologists; Iwi; Laboratory staff; Marketing academics; Mathematicians; Mechanical Engineers; Microbiologists; Midwives; Molecular Biologists; Neonatologist; Nephrologists; Neurologists; Nurses; Obstetricians; Oncologists; Ophthalmologists; Optometrists; Otolaryngologists; Pathologists; Pediatricians; Pharmacists; Pharmacologists; Physiologists; Physiotherapists; Programme Directors; Programmers; Project Managers; Psychologists; Public Health Physicians; Planning & Funding Managers; Policy Makers; Radiologists; Rehabilitation Specialists; Respiratory Specialists; Rheumatologists; Scientific Officers; Surgeons; Urologists
and containing healthcare costs, the skills of the health workforce must be harnessed, so that the full range of capabilities of the wider health team are utilised. While much remains to be done to realise this goal, our research contracts provide one opportunity for a diverse range of health professionals to work together to achieve a common goal.

In recent years, we have had a particular emphasis on connecting researchers and clinicians to improve knowledge transfer. Currently, our contracts involve over 560 qualified clinicians, 56 per cent in a DHB or in private practice, providing a high degree of end-user involvement in our health-delivery research.

Many of our research projects also provide a basis for implementing a ‘team health’ approach. Examples include connecting:
- teaching and health professionals to implement health programmes in schools (e.g. asthma support and rheumatic fever initiatives);
- health and environmental planning professionals to ensure that community health is part of our planning process;
- statisticians and health professionals to model and project population health issues (e.g. future burden of disease);
- economists and health professionals to ensure health interventions are cost-effective;
- policy-makers and health professionals to ensure that government and local policy best support population health.

The wide range of professionals our research contracts involve and the institutions at which they are based is summarised in the graphic HRC’s Team Health, on the previous page.
Chapter 4: GOING GLOBAL – collaborating across national boundaries
Forging international linkages

New Zealand’s involvement in international research collaborations offers significant opportunities to build our health research capacity and maintain research quality through engagement with top international research teams.

There are also real benefits to be leveraged by gaining access to infrastructure and resources not yet available in New Zealand, including equipment, technology, data and intellectual property - enabling New Zealanders to be early adopters of worldwide medical advances.

Our international linkages also increase the opportunities for our researchers to access international funding streams and to attract international investment to New Zealand. For example, New Zealand currently attracts $30-40M annually in funding for pharmaceutical trials.

HRC and our research teams work hard to develop and maintain strong international relationships. As an organisation, we work with other agencies to formalise funding opportunities. Our researchers build relationships both through funding from our international funding mechanisms and incidentally, as they undertake and disseminate their research.

HRC’s international partnerships

Our international funding partnerships provide important opportunities for researchers to collaborate internationally. The partnerships we have formed provide opportunities for New Zealand researchers to participate in mission-led collaborative research of mutual benefit to the countries involved.

The Tripartite Agreement: Indigenous Health Research

The HRC, the National Health and Medical Research Council (NHMRC) of Australia, and the Canadian Institutes of Health Research (CIHR) partnered to undertake joint research on Indigenous peoples’ health. The partners have committed to developing a programme of initiatives that will be implemented collaboratively over the next five years.

HRC-CIHR: Primary Care for Older Adults

The HRC and CIHR have partnered to undertake research exploring new ways to care for older people with high health needs in the community. The research project is jointly funded, with the HRC investing $1.2 million and the CIHR investing $2.5 million.

International Relationship Fund – e-Asia

New Zealand, via the HRC, has recently become a member of the e-ASIA program. The programme provides a significant opportunity to engage with Asia through joint international research projects. Other members include:
Chapter 4: Going global – collaborating across national boundaries

Cambodia, Indonesia, Japan, Lao PDR, Malaysia, Myanmar, the Philippines, Thailand, the United States, and Vietnam.

**International Relationship Fund – US-EU-China NCD Collaboration**

New Zealand, via the HRC, has an agreement to undertake work with the United States, the European Union and China that focuses on the critical worldwide issue of non-communicable diseases (NCDs).

**Human Frontier Science Program**

The Human Frontier Science Program (HFSP) provides funding for frontier research in the life sciences. It is a high-profile scheme, with 18 recipients of HFSP funding having subsequently been awarded Nobel Prizes. Its membership also provides substantial networking opportunities, as it includes the G7 nations, Australia, India, the Republic of Korea, Norway, Switzerland, New Zealand and the non-G7 members of the European Union (represented by the European Commission).

**Heads of International Research Organisations (HIROs)**

The HRC Chief Executive is a member of HIROs, an informal policy organisation that brings together major government and philanthropic funders of biomedical research. HIROs meetings are attended by representatives of major health research funding organisations from around the world. Issues discussed include global R&D funding flows, scientific misconduct, and creating and sustaining institutional research capacity in low- and middle-income countries.

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**Our researchers’ international partnerships**

Through the HRC’s international partnerships, our researchers have gained funding for a number of exciting projects such as those listed below.

- Researchers from New Zealand, the United Kingdom and Denmark have joined forces to use country-specific databases to develop personalised approaches for predicting, preventing or managing CVD. The longer term vision is to enable New Zealand to engage in the rapidly growing field of linked ‘big-data’ in health. The increasing availability of linkable electronic health records has the potential to revolutionise research.

- Researchers from New Zealand and the United Kingdom (Oxford University) are collaborating to establish a critical mass of expertise across clinical, epidemiological and biostatistical disciplines and focus joint efforts on developing personalised healthcare, particularly on improving CVD risk prediction and diagnosis.

- Researchers from New Zealand and Belgium are collaborating to develop a real-time, beat-to-beat measurement of ventricular stroke-volume (SV) with the aim of enabling optimal titration of treatments and personalised care for cardiac patients in intensive care. The collaboration with Belgium provides our researchers with the ability to perform complex cardiovascular animal trials for which there is no equivalent capability or experience in New Zealand.

- Researchers from New Zealand and Europe are collaborating to conduct a genome-wide association study (GWAS) for genes that cause gout, including a focus on pathways driving co-morbidities (e.g. diabetes, heart and kidney disease) and to study gene-environment interactions. The
collaboration enables our top New Zealand researchers to combine their expertise with others in this specialist field.

- A major collaboration between researchers from New Zealand and China is allowing us to develop new classes of anti-cancer drugs by combining New Zealand assays, cancer biology and drug development skills with a drug library of nearly 700,000 compounds and high throughput screening capabilities in China. The work will generate intellectual property and increase New Zealand’s access to the $80 billion p.a. worldwide anticancer drug market.

- A New Zealand team is using mobile phone technology to support smoking cessation measures in the Pacific Islands in a collaboration closer to home. This research provides New Zealand with the opportunity to develop further expertise in the emerging area of e-health and provides health benefits to Pacific Island nations.

In addition to research funded through our formal international collaborations, our researchers also undertake international collaborations through our other funding mechanisms (such as the Annual Funding Round). This is particularly true of international clinical trials, such as the following examples that are ongoing.

- In New Zealand and Australia, 2800 patients will participate in a study to determine if a restrictive fluid strategy following surgery leads to reduced complications and improves survival compared to a liberal fluid strategy.

- In New Zealand and Australia, 4000 intensive care patients will participate in a study to determine whether reduced sedation when receiving mechanical ventilation improves outcomes.
Patients in 100 Intensive Care Units (ICUs) across four countries (3 ICUs in New Zealand) will participate in a trial to establish whether or not selective digestive decontamination (SDD) reduces mortality risk for patients who require life support with a breathing machine in an Intensive Care Unit (ICU). SDD involves antibiotic treatments, hygiene protocols and the monitoring of swabs to target colonies of the harmful pathogens that mostly commonly cause life-threatening infections in ICU and that tend to proliferate when the balance of flora in the body is disturbed by serious illness.

In Australia and New Zealand, 400 patients in intensive care will take part in a trial to determine if equal doses of antibiotics given by continuous infusion versus intermittent antibiotics for severe infection can reduce the duration of intensive-care support.

The 2014 Annual Funding Round showed that 61 per cent of contracts identified at least one international collaborator on their research application, representing over 28 countries. Analysis of research outputs using our Data Information Report for the 2013/14 year also shows that many researchers form beneficial collaborations as an on-going part of their research. In total, 189 collaborations were reported (85 new and 104 ongoing).

Our Achievements through international partnerships

In recent years, our researchers, and the international partnerships they have been involved in, have achieved significant results that will influence not only the healthcare system in New Zealand, but worldwide. The following section outlines just a few of these achievements.

A clinical trial collaboration between the University of Otago and the Murdoch Childrens’ Research Institute (University of Melbourne) showing that a new rotavirus vaccine is effective in 90 per cent of babies treated has the potential to save over half a million lives worldwide each year.

Professor Sir Peter Gluckman, The Liggins Institute, and his international collaborators have provided important insights into the physiological basis of malnutrition phenotypes, highlighting the effects of in-utero environment in determining growth trajectories. Basically, how nutrition in pregnancy affects the future expression of genes in the child and their subsequent growth.

Dr Lynette Sadlier, University of Otago with the support of collaborators in Australia and the United States has discovered two new genes responsible for a severe type of epilepsy. This finding is important because it provides a definitive diagnosis and is a step towards developing targeted therapies.

Professor Brian Darlow, University of Otago, has led the New Zealand wing of a randomised controlled trial to test what the optimum oxygen saturation target range is for very pre-term babies. New Zealand data, combined with data from the UK and Australia provided evidence to support switching to higher oxygen levels to improve pre-term baby survival.
rates. The results provide evidence for oxygen saturation targets and are likely to change clinical practice worldwide.

- Associate Professor Cameron Grant, in collaboration with researchers at the University of Oxford has shown that fewer than half of children admitted to Starship Children’s Hospital had received antibiotics in primary care. The study highlights the need to improve diagnosis of acute illness caused by infection in children presenting to a GP.
Chapter 5: NETTING ECONOMIC RETURNS – how we deliver across the value chain
HEALTH SPENDING IS A KEY DRIVER OF WESTERN ECONOMIES, WITH THE OECD PREDICTING THAT RISING HEALTHCARE COSTS POSE THE BIGGEST THREAT TO THE LONG-TERM SUSTAINABILITY OF NEW ZEALAND’S ECONOMY. HRC PROVIDES THE ANSWERS TO OUR MOST PRESSING HEALTH QUESTIONS WITH RESEARCH THAT IMPROVES THE NATION’S HEALTH, RAISES THE EFFICIENCY AND EFFECTIVENESS OF SERVICES AND TRANSLATES TRANSFORMATIVE IDEAS INTO INNOVATIONS THAT IMPROVE LIVES AND BOOST GDP

Why is health research such a vital part of New Zealand’s economic growth solution?

Because NZ’s biggest economic challenge is health spending

Healthcare spending is a critical part of our long-term fiscal challenge because it is both large and growing - health spending has been increasing faster than our national income for most of the last fifty years. Long-term fiscal projections show health spending continuing to increase as a proportion of national income, from 6.9 per cent of GDP in 2011 to 11.1 per cent of GDP by 2060 - which would account for approximately 40 per cent of core government spending.

Health research is a significant weapon in the Government’s armoury – we have a vital role to play in ‘bending the curve’ in health expenditure through:

- improving health, which drives participation and productivity;
- containing healthcare costs by increasing efficiency, efficacy and cost-effectiveness of delivery, and
- generating new and transformative ideas, products, tools, interventions and services that have commercial value.

The payback

“New Zealand has an imperative to strengthen the use of health research to deliver better, more timely and convenient healthcare.”

The Treasury

Investing in health research generates considerable economic gain, in and of itself. Health research returns an overall economic value to society that exceeds the cost of investment.

The direct economic returns from cancer research in the UK between 1970 and 2009 translated to a rate of return on investment of 10 per cent, compared with the 9 per cent previously estimated for cardiovascular disease research. The wider ‘spill-over’ benefits produced a 30 per cent rate of return.

A comprehensive review of all phase III clinical trials in the United States found that, estimated conservatively, the economic benefit exceeded $15 billion over the course of 10 years, and that new discoveries from the trials were responsible for an estimated additional

17 Temple: Capital Investment Specialists ‘New Zealand’s addiction to healthcare: Diagnostic, trends and initiatives to manage cost growth’ August 2009.
When we invest in medical research, we win twice over: we make discoveries that lead to better health, while also generating wealth. The health research ecosystem is one of the most important contributors to the economy. A long-term, stable commitment to research is needed to ensure advances in the nation’s future health, and its economic prosperity.

Dr Jeremy Farrar, Director of the Wellcome Trust

470,000 healthy years of life. The 10-year return on the investment in clinical trials research funding was estimated to be 4600 per cent.

The economic value of a healthy and productive population

HRC-funded research reduces demand for health services by keeping people well, and by supporting innovative research that enables patients to better monitor and manage their own health outside of high-cost healthcare settings. Advances in screening, detection and diagnosis, prevention and intervention, as well as the identification of new and better treatments and services has led to substantive improvements in our health.

When New Zealanders live longer and healthier lives, this has the knock-on effect of enabling greater participation in the workforce and higher productivity, which enables economic growth. So in helping the population to be healthier, health research has a strong impact on the economy. Between 2000 and 2011, about 24 per cent of the growth in income in low- and middle-income countries resulted from health improvements.

Health research has led to reductions in risk-taking behaviours, prevention of injury and illness, increased awareness of healthy behaviours, and also tackled key environmental factors that affect our health. HRC-funded research in healthy housing, immunisation and urban design are just a few of the areas that net health gains can be attributed to. Health inequality has also been identified by economists as an important factor in slowing economic growth, due to both the high social and service costs involved, and the political instability health and social inequality creates. Significant improvement in Māori health can be seen even within the last decade where Māori life expectancy has increased by 3.8 years for both males and females, up from 66.6

We now have “good reasons and strong evidence” to believe that health improvements stimulate economic development. The “good reasons” include the effect of improved health on labour productivity, education, investment, access to natural resources, and the ratio of workers to dependants. The “strong evidence” comes from three types of research: historical case studies, microeconomic studies at the individual or household level, and macroeconomic studies that assess the effect of measures of health at the national level on income, income growth, or investment rates.

Bloom and Canning

Impact of advances in screening detection & diagnosis

- The disability rate among over-65s has decreased by 13 percent
- NZ’s infant mortality rate has declined by 30 percent
- Life expectancy has increased by 6 years for males and 3 years for females since the 1990s
- Survival rates from cancer have doubled since the 1970s
and 71.3 years, respectively, in 1995–1997.

**Antimicrobial Resistance – the biggest global economic threat**

Just as improved health produces a significant boost to our economy, significant deterioration in population health can severely threaten the economic stability of not just New Zealand, but the entire world. The discovery of antibiotics has had a major impact on health outcomes since penicillin came into common usage in the 1940’s. However, we must now face some concerning facts:

- no new antibiotics have come to the market for more than 25 years, and
- current projections indicate that, due to increasing antimicrobial resistance, the world population will be between 11 million and 444 million lower by 2050

This rate of mortality and morbidity would impact on world GDP, reducing it by between 0.06 per cent and 3.1 per cent, a cumulative loss of between $2.1 trillion and $124.5 trillion (this cost only includes disruption to the labour supply and not direct healthcare costs, or wider indirect social costs).

**The economic value of an efficient and cost-effective health system**

Health research delivers value for money in healthcare and improves the quality, efficiency, and sustainability of our healthcare system – results that are growing increasingly important in light of our ageing population and the escalation of chronic conditions such as diabetes, obesity, cardiovascular disease and cancer. HRC-funded research ensures that we get maximum health gains from every dollar spent, through greater understanding of the efficacy, efficiency and cost-effectiveness of treatments and services. Some key economic benefits to the health system from this knowledge over the last 25 years include:

- a 56 per cent reduction in hospital stays and related costs between 1980 and 2000;
- an up to 76 per cent reduction in diabetes related complications, such as blindness, related to technology to control blood glucose levels, and
- time in hospital reduced by a minimally invasive treatment for aneurysms compared with more invasive medical interventions (4.5 vs. 7.5 days).

Advances in identifying the right and most cost-effective treatment saves the New Zealand tax payer considerably. HRC-funded research identified that prescribing calcium supplements to prevent osteoporosis increased the rate of cardiovascular events in older women. This finding both improved the safety of clinical practice but also had a significant economic impact. The subsequent 66 per cent reduction in calcium supplements prescribed translated into $3.9M in savings over 5 years, with the annual savings likely to accrue into the foreseeable future (Gray, 2014)\(^\text{18}\). This does not include savings that result from not having to treat the cardiovascular events that might have resulted had the supplements been prescribed.

Technologies have reduced the costs of surgical procedures, such as laparoscopic techniques and balloon angioplasty. Other technologies have allowed cost-reductions by enabling a shift in treatments from an in-patient to out-patient setting, or to remote monitoring.

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The economic value generated from IP and Innovation

The medical devices and health technology sector is one of the most commercially successful in New Zealand, contributing more than a quarter (27 per cent) of export earnings to our high-tech manufacturing sector and injecting an estimated $1.4 billion into the economy.

The Institute of Economic Research states that New Zealand should prioritise areas of science where it is capable of playing a leading role and where there is the potential to deliver advanced technology products. As a country, we have an acknowledged comparative advantage in this field - thanks in part to our strength in health research. However, we have also achieved excellent engagement of the people who utilise the technology in the research endeavour - clinicians and health professionals.

Where do the ideas and evidence for the creation of medical devices and technologies come from?

Health research and health researchers

HRC-funding has led to a number of innovative companies being launched and intellectual property licensed to commercialise discoveries (see Appendix 1). These spin-off companies have received significant HRC support for underpinning research, and they have produced a wide array of commercial products that include therapeutics, software, imaging and diagnostic tools. In some instances, HRC can lay sole claim to the health and economic benefits accrued from the development of lifesaving tools, having supported the research from conception through to product development, such as in the

with two of case studies follow, PREDICT an the Cooling Cap - each illustrating that the road to discovery is usually a long one.

Investment that moves research from patent to patient does not necessarily take a direct route as the research progresses. Innovative research is complex and new questions and barriers arise constantly along the way - as the story of the development of New Zealand's first cancer vaccine demonstrates.

Even when the pieces of the story slot nicely into place, as with the development of the Cooling Cap, we expect a 'travel time' of twenty years from the first lab-based discovery to the trial of a clinical solution. For this reason, the HRC’s twenty-fifth anniversary is an exciting time for the organisation, as now the long-term programmes of research we have invested in for two decades are delivering on their promise with medical advances that will be life-altering for many New Zealanders, and others around the world.

More of the examples that we have given relate to biomedical research, because we want to illustrate the typical innovation process. However, public health research also generates commercialisable products. The premise that spin-off companies in the health sector are typically underpinned by decades of sustained investment in biomedical research, and often take years to see return on investment, has recently been challenged by successful companies built on HRC research funding. PREDICT software, an electronic decision-support tool for the prediction of cardiovascular risk, which was developed by Enigma Publishing and now used in primary care throughout New Zealand, was underpinned by HRC-funded epidemiological - rather than biomedical - research conducted by Professor Rod Jackson and colleagues at the University of Auckland.
Chapter 5: Netting economic returns – how we deliver across the value chain

PREDICT allows clinicians and hospitals to target limited resources to the right patients, preventing 30 per cent of cardiac events occurring compared to standard practice. This leads to a significant reduction in healthcare costs including hospital and post-hospital care. Auckland District Health Board estimate cost-savings of between $10M and $20M a year – extrapolated across all the DHBs adopting PREDICT, this could save our health system $300M a year. PREDICT has been sold to Australia, Singapore and Canada.

Keeping a cool head improves outcomes for newborns

Even with advances in obstetric care over recent decades, up to three babies in every thousand births will have abnormal brain function due restricted oxygen during labour - from a twisted cord, inadequate placenta or contractions that are too strong. Cerebral palsy is one of the most devastating consequences of oxygen deprivation or infection before or during this critical time.

The HRC first started funding research on trying to improve outcomes for these babies in 1994. The key steps on the pathway to discovery neatly illustrate how breakthroughs often come from a clinical observation, and the value of having those at the front-line of treatment trained to undertake the vital research to find answers.

- Professor Alistair Gunn notices that babies deprived of oxygen at birth improve initially but then decline - often with seizures.
- He undertakes a PhD with Professor Peter Gluckman to try to understand what is happening to these babies. His initial studies are in rats. He notices that when he gives them drugs designed to protect the brain from injury, they become cold. When he tries to keep them warm, the protective effects of the drugs are lost.
- HRC funding supports him and his team to show that cooling is a side-effect of the drugs and is protective in itself.
- Continued HRC funding leads to further breakthroughs:
  - brain damage develops progressively over time, following the initial injury;
  - damage is caused by a progressive biochemical cascade that results in the delayed death of brain cells - the reason babies improve, and then decline;
  - cooling the brain interrupts this cascade (Professor Tania Gunn - also a paediatrician - joins the
From patent to patient: The road to an innovative cancer vaccine

HRC contracts awarded to the Malaghan Institute of Medical Research

Spin-off research: on improving cancer detection, controlling aggressive brain tumours & a parallel programme on developing immunotherapy for asthma & allergic disease, all HRC funded

● 2006 Clinical trial of enhanced vaccine in melanoma patients (HRC 06/139)

● 2004 – Boosting response
The immune response in patients is variable & work continues, focused on extending the lifespan of the anti-tumour immune cells in the body by eliminating barriers to their survival (HRC 04/249)

● 2005 – Recruiting natural killers
Finding immune modulators that will amplify the body’s response to the vaccine, particularly that of ‘natural-killer T cells’ (HRC 05/459; 05/031)

● 2006 – Increasing the potency
In addition to testing compounds that activate natural killer T cells, the team looks at adding others that resemble those the body encounters in infections, to provoke an even bigger response from the immune system. An additional factor is added that will help the dendritic cells to interact with immune cells & transfer the tumour peptides to resident cells in the patient. The new vaccine is tested in an animal model of melanoma. The trials of the original dendritic-cell based vaccine continues in lymphoma patients. (HRC 06/316, 06/207)

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Distance (yrs):
Breakthrough 5
Progress 10
Impact 20

1998 – On the road to a vaccine
Identifying peptides on the surface of cancer cells that can be used to create antibodies to tumours (HRC 98/090)

1999 – The first vaccine
The tumour peptides are loaded onto dendritic (immune) cells from cancer patients and re-injected as a vaccine to prime the immune system to recognise & attack the tumour. (HRC 99/188, HRC 99/188)

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Code breaker:
Peptides – like proteins, but smaller, simpler molecules
Antigen - antibody generator; Dendritic cell - immune cell that ‘presents’ antigens to the immune system, T-cell – white cell, part of the immune system.
research effort, and the mother and son team develop the prototype 'CoolCap');

- cooling is only effective if started early in the process and there is a narrow time window in which it is effective;
- they develop a system for measuring brain activity to identify accurately the precise point when cooling should be applied, and
- they discover that the baby’s brain has to be cooled continuously for several days whilst the inflammation settles.

The first international trial was launched in 2005 - the CoolCap Trial. Many trials have followed, including one by researchers at Oxford University’s Health Economics Research Centre who have done a meta-analysis of trials and shown that the treatment is cost-effective, especially when those costs are viewed in relation to disability-free life years gained to 18 years of age.

The treatment is very cheap, all that is needed is cooling blankets and a capital investment of two cooling machines at a central neonatal intensive care unit. There are no additional costs beyond standard care. The return is paid over decades in the contribution these children subsequently make to society and the savings on life-long disability support services.

The HRC as a critical link in the innovation chain

It is common for start-up companies to access grants from more than one public funding agency before securing private funding. The following case studies describe the success of two research groups who have formed biotechnology spin-off companies. They demonstrate how HRC funding adds value to the R&D enterprise in New Zealand by filling critical funding niches in the pathway to generating economic return.

Both companies accessed substantial HRC funding at very different stages of product development. The first, Pacific Edge Limited, illustrates how the HRC’s sustained investment in world-class, biomedical research has been critical in providing the initial platform of innovations and discoveries on which companies can build. In contrast, the development of Telemetry Research and wireless technology for medical devices illustrates how HRC funding has been essential to support the clinical translation of a platform of research that was initially developed for industry by the University of Auckland’s Bioengineering Department.

Economic Impact Study:

Pacific Edge Limited

Pacific Edge Ltd is a NZX-listed spin-off company based on commercialising intellectual property generated by the Cancer Genetic Laboratory at the University of Otago, which received HRC Programme support for over a decade (over $9 million) to research the genetics and epigenetics of cancer.

This laboratory, led by Professors Tony Reeve and Parry Guilford, has a guiding philosophy that their research should ultimately translate to the cancer clinic. Their findings on diagnosis of Wilm’s tumour and stomach cancer have benefited many families worldwide, saved lives and gained international recognition. But it has been the group’s continued
emphasis on protecting intellectual property that has made it possible for Pacific Edge to achieve ongoing success in delivering commercial cancer tests for early diagnosis and better treatment.

Pacific Edge's flagstone product is CxBladder; a diagnostic test for bladder cancer that was first introduced to the NZ market in 2011, and is now also available in Singapore and the USA. Bladder cancer is only the ninth most common cancer overall, but has a high risk of recurrence and requires life-long surveillance, making it the most expensive cancer to manage from diagnosis to death. It is typically diagnosed by cystoscopy (endoscopic evaluation, which is highly invasive and expensive). CxBladder Detect is a non-invasive laboratory test, conducted on urine samples, with better sensitivity than competing products.

A second product, CxBladder Triage, was launched in New Zealand in 2014 to complement CxBladder Detect, and brings the company closer to their goal of creating a ‘one-stop shop’ for urological cancer detection and management products.

The company’s growth plan is to expand into the USA, the world’s largest biomedical market, with up to 2 million potential CxBladder test opportunities every year. To this end they are pursuing initiatives that include expansion of the US Sales and Marketing team, the continuing rollout of ‘User Programmes’, negotiation of agreements with funders in the US healthcare system, and advancing commercial relationships with private insurance companies.

Pacific Edge also have a promising pipeline of other cancer detection tests in late-stage development (see: www.pacificedge.co.nz), including CxColorectal, for diagnosis of colorectal cancer, which has completed clinical trials and is being prepared for commercial launch. The company’s patent portfolio continues to grow and expand into different countries, reflecting the high-quality innovative science underpinning their products.

Pacific Edge now has extensive experience in intellectual property protection of health technologies, is well connected to the pharmaceutical industry and has experience in the identification of the international partners who are likely to be required to co-fund clinical trials and enable rapid market entry. In recognition of its contribution to industry, Pacific Edge was awarded the 2013 Supreme Winner of the New Zealand Innovators Award, and named NZBIO’s top bioscience company for 2014.

The company’s annual report for the 2014 financial year shows trading revenue of $523,000, up 187 per cent; total revenue $838,000, up 63 per cent; 33 global employees, and considerable growth in the share price, culminating in Pacific Edge entering the NZX50.

Since 2011, Pacific Edge has received approximately $0.5M in grants from MBIE, and in 2014 was awarded a Growth Grant from Callaghan Innovation ($4.5M over three years, with additional funding for a further two years available on review). This support builds on the company’s track record of turning scientific discovery into products that bring real benefits for clinicians and patients, and will provide additional resources to accelerate the
development of a range of cancer detection tests.

**Where HRC made the difference**

The HRC funded the early research that formed the basis of Pacific Edge’s success, and continues to fund pioneering research conducted by researchers at the University of Otago’s Cancer Genetic Laboratory. This includes:

- investment of over $2 million in research on the next generation of urological tests based on single cell RNA profiling, with potential for unprecedented accuracy, and
- a promising new approach to target and treat tumours, based on exploiting the observation that the tumour-suppressing protein E-cadherin is frequently inactivated in many common cancers.

**Economic Impact Study:**

**Telemetry Research**

Professor Simon Malpas’s research career began in cardiovascular physiology but has evolved to see him leading a start-up R&D company, Telemetry Research, and using innovative wireless technology to develop medical devices for the worldwide market. The impetus for the start-up came from a 1998 HRC grant that he received to study hypertension, when he found that he was unable to buy the instrumentation needed for physiological measurements of animals in a free-roaming, rather than anaesthetised, state. He teamed up with Dr David Budgett from the Bioengineering Institute, and they set about building a device that could make the required measurements.

They received funding from FRST to develop the core technologies of miniature sensors, wireless communication, and wireless power, and founded Telemetry.

**Research in 2005** to capitalise on the intellectual property generated from this work. Telemetry partnered with, and was eventually bought by Millar Inc (Houston). The resultant product portfolio, which is focused on developing and marketing tools for use in biomedical research (animal studies), continues to do extremely well. Products are now sold in over 30 countries.

Professor Malpas’s research team have their sights firmly set on developing their technology for clinical use in implantable medical devices – representing a big step up into a R&D environment that is extremely challenging and dynamic, with the most stringent requirements for demonstrating safety.

The device developed to monitor animals in free-roaming conditions and below, the size of the tip in relation to a paper clip.
They recognised a huge market opportunity in being able to deliver wireless power and communication to implantable medical devices, obviating the risk of infection and inconvenience inherent to the alternative technology – a ‘driveline’ cable passing through the skin.

Malpas’s approach has been not to develop the devices, but to bring his group’s technology to a point where they can partner with international device companies, and seek private investment for the expensive phase of development: full medical device development, regulatory approval and human trials.

He sees local funding as critical, as it ensures that the University research team can keep control of the direction of the research, secure the intellectual property, and build a critical mass of expertise in New Zealand to support the growth and development of a high-value export sector - centred on implantable medical devices.

The research to date has built on a substantial array of funding over the past 6 years. The University of Auckland has made a $12 million investment into core wireless power technologies that have resulted in more than 60 patents for industry. In terms of applying that technology to medical devices, the research team have received project grants from both FRST/MBIE and HRC.

FRST/MBIE funding has included a 2008 NERF grant followed by Smart Ideas grants in 2012 and 2014. These grants have been awarded to bioengineers to develop the platform technology known as TET (transcutaneous energy transfer), and to develop wireless power technology in a small battery-less implantable device, with potentially broad clinical application.

Where HRC made the difference:

The HRC grants in 2010 and 2014 were awarded to accelerate development of devices for the first clinical applications: management of a) heart failure and b) hydrocephalus. The HRC-funded teams have been multidisciplinary, consisting not only of engineers and physiologists but also expert clinicians in the areas of cardiac medicine and neurosurgery, respectively for each project.

The scope of the HRC grants has been to validate technical requirements, including the conduct of studies in large animals to ensure compatibility with humans. This funding is intended to provide proof of principle and bring the technology to a point where it is attractive to private investors.

In terms of private investment, the heart pump research findings are currently under evaluation by international companies, for the powering of their ventricular assist devices.

How HRC’s sustained investment in the best people and ideas underpins the success stories of MBIE and the Callaghan Institute

HRC funding not only plays a critical role as a ‘cog in the innovation machinery’ - the ideas and the people we support produce the evidence and clinical platforms (the commercial-potential pool) from which MBIE and Callaghan Innovation can draw to generate commercial products with economic value for New Zealand.

In 2014, the HRC commenced long-term Independent Research Organisation (IRO) Capability Funding for the Malaghan Institute, which is at the international forefront of research in cancer vaccine technology (see From...
patent to patient, p60 and Spotlight on the Malaghan Institute, p80).

The Malaghan Institute has an impressive track record of gaining competitive funding from the HRC, including Programme funding in 2010 for pre-clinical and early stage clinical studies of a new melanoma vaccine. Building on this, and supported by IRO funding, the Malaghan is now undertaking a clinical trial of the vaccine, in collaboration with Capital & Coast District Health Board, Callaghan Innovation, The University of Auckland and Cancer Trials New Zealand. Leading this work is Associate Professor Ian Hermans, the Malaghan Institute’s Deputy Director of Research, and former recipient of the HRC’s prestigious Hercus Fellowship.

**Ideas in the pipeline**

The HRC’s strong investment in basic biomedical research, and our training and engagement of clinicians in research, continues to provide a well-spring of new opportunities.

Exciting and promising research with commercial potential that we currently have in the pipeline is highlighted in 'Ideas in the HRC Pipeline' (right). **Twenty-one per cent of our investment in 2014 focuses on new opportunities in developing and testing novel health**
Chapter 5: Netting economic returns – how we deliver across the value chain

technologies and devices, and identifying new drugs and biologics.

HRC-funded research will continue to be a particularly important source of commercial potential for Callaghan Innovation, given their move away from conducting basic research and their new primary focus on industry demand-driven development projects.

The value of patents - where ideas become exploitable

For ideas at the technology frontier, the single most useful measure of innovation is ‘international’ patenting. Patents reflect the realisation of national innovative performance because they are a marker of potential economic value, and because the patenting process ensures a standard of technological excellence that is at or near the global technological frontier (Porter and Stern, 2001).

In the last 6 years, HRC-funded research has resulted in 31 unique patent grants being awarded. In 2014 our researchers were awarded or have patents pending for:

- diagnostic/prognostic biomarkers for pneumonia or atherosclerotic conditions;
- novel devices relating to wireless power technology, and
- molecules with anti-cancer activity.

HRC's role in fuelling the innovation value chain

How we add value

The commercialisation of research ideas to realise economic potential often requires investment over a long period of time. HRC has an impressive track record of providing vital support for innovative, revenue-generating health research in New Zealand, and is a key player in supporting New Zealand’s health technology pipeline.

We recognise that sustained investment in the best people and ideas is essential to underpin innovation and provides the platform of discoveries on which companies will build. Ensuring that the nation’s top teams are funded for the long-term is critical because some of the most innovative and productive research programmes span a decade or more.

HRC identifies scientifically valid commercial opportunities

HRC strategically makes significant investment in biomedical research to ensure that there is a continuous flow of new discoveries in the pipeline to commercialisation and that the skills and the talent required to power the innovation system are maintained in New Zealand.

Over the past 5 years, an average of 42 per cent of our funds have gone to support biomedical research.

“The there is a strong relationship (R² = 0.80) between the ability to create wealth from innovation and the number of scientists and engineers in the workforce. Basic research is the key driver of long-term innovation and makes contributions which are extremely important in areas in which New Zealand is unique, including biodiversity, health and Māori studies.”

Ministry of Economic Development 2003

Understanding customer needs

The success of the medical technologies and devices industry depends on being able to understand customer needs and demands – especially the clinicians and health professionals who utilise the technology. HRC’s success in engaging clinicians and end-users on our research
teams and contracts, along with the research training opportunities we have provided for health professionals over the past 25 years, means New Zealand is ideally placed to drive a customer or consumer-led medical technologies enterprise. Our research-savvy clinicians are ready to explore new and better ways of using technology in health care practice. They can develop medical devices, equipment, processes and technology based upon a core understanding of what is needed, and how it will work in the healthcare environment.

Our unique contribution

**HRC is the only funder supporting clinical trials of novel drugs and biologics in patients**

In 2012, an analysis of HRC, Marsden and MSI’s investment in health technology was undertaken. Health technology research accounted for 34 per cent of HRC funding, 17 per cent of the Marsden Fund’s health-related funding and 70 per cent of MSI’s health-related funding. Marsden funding primarily supported early-stage identification and development of drug candidates, and biological therapies. MSI funding was focused on the manufacture of drugs and biologics, preclinical development of drugs, and development of a range of medical devices. HRC funding spanned all categories. However, we were the only agency to fund clinical trials of novel drugs and biologics in patients – this, therefore, is our specialist niche and unique contribution to the innovation value chain.

While MBIE and Callaghan could be described as having a top-down (product or industry-led approach), HRC has a bottom-up (ideas-led) approach. These approaches are complementary, mutually reinforcing, and are both required to support a productive innovation chain.

**Barriers**

The primary barrier to HRC playing a more significant role in helping New Zealand to further capitalise on the enormous world-wide health technology market is our current level of funding. R&D expenditure as a proportion of GDP declined across all sectors in 2014 compared to 2012 levels (1.25 per cent in 2012 to 1.13 per cent in 2014), while the OECD R&D expenditure as a proportion of GDP rose from 2.33 per cent to 2.40 per cent. These ratios are considerably less...
than those for other economies similar to that of New Zealand.\(^{19}\)

**HRC has not had an increase in funding since 2009 which considerably weakens our ability to continue to support the full value chain from discovery to exploitation.** There is evidence that our static (in real terms, declining) budget, is starting to restrict the sector as we would like, or can be moving forward.

### The future

*Never before has the call for innovation technologies been so great or the pressure on healthcare budgets so acute. Consequently we have to make sure that our innovations are accompanied by data and evidence on safety, efficacy and cost-effectiveness.*

A number of emerging medical technologies may hold the key to revolutionary changes in the way we deliver healthcare in the next 10-15 years.

Telemedicine and telehealthcare are already making a huge impact on the health sector. Information technology and the expansion of the internet and broadband connections are already allowing remote monitoring and diagnosis of patients. Smart-phone apps, social media platforms, and sensor-embedded smart devices will increasingly putting health management into the hands of patients, in conjunction with healthcare providers. The rise in mobile phone ownership creates huge opportunities for remotely tackling chronic diseases, all of which improves access to health services, reduces costs, and empowers patients to take control over their own health. **HRC has supported a small number of successful clinical trials which demonstrate the effectiveness of this kind of technology, but there is more that we would like to contribute in this space.**

**Key opportunities for HRC to strengthen the innovation value chain**

We need to:

- improve our linkages, networks and knowledge sharing with MBIE and Callaghan Innovation;
- encourage exploration of technology, either improved or the wider application of existing technology;
- better support the exploration of commercial potential arising from other research domains – such as clinical, public health and health services delivery research, where innovative interventions, clinical decision-making tools and models of service delivery may evolve;
- encourage and incentivise research in areas of converging technologies;
- boost our support for comparative data review - new medical technology and data increasingly require comparative-effectiveness evidence to increase marketing power and sales;
  - the HRC can build on our current experience and developing expertise, through our Health

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Innovation Partnership with the National Health Committee (NHC), to provide evidence of the cost-effectiveness of new and existing technologies;

- support critical research capability and provide targeted training opportunities to meet important research capability gaps, such as in health informatics, telehealth and health economics;

- continue to build our clinical trial assessment and clinical trial monitoring expertise,

  - “a fertile clinical trials sector in NZ will help the country continue to be a great market for innovation” (A Global Ambition: A Thriving Medtech Economy, Medical Technology Industry Sector Blueprint, 2011), and

- make sure we continue to provide the right signals, incentives and opportunities that enable our researchers to pursue their ideas in multiple directions and not restrict them to a pre-defined pathway that is limited by what is known and expected.
Chapter 6: INVESTING IN PEOPLE – our innovating research workforce
OUR RESEARCHERS ARE THE ENGINE THAT DRIVES ADVANCES IN NEW ZEALAND’S HEALTH AND PRODUCTIVITY. OUR TOP TEAMS ARE INTERNATIONALLY RECOGNISED, WHILST OUR EMERGING RESEARCHERS ARE POISED TO BECOME THE NEXT GENERATION OF RESEARCH LEADERS. THE HRC TRAINS AND SUPPORTS THE HEALTH RESEARCH WORKFORCE, MONITORING TO IDENTIFY CRITICAL STRENGTHS AND NEEDS

A Profile of Our Health Research Workforce

Each year we undertake a detailed ‘stocktake’ of our entire health research workforce on current contracts. Through this work, we track New Zealand’s health research capacity, identify skills, identify gaps and review the effectiveness of our workforce development initiatives.

The information presented in this section is based on our most up-to-date analysis, undertaken for the 2013/14 financial year. All Individuals named on HRC contracts are included - using information from curriculum vitae submitted with research proposals.

Our analysis takes account of the differing career paths of non-clinical academics, clinical academics, and Māori and Pacific researchers - and so varies slightly across these groups.

Our research workforce on the 356 current contracts in 2014 comprises 1,391 unique named individuals who contributed an estimated 714 FTEs through 2,571 positions (of which 1,721, 67 per cent, were salaried). Non-salaried clinical and research staff make a valuable contribution to contracts, at no extra cost to the HRC. Half are Senior Researchers

Key facts about our clinical workforce

<table>
<thead>
<tr>
<th>Total: 575 clinically trained individuals^{20}</th>
</tr>
</thead>
<tbody>
<tr>
<td>Researchers: 478 researchers</td>
</tr>
<tr>
<td>Practising: 57 per cent</td>
</tr>
</tbody>
</table>

What expertise do our clinicians have?

<table>
<thead>
<tr>
<th>Qualification</th>
<th>Per centage (n= 575)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Medical Practitioner</td>
<td>80 per cent</td>
</tr>
<tr>
<td>Nurse/Midwife</td>
<td>9 per cent</td>
</tr>
<tr>
<td>Clinical Psychologist</td>
<td>7 per cent</td>
</tr>
<tr>
<td>Physiotherapist</td>
<td>3 per cent</td>
</tr>
<tr>
<td>Other</td>
<td>1 per cent</td>
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</tbody>
</table>

What roles do clinicians play in research?

<table>
<thead>
<tr>
<th>Research Role</th>
<th>Per centage (n= 575)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Senior Researcher</td>
<td>46 per cent</td>
</tr>
<tr>
<td>Researcher</td>
<td>24 per cent</td>
</tr>
<tr>
<td>Emerging Researcher</td>
<td>12 per cent</td>
</tr>
<tr>
<td>Clinician</td>
<td>13 per cent</td>
</tr>
<tr>
<td>Research Assistant</td>
<td>3 per cent</td>
</tr>
<tr>
<td>Support</td>
<td>1 per cent</td>
</tr>
<tr>
<td>Advisor</td>
<td>1 per cent</td>
</tr>
</tbody>
</table>

^{20} Includes non-researchers, for example doctors collecting samples.

^{21} The 714 FTEs consists of 628 FTEs contributed by the 1,721 salaried positions, plus an estimated 85 FTEs contributed by the 850 time only positions (assuming an average of 0.1 FTE per time only position, based on previous analysis).
**Key characteristics of HRC’s health research workforce in 2014**

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Highly qualified</strong></td>
<td>84 per cent of named researchers hold a postgraduate research qualification (PhD, Master’s degree or equivalent) and 76 per cent have a Doctor of Science, Doctor of Medicine or PhD.</td>
</tr>
<tr>
<td><strong>Experienced</strong></td>
<td>66 per cent of named individuals are classified as a Researcher or a Senior Researcher.</td>
</tr>
<tr>
<td><strong>Internationally connected</strong></td>
<td>203 positions were held by international collaborators, from Australia (76); the US (55); the UK (41); Canada (7); Germany (4); Spain (3); Belgium (2); Japan (2); Singapore (2); Austria (1); Fiji (1); Hong Kong (1); India (1); Ireland (1); Italy (1); the Netherlands (1); Norway (1); South Korea (1); Switzerland (1); and Thailand (1).</td>
</tr>
<tr>
<td><strong>Clinically trained</strong></td>
<td>43 per cent of named researchers (478/1124) are clinically trained, 57 per cent of these are practising at a DHB or in private practice. An additional 73 non-academic clinicians are named on contracts.</td>
</tr>
<tr>
<td><strong>Nurturing emerging researchers</strong></td>
<td>Almost 20 per cent of named investigators are Emerging Researchers (240, 17 per cent), including 102 Research Fellows and 92 postgraduate students (82 are doctoral candidates).</td>
</tr>
<tr>
<td><strong>Gender-balanced</strong></td>
<td>The male-to-female ratio for named individuals on contracts is approximately 1:1. However, 70 per cent of Senior Researchers are male. The majority of emerging researchers (64 per cent) are women, signalling a potential change in the gender balance in senior positions in the future.</td>
</tr>
<tr>
<td><strong>Growing Māori research capacity</strong></td>
<td>12 per cent of named individuals on contracts are Māori (163). Nearly half are Senior Researchers (26 per cent) or Researchers (33 per cent). A further 22 per cent are Emerging Researchers. Approximately one-quarter of the Māori workforce (26 per cent) are clinicians.</td>
</tr>
<tr>
<td><strong>Growing Pacific research capacity</strong></td>
<td>The number of Pacific researchers remains very low, at 41 named individuals (3 per cent) and 67 research positions. Only 8 of these are Senior Researchers. This is despite a decade of capacity-building measures, similar to those that have proved successful in building the Māori research workforce. The HRC is currently reviewing capacity building measures for Pacific research.</td>
</tr>
<tr>
<td><strong>Diverse employers</strong></td>
<td>1798 (84 per cent) of named research positions were at universities. However, hospital/DHB’s accounted for 543 researcher positions (25 per cent, up from 13 per cent in 2012/13 and 8 per cent in the 2011/12 analysis) and there were 363 joint appointments, mostly for clinicians with an academic post and a clinical position. Other employers included independent research institutes (77); charitable trusts (28); private contractors (20); private practice (17); PHOs (11); Māori health providers (9); and industry (7).</td>
</tr>
</tbody>
</table>

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22. “Researchers” in this context excludes support, research assistants, advisors, and non-academic clinicians (includes 1124 unique named individuals).

23. The number of international collaborations is under-estimated in this dataset, because data is not available for some of the older contracts.
We have invested considerable effort in recent years to encourage clinicians to become engaged in research, including initiating new Career Development Awards.

The success of these initiatives is evidenced by our growing clinical research workforce. Analyses of this group, see breakdown on previous page, shows that many are highly trained. Their involvement, and strong track record to guide the research, is a good indicator for successful transfer of the knowledge gained to clinical practice.

Building capacity – supporting tomorrow’s leaders

Emerging researchers are not only tomorrows leaders, they also bring innovative and creative ideas to health research.

Through our role in attracting and retaining critical research capability, and creating attractive career paths, we have supported many researchers who are going on to forge promising careers. Brief profiles of just a few of these researchers are presented in this section.

Across the board, our emerging researchers achieve outstanding results, as indicated by some of the following examples from the 2013/14 year.

- A total of 101 peer-reviewed publications, highlighting the quality of their research.
- One researcher was presented with an Auckland DHB Healthcare Excellence Award for work in paediatric emergency medicine.
- Another achieved a Fulbright New Zealand Visiting Scholar Award.
- A provisional patent for MicroRNAs as diagnostic and prognostic biomarkers for atherosclerotic conditions was awarded to a Sir Charles Hercus Fellowship holder.

The following ‘Spotlight’ highlights some of the career achievements of our former Sir Charles Hercus Fellowship holders.

Supporting our high-performing teams

Established, high-performing, health research teams are the key to a strong health research workforce. They are repositories of research wisdom, have
Spotlight on: HRC’s Hercus Fellows

Sir Charles Hercus (left) provides the inspiration for our most prestigious fellowship. This advanced postdoctoral award has assisted many outstanding researchers to develop their research careers.

Professor Jeroen Douwes: supporting public health

Having developed an impressive research portfolio both in New Zealand and internationally, Professor Douwes won a Sir Charles Hercus Fellowship in 2004. Since this time he has established an international reputation for his work in public health. He is now Director for the Centre for Public Health Research at Massey University and has been awarded more than $20M in research grants in the last 10 years (as first or named investigator), through 24 contracts. While his work ranges from protection from allergies (e.g. raw milk) to occupational health risks, the key focus is always informing policy and practice.

Associate Professor Ralph Maddison: health technologies

Associate Professor Maddison’s comprehensive cardiac rehabilitation research portfolio and string of research awards won him a Sir Charles Hercus Fellowship in 2012. Through his fellowship, he has established worldwide collaborations and his mobile and web-based rehabilitation system is attracting interest in New Zealand and internationally. He has begun commercialisation work with Uniservices Auckland. He has also achieved an impressive number of peer-reviewed publications and additional funding, including from the World University Network.

Dr Souxie Wiles: outsmarting superbugs

Dr Souxie Wiles initially established her research career in the United Kingdom. In 2009, she won the Sir Charles Hercus Fellowship and migrated to New Zealand to undertake research on infectious disease. She now heads the Bioluminescent Superbugs Lab at the University of Auckland. The team works to better understand and combat infectious diseases, which kill a staggering 14 million people worldwide each year. Dr Wiles also has an impressive record of science communications. She was awarded the New Zealand Association of Scientists (NZAS) Science Communication Award in 2012 and the Prime Minister’s Science Media Communication Prize in 2013.
outstanding publication records, and excellent connections (nationally and internationally).

Many of our most significant impacts emerge from the research undertaken by these teams, as shown in the profiles provided. Their international reputation also serves to raise the profile of New Zealand’s science and technology sector on the world stage.

At the HRC, we aim to support our high-performing teams through longer term grants, such as Programme grants. Many of the individuals and groups we have supported over the years are now key players in multidisciplinary teams, such as the Centres of Research Excellence (CORES).

For example, Gravida - a CORE focusing on how conditions encountered in early life affect the way an individual grows and develops throughout life - includes the following research groups who have received long-term HRC support:

- The Liggins Institute;
- The Christchurch Heart Institute;
- Otago Centre for Neuroendocrinology;
- Otago Centre for Free Radical Research, and
- Auckland University Faculty for Medical and Health Sciences.

Our most experienced researchers are also playing a key role in developing several of the National Science Challenges. All of the lead researchers for the health-related challenges have received significant HRC funding, as have many of the other team members.

The Christchurch Heart Institute’s is an excellent example of a high-performing team. The internationally renowned team of researchers has helped save thousands of lives through improving

Rising stars: Elizabeth Forbes-Blom
Malaghan Research Centre
Reaping health and commercial gains for New Zealand

Dr Forbes-Blom’s research career has taken her from science undergraduate to Senior Research Fellow at the prestigious Malaghan Institute of Medical Research, where she investigates strategies for preventing and treating food allergies.

It was whilst at the Australian National University on a summer scholarship that Dr Forbes-Blom discovered her passion for medical research. She then studied for her PhD and was later awarded a Fulbright Scholarship to study at the Cincinnati Children’s Hospital Medical Centre in the United States.

The HRC has supported her through the critical early stage of her research career with an Emerging Research First Grant.

At the Malaghan Institute, she is part of the team that was awarded a nearly $5M HRC grant in 2014 to investigate the immunological mechanisms of allergies. She has also been awarded $400,000 from MBIE as part of a joint New Zealand and Japan research programme investigating the use of prebiotic and probiotic (synbiotic) foods to strengthen the immune system.
Spotlight on:  
Rebuilding brains

Scientists at The Centre for Brain Research, led by Professor Richard Faull, make a major contribution to the international fight against devastating neurological disorders

In a research career spanning 35 years, Professor Richard Faull has built an international reputation as a leading expert on neurodegenerative diseases of the human brain. His passion for his subject has enabled him to champion brain research, attracting other researchers to build a world-class research team in New Zealand, gaining extensive funding – including 25 years of HRC funding support, and garnering support from the general public.

The Centre’s neuroscientists have developed into an outstanding neurological research resource, both for New Zealand and the world. They have made ground-breaking discoveries, such as when they reported the first discovery of stem cells in the brain in 2003, and the first evidence that the diseased human brain can repair itself by generating new brain cells - overturning the long-held view that the adult brain can only degenerate.

The 2009 launch of the Centre for Brain Research has enhanced the connections between researchers, clinicians and the community. The Centre brings together over 53 different research teams and over 200 researchers all working towards the common goal of finding and developing new treatments for neurological disease. These connections are enabling our researchers to move ever closer to new treatments for devastating neurodegenerative conditions, such as Huntington’s disease.

It’s the connectivity of the brain that makes it such an incredible organ. Put that all together and you get a unique human being who has intuition, memory, imagination, foresight and philosophical abilities, which to me, is marvellous.

Professor Richard Faull

BRAIN BREAKING FACTS

One in five people will suffer from brain disease

Neurological diseases are among the top five most common causes of death and long-term disability

The cost to families and society, both financially and socially, is enormous
the prediction, diagnosis and treatment of heart disease.

The team has achieved ground-breaking impacts, such as the discovery of cardiac hormones that have enabled the development of a blood test for heart failure (NTproBNP). This test is now used worldwide for diagnosis and monitoring of heart failure. It saves hundreds of thousands of lives each year together with millions of health care dollars. The test is now part of international heart failure treatment guidelines.
Chapter 7: DREAMS WE CAN DELIVER –
discoveries on the horizon
WE CAN LIVE IN A NATION WHERE WE STOP THE EPIDEMIC OF RHEUMATIC FEVER THAT IS CRIPPLING GENERATIONS OF OUR MOST VULNERABLE CHILDREN, PREVENT ASTHMA FROM EVER DEVELOPING AND CONTROL AGGRESSIVE CANCERS - LIKE MALIGNANT MELANOMA. HRC FUNDING OVER DECADES HAS BUILT THE CAPACITY TO MAKE SUCH DREAMS A REALITY

The power of vaccines

Fifty years ago we envisioned a world without cancer, now we know that cancer is a natural consequence of cell division and ageing, and that abolishing all cancer is not a realistic goal. Instead, we must focus on eliminating the most aggressive and painful forms of the disease - and those that often hit people in their prime. We must find better ways to control cancer growth, so that people can live longer, productive lives despite a cancer diagnosis.

Previously, vaccines were used solely in the realm of infectious disease. Now we realise that they have therapeutic potential in any condition in which the immune system plays a role, and can prime the system to attack abnormal cells as well as infectious aggressors. The potential for cancer treatments is so great that the prestigious journal Science named cancer immunotherapy as the breakthrough of the year in 2013.

HRC-funded researchers at the Malaghan Institute have been working towards developing a cancer vaccine for twenty years. Many obstacles in delivering the vaccine and stimulating a response have been overcome and now the vaccine is in clinical trials in patients with malignant melanoma. This is an aggressive cancer that affects people of all ages, making a fitting candidate to target for the first trials (see From Patent to Patient: the road to an innovative cancer vaccine, Chapter 5).

The vaccine mobilises the body's immune defences against the cancer cells, strengthening and targeting the immune response. Used in conjunction with
Spotlight on: The Malaghan Institute of Medical Research

The HRC has supported the work of the Institute with 48 contracts totalling over $50M over the last 20 years. The world-class teams funded have delivered innovations that could potentially revolutionise the treatment of cancer and asthma and allergy, and are contributing to the understanding of many other conditions.

The work of the Malaghan Institute is an excellent illustration of how sustained support for outstanding teams generating fundamental new knowledge about how the body functions powers innovations and creates possibilities that were not even on the horizon when the work was begun. Their work has had a major impact in a number of areas.

Cancer immunology is the major focus of the Malaghan’s work on curbing cancer. However, breakthroughs are also imminent in the treatment of asthma and atopy. Studies of the way the hookworm parasite suppresses the immune system of its host have not only made the first vaccine for hookworm possible, but also provided clues as to how allergic reactions could potentially be controlled in a revolutionary approach to treatment that offers real promise. The Malaghan is an integral part of an international effort to develop the first hookworm vaccine. The Institute’s major research programme on the origins of allergic disease has one overarching goal – to prevent asthma and eczema from developing in the first place. Last year they announced a vaccine that successfully prevented asthma in mice & they plan to have an asthma vaccine for humans within 5 years.

KEY FACTS

Research at the Malaghan offers hope of some radically different treatment approaches to some of the most refractory diseases: cancer and allergy and asthma.

As is the case with most major medical breakthroughs, it has taken 20 years of research funding, from multiple sources, to make the dream of a revolutionary new treatment for cancer a reality.

The Malaghan earns HRC support not just for research but for its critical role in developing emerging research leaders and research training. The staff includes two recipients of the HRC’s prestigious Hercus Fellowship.

HRC has supported 31 Projects and 4 Programmes at the Malaghan over the last 20 years.

“HRC funding and application process challenged the investigator to focus on making a big discovery, leading to the aims of my research programmes going well beyond the minor incremental research outputs.”

Professor Graham Le Gros, Director, Malaghan Institute
chemotherapy that also selectively targets cancer cells, it represents a radical and promising new ‘two-pronged’ approach to treatment that will mean less systemic toxicity for patients – a major drawback of conventional treatment. Whilst the vaccine is still in the early stages of clinical testing for safety and efficacy, a number of improvements have been made to increase the range of tumour proteins that the immune system is primed to recognise and further components have been added to provoke a stronger response to the vaccine.

The synthetic vaccine technology has generated five patents to date, and a new company is likely to be established by the end of 2015 to commercialise a product.

The Malaghan Institute has also made major advances in the development of an asthma vaccine to prevent the disease from developing (see Spotlight on The Malaghan Institute).

The HRC has been supporting work that will reduce the incidence and impact of rheumatic fever for decades. Initially through 20 years of funding for the research that launched BLIS Technologies and the production of a throat lozenge to prevent strep throat from developing into the disease, and more recently for the research aimed at developing a vaccine against Streptococcus aureus.

**Visionary Science – HRC’s Explorer Grants**

One criticism that has been levelled at HRC is that we are risk-averse. In some ways, this is true, our processes are designed to get the New Zealand public the best return on their investment, meaning our assessing committees need to be convinced that the research will make a positive impact. We do this by ensuring that we back appropriately qualified and experienced teams that demonstrate a compelling reason for doing the research and a robust methodology. Obviously, this biases positive outcomes towards established teams and ‘safe’ ideas and means we could potentially miss out on more avant garde work. For this reason we introduced Explorer Grants in 2012. For these we ask for ideas that will excite and assess applications blind, so that those making the funding recommendations have no knowledge of who is putting forward the proposal.

The six proposals supported to date have involve some truly visionary science, tackling antibiotic resistance, a revolutionary treatment for Parkinson’s disease and a radical new approach to controlling tumour growth. It is too soon to tell how successful these grants will be, but the projects funded give a glimpse of health innovations to come.

**Can we fight back against antibiotic resistance in radical ways?**

Antibiotic resistance is one of the greatest issues that we will have to tackle this century. To date, we have few effective options to address this rapidly growing problem. In the time that it will take us to develop new agents that will outpace the ability of bacteria to develop resistance, we could find that people are once again dying from what we now
consider treatable infections. It is fitting that three of our six current Explorer Grants focus on radical new approaches to combat antibiotic resistance.

The first approach bypasses classic targets on bacterial cells and goes to the powerhouse of the cell itself. Termed ‘metabiotics’, they work by interfering with the metabolic processes of the cells, rather than the historic sites of action (the cell wall, DNA, RNA and protein synthesis). The team see the outcome of this work as the development of ground-breaking metabiotics that combat all pre-existing resistance mechanisms of multiple-drug-resistant bacteria.

The second project addresses the gaps in our knowledge around how bacterial pathogens interact with their host. Using a bacteria that naturally infects laboratory mice as a model, the investigators will study pathogen-host interactions and how the bacterial DNA changes in response to the mouse it infects. This will allow us to better 'know our enemy' and develop models to predict how bacteria will react and adapt, so that we can develop strategies to outpace them.

The third project is again exploring new therapeutic territory, zeroing in on how bacteria communicate with and manipulate the cells of their host. The goal is to then develop therapeutic agents that will disrupt these communication pathways to prevent the bacteria from taking over control of the cell and its defences.

**Can we mimic the way brain cells signal to deliver drugs in neurological disease?**

A life-long treatment for Parkinson’s disease that does not cause severe and debilitating side-effects is the vision of another team awarded a HRC Explorer Grant. They are working on an animal model of the condition and using novel system that they have developed that will mimic normal neuro-chemical signalling in the brain. They hope to reinstate the missing dopamine signal in Parkinson’s disease by activating the release of dopamine-like drugs from biological carriers ('liposomes') in targeted brain areas at natural timing. This would hopefully prevent the side effects of current dopamine-replacement therapies. These include abnormal and uncontrollable movements and aberrant behaviour, such as pathological gambling. If this proves successful, this drug delivery system may unlock a means of treating a range of neurological disorders that currently are devastating to sufferers.

**Could we grade tumours non-invasively in the body?**

The process of cells dividing and becoming more specialised is called differentiation. Normally, cells divide to become more differentiated but in cancer, the opposite occurs. The cells become less differentiated as the disease progresses, i.e. less and less like the cells of the tissues that they originated from. This declining degree of differentiation is used to grade tumours. As cancer cells become progressively less differentiated, the cancer becomes more aggressive. Another Explorer Grant has gone to a team that have developed a way of using circular polarised light to measure the size of the nucleus in relation to the cytoplasm of a cancer cell. The greater the size of the nucleus, the less differentiated and more aggressive the cancer has become. The enlarged nucleus affects the pattern of scattered light through the cell and it is this pattern that the research team can analyse.

This work will provide important new knowledge about the relationship
between nucleus size and differentiation, which is currently an underexplored area of research and holds great potential for better prognostic tools in the future. It would be potentially possible to grade tumours non-invasively within the patient's body. The techniques also show great promise for tools in research involving stem cells.

**Could we possibly cure hereditary diseases caused by single gene defects?**

There is no cure for the majority of hereditary genetic disorders arising from **single gene defects**. Two of the cruellest such diseases are **cystic fibrosis** and **hereditary diffuse gastric cancer**, which are associated with high morbidity and lead to premature death. Employing novel drug-delivery technology to replace the defective proteins associated with each disease is the subject of an Explorer Grant directed at providing a potential cure. The technology could transform medical practice in the prevention or treatment of genetic disorders that are currently incurable. The provision of a cure for an incurable disease is transformative, with the potential for a major impact on the lives of those affected.

**The Physiome Project – Can we build a virtual human?**

Decades of HRC-funded research by Professor Peter Hunter and his team at Auckland Bioengineering Institute underpins the first virtual organ to be completed for The Physiome Project - the heart. The Physiome Project ('Physio', meaning life; and 'ome', as a whole) takes what is known about our genome and the chemistry, physics and anatomy of the human body to create computerised models of how we function at the level of cells tissues and organs. Initiated by the International Union of Physiological Sciences, the project involves co-ordinating efforts from scientists across the globe working towards creating, in essence, a digital human. Standardising programming language so that data and models can be easily shared, their contributions could change the way that modern medicine is practiced.

By the time the Human Genome Project was complete in 2003, the Physiome Project was already underway. Professor Denis Noble of the University of Oxford’s Physiology Department, a key figure in The Physiome Project and a collaborator with Professor Hunter’s team, has said that relying on the genome alone to understand the human body “is like looking at a telephone directory and thinking you have the secrets of the city”. While the data on the genome is very important, it must be integrated with the vast amount of the
knowledge that we have about the human body before we can appreciate the full picture. The key to doing this lies in creating mathematical models of how these data are related. These models must be consistent with the laws of nature, and take into account how each of the systems of the body interact with, and impact on, each other.

The team at the Bioengineering Institute has now developed a model of the heart that links the organ and tissue structure to how the heart functions at a cellular level, allowing them to predict how the heart will react to a given event, such as the administration of a drug. The implications are phenomenal. The virtual heart can be programmed to do everything that a real heart will do naturally, in health, disease, or in response to stressors such as a toxin or surgery. This has great benefits not just for predicting how a patient will respond to a certain treatment, but also for surgical planning and diagnostic tests. In the future, it will be possible to predict the effects of stress on a patient’s heart without the risks attendant to stress tests.

Developing a new drug costs approximately $8 billion US dollars; partly because of the ‘scattergun’ approach of developing multiple candidate molecules in the hope of finding one that will be safe and effective. Many experimental drugs are abandoned because of toxic effects on the heart. Some of these toxic effects are not discovered until after the drug has been marketed, exposing patients to increased risk and drug companies to the exponential costs of class-action suits. All of these costs are ultimately translated to consumers - principally our overstretched health services. If drugs can first be tested in computer models, the risk to patients and the cost of development can be greatly reduced.

Horizon scanning

Drivers of change

Some of the greatest discoveries that have had the most impact on public health have arisen out of chance, such as the discovery of penicillin, or the development of the first drugs to lower blood pressure. While we can’t predict what will be possible twenty years from now, we can pick some areas in which we believe there will be major developments over the coming decades. We have laid these out in following schematic ‘Our vision of key changes in our healthcare system by 2050’, used as part of our horizon scanning activities. The schematic is based on a framework by Auffrey et al. 24, which outlines that healthcare in 2050 will be characterised by the four ‘P’s: prediction, prevention, personalisation and participation. We have added a fifth ‘P’ to represent the strong emphasis that we place on partnership in health research, services and delivery.

Under the five ‘P’s’ we have tried to predict the advances that will have

Our vision of changes in New Zealand healthcare by 2050

<table>
<thead>
<tr>
<th>Prediction</th>
<th>Prevention</th>
<th>Personalisation</th>
<th>Participation</th>
<th>Partnership</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cheap technology means all citizens have personal devices that non-invasively monitor vital signs. Researchers access vast datasets for population health modelling</td>
<td>Individuals have their genome assessed, know their health risks &amp; follow their own predetermined intervention plans from an early age</td>
<td>Computer models of body systems customised with patient's data predict individual responses to drugs or invasive treatments. Adverse events greatly reduced</td>
<td>Patients involved in their care to an unprecedented degree. Connected through technology to algorithms, guidelines, health professionals &amp; other stakeholders</td>
<td>Health is a cross-sectoral responsibility</td>
</tr>
<tr>
<td>Understanding of the body in health &amp; disease leads to greatly improved prognostic tools</td>
<td>Non-invasive personal monitoring technology is widespread, &amp; reports anomalies to family doctor</td>
<td>Many treatments tailored by genetic &amp; medical data patients carry on wearable device</td>
<td>They monitor their own progress, guide their own care &amp; critically assess services</td>
<td>We have healthier urban environments &amp; healthier housing</td>
</tr>
<tr>
<td>HRC impacts now: PREDICT software contributes CVD risk factor data to large international database with every doctors visit</td>
<td>We understand the links between nature and nurture and antecedents of chronic diseases</td>
<td>Gene therapy stops some diseases from ever developing</td>
<td>Many more patients managed at home, linking to their doctor through telemedicine &amp; non-invasive monitoring data</td>
<td>A holistic approach to health embraces all facets of an individual’s life - home, work, social, environment, emotional &amp; physical</td>
</tr>
<tr>
<td>Tests to predict onset &amp; severity of Alzheimer's disease</td>
<td>Mobile phone technology used in smoking cessation &amp; suicide prevention interventions</td>
<td>Immunotherapy routinely used to harness/control patients' immune responses as part of treatment for many acute &amp; chronic diseases</td>
<td>Advances in rehabilitation techniques mean people stay in their own homes for longer</td>
<td>Mental &amp; physical health are no longer seen as separate &amp; services are closely connected</td>
</tr>
<tr>
<td>Predictions:</td>
<td>Investment in 3 longitudinal studies provides major insights on interaction between genes &amp; environment</td>
<td>HRC impacts now: Funding of virtual heart for Physiome Project &amp; computerised heart models already in use</td>
<td>Fewer hospitals needed &amp; treatments such as nanotherapy to repair damaged organs &amp; tissues have replaced some surgery &amp; shortened hospital stays</td>
<td>HRC impacts now: Partnership Programme links social development, education, environment, justice &amp; health sectors &amp; joins them with NGOs</td>
</tr>
<tr>
<td>Major research programme on prenatal origins of adult disease</td>
<td>Immunotherapy research in cancer, asthma &amp; atopy</td>
<td>HRC impacts now: Partnership with the National Health Committee evaluating new technologies in healthcare</td>
<td>Healthy housing &amp; built environment research programmes</td>
<td></td>
</tr>
</tbody>
</table>
revolutionised healthcare, and have identified three main drivers of change that are likely to have had a major impact by 2050.

1. The proliferation of cheap technology, putting personal, wearable devices within reach of even those with meagre resources
   - the means that this technology provides to collect personal data non-invasively through 'health apps';
   - the opportunity that such personal devices hold for mass administered, yet personalised interventions;
   - the opportunity to generate large datasets from personal devices, available to public health researchers and healthcare professionals, and
   - the opportunities this provides for personalised medicine in terms of 'health plans', health monitoring and interventions.

2. The major advances that will build on mapping of the human genome and the Physiome Project.

3. The impact of knowledge on the relationships between genes and our environment and the prenatal origins of adult disease that we have invested heavily in creating.

We have listed brief examples of how the HRC's current work will underpin the changes we foresee.
Chapter 8: HRC’S VALUE PROPOSITION – balancing issues and managing risks
For the past 25 years we have been privileged to serve New Zealanders and to play our part in making our country a healthy place to grow up, to live and to grow old in.

### The difference we make

Since our establishment in 1990 the quality of life for all New Zealanders, and the number of years we can expect to live free from disease and disability has improved significantly. The Government’s commitment to funding health research in New Zealand has ensured that our health, and our health system is underpinned by the best and latest research evidence. This means that we can continue to capture and realise the benefits of health and medical advances and we will do our best to make sure we continue keep pace with the rest of the world.

Our role in making this happen, both past and future, is to:

- support the best quality research that will deliver the greatest health and wellbeing gains for New Zealand;
- to solve the problems of our health system and ensure that our healthcare services are safe, effective and efficient;
- to boost our nation’s income through our support for new and innovative medical devices and technologies;
- to ensure we have the skills, capacity and capability to meet our health and service delivery needs, and
- to grow New Zealand’s international reputation as a key contributor to the global health research enterprise.

### Where we make the difference

#### Meeting New Zealand’s health needs

Our current portfolio of research is making a critical impact where New Zealand’s burden of disease is greatest – this includes targeted investment focused on improving our top five risk factors – diet, obesity, smoking, high-blood pressure and physical inactivity. We have a dedicated investment stream focused on keeping people well and preventing disease and injury. **We are also focused on supporting research that we need to do in New Zealand – 47 per cent of our investment focuses on improving health and health equity outcomes for our population.** Further to this, we have directly commissioned research aimed at increasing immunisation rates for our children, and reducing the incidence and impact of rheumatic fever (see ‘How our activities map to the governments targets and goals for health research’ overleaf).

Our research is making a significant difference to the quality, effectiveness and efficiency of healthcare in New Zealand – everything from better risk assessment, accelerated treatment pathways and reducing hospital stays, through to providing the evidence base to develop clinically integrated, people-centred services that enable us to have greater control over the management of our own health – such as developing personal health monitoring support tools and ‘at home’ rehabilitation programmes (see table overleaf).
### How our activities map to the governments targets and goals for health research

**Tackling greatest burden of disease**
- Invested $47.5M over 8 years to prevent obesity, diabetes, and cardiovascular disease
- Invested $29.4M over year years to improve physical exercise, nutrition and built environments

**Improving New Zealand’s health system**
- Dedicated investment opportunity through New Zealand Health Delivery RIS
- Partnership with National Health Committee to test new and existing technologies

**Improving New Zealand’s health system**
- 47% of contracts

**Increasing infant immunisation**
- Two partnerships with MoH on whooping cough vaccine for pregnant women

**Reducing incidence of Rheumatic Fever**
- $3.19M partnership with MoH, Heart Foundation, Cure Kids, Te Puni Kōkiri
- $1.5M trans-Tasman partnership to develop rheumatic fever vaccine

**Shorter stays in emergency departments**
- Study on better triage/risk assessment for chest pain
- Study on integrated care models for high intensity users

**Better help for smokers to quit**
- $5M partnership with MoH with aim of halving smoking by 2030

**Clinically integrated, people centred services**
- Study on home-therapy for stroke recovery
- Mobile phones for diabetes management

**Supporting economic outcomes**
- HRC contributes to a healthy and productive population (100% of contracts)
- HRC contributes to an efficient and cost effective health system (33% of contracts)
- HRC generates value from IP and innovation
  - 21% of contracts focused on discovery/development
  - Since 2007, 51 patents awarded, 25 unique produces
  - 9 active start-up companies

**Attracting international investment to NZ**
- NZ’s clinical trial estimated to attract $30-40M annually in pharmaceutical sponsored trials

**Value to of a highly trained and skilled research workforce**
- Ability to create local solutions
- Able to build critical mass in key areas
- Attract the best to work with NZ teams

**Supporting National Science Challenges**
- HRC has had significant input into the development of health challenges
- 65% of current investment is relevant to the health challenges
- HRC researchers working in challenge areas are required to connect with the challenge effort and report back

**Supporting science and Innovation skills**
- 2679 individuals supported on HRC contracts (765 FTEs)
- 121 post-doctoral positions supported by HRC contracts (90 FTEs)
Growing New Zealand’s economy

Our investment is making a valuable contribution to New Zealand’s innovation system, creating economic gain, and supporting economic growth – we have successfully seeded the development of six successful spin-off companies, enabled the creation of commercial products which span therapeutics, software, imaging and diagnostic tools - and we fund clinical validation of devices and therapeutics in patients. We are also a vital piece in the innovation puzzle with our research underpinning close to 50 per cent of the medical technology contracts currently supported by MBIE – and Callaghan Innovation is now reaping the benefit of nearly 20 years of HRC support for the development of vaccines and diagnostic tools for cancer.

Building and sustaining the capability and skills New Zealand needs

We are creating value through investing in people. Our career development opportunities ensure we have the research capacity to meet the needs of our unique population and enable promising emerging researchers to gain valuable research experience. Despite how highly competitive health research funding has become, our targeted career development awards have been successful in retaining our emerging talent, with 56 per cent of our Emerging researchers and 71 per cent of our Hercus fellows still engaged in research. HRC has also played a fundamental role in developing and supporting the research leaders of today – those key individuals are leading Centres of Research Excellence (COREs) and the three health-focused National Science Challenges. Our funding processes and requirements have also made considerable in-roads to enabling ‘team health’ – where nearly every science discipline is drawn to work together across the wider health domain – everyone from geneticists to bioengineers, and environmental health offices to planning and funding managers.

Responsive to signals from Government

HRC has a strong history of delivering results, but also of being agile and responsive to the Government’s signals and priorities. When the Minister of Health asked us each year in his Letter of Expectations to grow research opportunities for frontline clinicians, we did. Now 43 per cent of our workforce are clinically trained, and 56 per cent of these are practising – up from 17 per cent in 2006. The Government and HRC recognise the importance of boosting New Zealand’s capacity for clinical research. Clinical research adds value on a number of levels, including direct benefits for patients and healthcare providers. The wider spill-over benefits for New Zealand include the training and retention of highly skilled health professionals, improvements to the quality of health care, and increased ability to attract investment from overseas pharmaceutical companies.

Ensuring value for money

It is vital that New Zealand derives the best value possible from our investment in health research. HRC works hard to further maximise the benefits and value of our research by requiring our researchers to develop effective ways to maximise the impact of their findings. We also strongly encourage multidisciplinary approaches, collaboration and end-user engagement, which, in turn, promotes research translation and uptake – 43 per cent of our contracts meet the criteria for translational research, up from 18 per
In 2008, while 69 per cent involve end-users.

Considerable benefit – both financial and in-kind - is generated by our international relationships and collaborations. We have 189 international collaborations, with 203 international researchers engaged on our contracts, spanning 28 different countries. This strengthens the capacity of our science system and provides our scientists with invaluable access to infrastructure, technology, expertise and resources. It also attracts international investment to New Zealand and provides our research teams’ access to international research funds and funding opportunities.

To deliver maximum value, we also need to be highly effective, efficient and accountable in what we do as an organisation. HRC is extremely cost-efficient, and this is a key organisational priority. We have had no increase in the funds we receive to run our organisation for more than 10 years. However, there has been no decrease in performance and no cut in the valuable activities and services we provide. We have achieved this, in part, by driving down our organisational costs and staff full time equivalents, but it is also testament to the depth of experience, institutional knowledge and valuable relationships that HRC has forged over many years. It is hard to imagine that any other organisation would be in a position to deliver the breadth and quality of service HRC achieves for as little as $3.2M per annum.

Delivering the highest quality evidence

Poor quality research delivers poor quality outcomes that achieve little or no impact. The stronger the research, the stronger the evidence base – and it is the strength and quality of the evidence which determines the degree of change and improvement we can make. Our processes and funding opportunities are designed to support the best people with the best ideas in areas where research can make an important difference to the health and wellbeing of New Zealanders.

The results of our most recent HRC Bibliometric Study (2014) clearly demonstrate that our processes are working and that we are backing the best. Not only are HRC-funded publications cited well above the world average in nearly every health research field, the proportion in the top 20 per cent for impact worldwide was higher for HRC than for any other New Zealand funding sector looked at. See ‘Measuring up’ for more in-depth coverage of these exciting results.

The risks we face

Currently the HRC is contending with a number of risks that could compromise our ability to perform our role, meet our diverse responsibilities, and achieve our mission and vision. If they are not addressed, we expect the impact to become evident in the near future.

Level of investment

The level of funding we receive has a major impact on performance.

Adjusted for population size, funding
HRC Bibliometric Study 2014

Measuring up

To better understand the impact of the health research we fund, we studied all health research articles with New Zealand funders between 2005 and 2009, analysing how often they were quoted in the literature and how they ranked internationally. The results show that HRC systems work well – we are backing the best.

Bibliometrics is the study of the impact of publications. There are many other, important, research impacts but they are hard to objectively measure. Data on publications for New Zealand and the world can be purchased, allowing us to benchmark our performance both nationally and internationally. This provides information that we cannot gain by any other means.

This table provides a brief summary of what we did, following an identical methodology used by the Australian National Medical Research Council to undertake their triennial bibliometric review. We adjusted the number of times our articles were quoted in the international literature by the world average in each field to get a ratio called the Relative Citation Impact (RCI). To get an idea of the relative quality of the journals those articles were published in, we also adjusted our citation rate by average citation rate of the journals those articles were published in. This gave us the Relative Journal Impact (RJI). Our graphs show the RCI and the RJI in relation to the world average (the blue line) which, because this is a ratio, is at one for both measures. This allows us to compare both together on the same graph for reassurance that one sector is not being quoted highly in low impact journals.

<table>
<thead>
<tr>
<th>Data purchased from Thomson Reuters ISI, NZ health research publications 2005-2009, Journal Citation Index 2010</th>
</tr>
</thead>
<tbody>
<tr>
<td>HRC-funded research articles: 1,560</td>
</tr>
<tr>
<td>Articles with no HRC funding: 10,183</td>
</tr>
<tr>
<td>Four sectors defined by author addresses &amp; HRC contract data: HRC, University, Hospital and Other</td>
</tr>
<tr>
<td>Duplication of articles across all sectors but HRC: Articles attributed to multiple sectors according to authorship, except when funded by HRC</td>
</tr>
<tr>
<td>ANZ Fields of Research Groups used: 13 of 22 categories with enough articles to analyse</td>
</tr>
</tbody>
</table>
Clear international strengths

**HRC articles were cited at or above the world average in every field that we could analyse.** Compared to the other funding sectors, the HRC had the highest RCI in Cardiovascular Medicine & Haematology; Clinical Sciences; General Biological Sciences, Genetics, Immunology; Neurosciences; Nutrition & Dietetics; Paediatrics & Reproductive Medicine; Pharmacology & Pharmaceutical Sciences and Public Health and Health Services Research. The only areas in which the HRC did not have a higher RCI was in Biochemistry and Cell Biology and Oncology and Carcinogenesis.

**HRC was the only sector to achieve 20 per cent of articles ranked in the top 20 per cent for impact worldwide**

Looking at the percentile ranking of articles removes the potential problem of highly cited articles influencing the results. **The percentile data reinforces the results from RCI and shows that HRC performance is particularly strong in the areas of Paediatrics and Reproductive Medicine; Immunology; Genetics and Clinical Sciences.**

**CONCLUSION**

Despite receiving only a fraction of the health research funding invested in New Zealand, the HRC is making the strongest contribution to the international literature of any of the funding sectors studied. The full technical report will be published on the HRC website in September 2015: www.hrc.govt.nz/publications/hittingthemark2015.html.
for health research in New Zealand is less than one-third ($12 per capita) of that in Australia ($41 per capita), less than one-fifth of the United Kingdom ($54 per capita) and only 10 per cent of that in the United States ($115 per capita). While our sister organisation in Australia, the National Health and Medical Research Council (NHMRC), has maintained success rates of around 23 per cent over the past several years, HRC’s success rates have dropped from a high of 24 per cent in 2009/10 to an average of 10.32 per cent over the last 5 years.

HRC’s budget has been static since 2009. Coupled with inflation, the rising cost of undertaking research (approximately 6 per cent per annum with academic salaries increasing 19 per cent between 2008 and 2012), and the increasing demand for health research funding (the number of health professionals and academics has significantly increased in the last 6 years), has considerably diminished the HRC’s purchasing power.

To deliver on the outcome we have proven is possible, our current financial position needs to change. HRC sees additional investment as crucial to avoid the very real threats to our ability to continue to:

- **Sustain health research productivity and performance** – a significant risk to New Zealand’s global research reputation with health research being one of only two internationally recognised areas of research strength internationally.
- **Maintain the gains that have been made**
  - there is at least $50M worth of the highest quality health research each year that cannot be supported which constitutes a huge opportunity cost.
- **Our ability to deliver what the health sector requires is becoming unsustainable.** For the first time in over 40 years of continuous support, the HRC could not support the Dunedin Multidisciplinary Longitudinal Study.
- **Retain the research capacity and capability NZ needs** - increased competition means fewer opportunities to support emerging researchers and losses from the health research workforce.
- **Ensure NZ is seen internationally as a healthy place to live and attract the best people to teach our health professionals**
- **Have international partnerships where leading researchers want to work with our researchers**
- **Support the full value chain from discovery to exploitation** - our static (in real terms, declining) budget, is starting to restrict the pipeline that ultimately feeds the most significant advances in health care and medical technologies.
  - This is best demonstrated by a steady decline in the number of HRC-funded patents filed (from 44 in 2007 to 4 in 2014).

HRC has used a variety of approaches to maintain productivity despite static investment. We have sought to drive efficiencies within research organisations and have partnered with others to gain co-investment. We also introduced budget caps to further derive maximum value from our research investment. While not popular with our research community, it was a proactive step taken to try to stretch our funds further, while maintaining the number of research projects and teams we could support, in the face of increasing demand. However, steps taken by HRC to ameliorate the situation have had minimum impact and are a very short-term fix.
New Zealand urgently needs to recognise, as other developed countries have for some time, that health research funding is an integral part of the total investment in health. Internationally, health research funding is often indexed as a percentage of the government’s health expenditure, which is usually calculated at a rate of 3-4 per cent. Three per cent of Vote Health expenditure in New Zealand is just over $400M. HRC currently receives approximately $82M to support all our activities. Just 1 per cent of $400M would raise HRC’s annual budget to $133M – still well short of Callaghan Innovation’s $249M annual budget ($149M of which is to fund grants), which arguably delvers on a much narrower set of priorities and outcomes for New Zealand.

At the time of writing the HRC is undergoing a ‘strategic refresh’ where many people have been quoted as saying funding for HRC needs to be at least doubled.

HRC has long been known as a very lean machine - delivering more for less over many years. However, we are at a tipping point of being able to keep delivering for New Zealand. A constant quality-improvement approach should underpin our investment processes but this takes resources. We have more and better data than many other funders - evaluating our investment strategy and funding instruments - but we can do more. We can make a greater contribution to both the health and science and innovation sectors. **Stronger linkages, clearer direction, better alignment and more effective pathways to uptake are what is needed - and the HRC (as the only health-and-science-facing organisation) is best placed to do this.** Any increase would necessarily be based upon a sound business plan, with agreed deliverables, and a clear return on investment.

**Current structure and level of engagement**

HRC’s current position, sitting between both the health and science and innovation sectors poses a number of risks that need to be actively managed. **HRC faces the very real risk of falling between the cracks.** Two restructures in the science funding system have resulted in a significant loss of sector and institutional knowledge regarding the role and work of the HRC. This, in turn, has led to recent decisions which have resulted in the health spend becoming increasingly devolved. The ‘strategic refresh’ should arguably ensure that HRC, the Government’s principle and specialist health research purchase agent is consulted and engaged in sector discussions and decision making processes to reduce lost opportunities and avoid duplication.

The health research landscape is complex and we need to work together across each part of the investment system to create strong linkages, ensure investment is well aligned and mutually reinforcing, and most importantly, derive maximum value from the public’s investment.

The devolution of the Ministry of Research, Science and Technology (MoRST), and the bringing together of the Government’s largest science funding body with science policy functions, means HRC is effectively in a position of being in competition for funds with its own funding body - a fellow funding agency. **There clearly needs to be an avenue or opportunity for HRC to participate in the budget process.**

Our current governance arrangement mean HRC is ‘owned’ by the Minister and
Ministry of Health, but our investment funding comes from the Minister of Science and Innovation. This provides unique opportunities (as well as risks) for the HRC and NZ. Whilst one Ministry is focused on improving health, the other is focused on economic gain. Whilst these are not one and the same thing, keeping people well for longer clearly brings economic advantage for our country. The direct and indirect value add of health research, is significant. We have a key role to embed health research as a fundamental component of the health sector in New Zealand.

Some might think health research is ‘academic’ or ‘removed from reality’ but it is in essence completely about improving knowledge, underpinning prioritisation of services, improving systems, and helping clinicians, patients and every New Zealander make better decisions for health. Health research is everybody’s business.

Health research investment in New Zealand in relation to the global health research effort

New Zealand’s investment in health research is minimal compared with the billions invested in health research worldwide. The risk is that this will be perceived as a reason not to commit valuable research dollars here, on the premise that New Zealand can simply benefit from and adopt medical advances identified elsewhere belies the critical advantages that a country’s health research capability bestows, such as:

- the value tied-up in New Zealand’s global reputation for health research;
- the understanding that involvement in the international health research effort affords New Zealand the opportunity to be early adopters of evidence-based advances;
- the ability to build critical mass in areas of specific need for New Zealand, and
- the research capability needed to successfully adapt international findings in order to create local solutions to common global health problems.

The increasing incidence of pandemics is just one compelling reason for New Zealand to remain research active and maintain our own country-specific expertise.

**Things to work on**

HRC has identified a number of key areas where we believe critical gains can be made that will benefit all stakeholders in health research. There are several things that we know we can do differently and better – but the really significant gains are those that can be made in collaboration - by HRC working more effectively in partnership with each part of the system.

- Achieving greater alignment, improving co-ordination, knowledge sharing, and working together to ensure that our collective investment is mutually reinforcing and delivering the best possible value – the landscape has changed – there are many possible partners for HRC to work with who can help us to achieve even greater health and economic outcomes for New Zealand.

- Better understanding the health research expectations of the Government, the sector and the public, and developing a collective, articulated vision for health research - one with an agreed set of overarching priorities and outcomes,
and a shared understanding of the current and future direction for health research in New Zealand.

- Getting the **balance** right - identifying the investment balance New Zealand needs to deliver the best health and economic outcomes.

- Creating **stronger linkages and better integration** across the health and science and innovation sectors - seamless progress and development requires close relationships between the biomedical, public health, clinical, and health services parts of the health research sector and effective relationships between the research sector, the health sector, and their public and private sector components. New Zealand has a comparative advantage here as the number of players is modest, and there is the background of high-quality healthcare and high-quality research.

- Better **incentivising health and economic outcomes** and better understanding our role in the health and innovation systems, which turns ideas into commercial value and cost-savings.

- Retaining the benefits of **contestable research funding** while working together to mitigate some of the unintended consequences, for example, the transaction costs involved in the process and the conservatism that has begun to creep into the process.

- Improving the **translation, uptake and application** of health research findings - there is opportunity for a much greater interaction and involvement of policy-makers, clinical care decision-makers, entrepreneurs and private enterprise. Knowledge and technology transfer crosses traditional boundaries, remains one of the areas of greatest weakness in the research endeavour.

- Increasing opportunities and incentives for all our stakeholders to partner with us and better **leverage investment** in health research, from DHBs, universities, and international research funding agencies, through to charitable trusts, foundations and philanthropists.

- Work across the sector to better leverage international research and **international research collaboration** for the benefit of New Zealand, including greater opportunities to respond to and participate in international collaborations of significant health and economic value.

- Work with the health and science and innovation sector to **grow New Zealand's investment in research** (and health research in particular) to a level more comparable with other similar sized nations and economies by OECD standards.

- Improving HRC's **visibility and profile**, garnering the support and engagement of the New Zealand public, and better demonstrating the value of health research – it is our job to provide a more stable and secure investment platform for health research and health researchers in New Zealand, both now and into the future.

**Where we want to go**

New Zealand can and should aspire to be the most successful small economy in the world, with New Zealanders enjoying the highest quality of life, supported by the best and most efficient health system there is. HRC has an extremely important part to play in achieving this.

We are ready and able to provide the leadership required, and to be the conduit bringing all the necessary parts of the system together to achieve this. We want to be the lead organisation of choice for New Zealand’s investment in health research, and strongly believe we are best placed to fulfil this role. Better health and economic outcomes can be achieved if
more of the public’s investment in health research is co-ordinated through and invested by the HRC.

HRC is committed as an organisation to being responsive, forward looking and future focused; to working collaboratively with all our stakeholders to meet the health and health care needs of New Zealanders today, and tomorrow; to play a key leadership role in better aligning, co-ordinating and integrating the diverse health research effort to achieve maximum impact and value; to be a thought leader in the health, science and innovation, and research investment space; and to continually reflect on the nature and impact of our work, such that we embody continuous quality improvement.
## APPENDIX 1

### Selected examples of the commercial impact of HRC research investment

<table>
<thead>
<tr>
<th>Technology</th>
<th>Brief Description of Company</th>
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</table>
| **Diagnostics** | **Pacific Edge Biotechnology Ltd**  
www.pacificedge.co.nz  

This Dunedin-based biomedical company was formed in 2001 to develop tests for cancer detection and management, and in FY14 entered the NZX50. Pacific Edge has two products in the marketplace, Cxbladder Detect and CxBladder Triage (bladder cancer diagnostic tests), and several other products in late stage development. Science leads Professors Guilford and Reeve have received HRC funding to research the genetics and epigenetics of cancer since 1995. (See case study, page 61.) |
| **Imaging** | **Cardiac Image Modeller (CIM)**  

The Auckland MRI Research Group (UoA) have won international recognition for their work in developing analysis software known as the Cardiac Image Modeller (CIM). The software combines a mathematical heart model with information obtained from a patients’ tagged MRI scan, and was developed to predict and understand the effect of surgical and pharmacological treatment on cardiac function. Parts of CIM have been licensed to Siemens Medical Systems for worldwide distribution and have been installed in world-leading research institutions including Johns Hopkins University, the National Institutes of Health and UCLA in the USA and to Oxford College in the UK. The software development was led by Professors Alistair Young and Brett Cowan at The University of Auckland, who have received HRC funding since 1993 and 2000, respectively. |
| **Medical Devices** | **Telemetry Research**  
(Merged in 2011 with Millar Instruments, Inc. Houston Texas; now a wholly owned subsidiary)  

This company has combined technologies in areas of miniature sensors, wireless communication and wireless power transfer to develop a suite of products for use in biomedical research, now sold in over 30 countries. They are currently adapting the technology for clinical use in implantable medical devices that would benefit immensely from being recharged or transmitting information without needing wires passing through the skin, including heart pumps for management of cardiac failure, and a ‘Smartshunt’ for management of hydrocephalus. The University of Auckland’s Professor Simon Malpas, founder of the company, has received HRC funding since 1998. (See case study, page 63.) |

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25 For more detailed background on these spin-off companies see: Celebrating 20 Years of Health Research in New Zealand. the HRC’s 20th year publication
Appendix: Examples of the commercial impact of HRC investment

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<th>Technology</th>
<th>Brief Description of Company</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Pharmaceuticals</strong></td>
<td>Proacta Therapeutics Ltd</td>
</tr>
<tr>
<td>Proacta Inc. is a spin-out, clinical-stage pharmaceutical company, formed to commercialise the IP of scientists at the Auckland Cancer Society Research Centre (ACSRC) at The University of Auckland, and Stanford University. Proacta aims to find new ways to treat cancer using hypoxia-activated “prodrugs” that target cancer cells, and have a number of pro-drugs in development. Their latest drug to reach clinical trial, TH-4000, has a new sponsor: US company Threshold Pharmaceuticals, who are planning two trials in patient with non-small-cell lung cancer and the other for people with head and neck cancers. Founding scientists, Professors Bill Denny and Bill Wilson from ACSRC, have received HRC funding since the early 1990s.</td>
<td></td>
</tr>
<tr>
<td><strong>Software</strong></td>
<td>PREDICT software</td>
</tr>
<tr>
<td>(Developed by Enigma Publishing; <a href="http://www.enigma.co.nz">www.enigma.co.nz</a>)</td>
<td></td>
</tr>
<tr>
<td>PREDICT is a web-based decision support software, used mainly to assist primary care practitioner to assess and manage cardiovascular risk. The software was developed by HRC-funded cardiovascular epidemiologists, in collaboration with healthcare providers and electronic health information system developers, and places New Zealand at the forefront of the new field of computer-based clinical decision-making. PREDICT is sold in NZ, Australia and Singapore, and has been integrated into MedTech, the leading New Zealand medical records system used by New Zealand GPs which is increasingly being adopted in Australia. In 2009 was being used by 80 per cent of Auckland and Northland PHOs. PREDICT was created by Professor Rod Jackson and his team from The University of Auckland, who have received substantial HRC funding for underpinning epidemiological research, and ongoing validation and refinement of the PREDICT tool.</td>
<td></td>
</tr>
<tr>
<td><strong>Probiotics</strong></td>
<td>BLIS Technologies Ltd</td>
</tr>
<tr>
<td><a href="http://blis.co.nz">http://blis.co.nz</a></td>
<td>This company was based on findings of HRC-funded Professor John Tagg’s 20 years of research into Bacteriocin Like Inhibitory Substances (BLIS) - producing organisms. The primary focus is the international commercialisation of Streptococcus salivarius K12, known as BLIS K-12 Throat Guard, used for maintenance of throat health and control of bad breath.</td>
</tr>
</tbody>
</table>
ANNEX A: CURRENT INVESTMENT PROFILE

The following section provides an analysis of the HRC’s investment in health research for the 2013/14 financial year. It includes all funding opportunities and contract types with a value of greater than $20,000 that received funding in the financial year.

Balance of Investment

The following table shows the balance of investment between RIS both in terms of the total value of those contracts active in the 2013/14 financial year, and in terms of the spend on contracts active during the same period. Table 3 provides information on investment by grant type.

Table 2: Investment by Research Investment Stream

<table>
<thead>
<tr>
<th>RIS</th>
<th>Contracts (per cent)</th>
<th>Investment (per cent)</th>
<th>Investment ($)</th>
<th>Spend 2013/14 Year (per cent)</th>
<th>Spend 2013/14 Year ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>IOACC</td>
<td>43 per cent</td>
<td>45 per cent</td>
<td>$152,240,856</td>
<td>46 per cent</td>
<td>$37,320,887</td>
</tr>
<tr>
<td>HW</td>
<td>29 per cent</td>
<td>32 per cent</td>
<td>$107,407,196</td>
<td>30 per cent</td>
<td>$24,387,740</td>
</tr>
<tr>
<td>NZHD</td>
<td>13 per cent</td>
<td>12 per cent</td>
<td>$42,070,186</td>
<td>14 per cent</td>
<td>$11,548,274</td>
</tr>
<tr>
<td>RHM</td>
<td>15 per cent</td>
<td>11 per cent</td>
<td>$36,265,008</td>
<td>10 per cent</td>
<td>$8,472,129</td>
</tr>
</tbody>
</table>

Table 3: Investment by Grant Type

<table>
<thead>
<tr>
<th>Grant Type</th>
<th>Contracts (per cent)</th>
<th>Investment (per cent)</th>
<th>Investment ($)</th>
<th>Spend 2013/14 Year (per cent)</th>
<th>Spend 2013/14 Year ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Programmes &amp; Extensions</td>
<td>8 per cent</td>
<td>38.9 per cent</td>
<td>$131,583,275</td>
<td>37.2 per cent</td>
<td>$30,371,800</td>
</tr>
<tr>
<td>Projects</td>
<td>40 per cent</td>
<td>43.5 per cent</td>
<td>$146,946,562</td>
<td>38.7 per cent</td>
<td>$31,591,418</td>
</tr>
<tr>
<td>Explorer Grants</td>
<td>1 per cent</td>
<td>0.1 per cent</td>
<td>$450,000</td>
<td>0.3 per cent</td>
<td>$212,500</td>
</tr>
<tr>
<td>ERFG26</td>
<td>9 per cent</td>
<td>1.4 per cent</td>
<td>$4,842,498</td>
<td>1.6 per cent</td>
<td>$1,335,743</td>
</tr>
<tr>
<td>Feasibility Studies</td>
<td>3 per cent</td>
<td>0.5 per cent</td>
<td>$1,574,478</td>
<td>1.2 per cent</td>
<td>$1,014,828</td>
</tr>
<tr>
<td>Partnership</td>
<td>6 per cent</td>
<td>4.7 per cent</td>
<td>$15,787,959</td>
<td>10 per cent</td>
<td>$8,180,925</td>
</tr>
<tr>
<td>IIOF27</td>
<td>1 per cent</td>
<td>0.2 per cent</td>
<td>$769,873</td>
<td>0.1 per cent</td>
<td>$65,609</td>
</tr>
<tr>
<td>CDA28</td>
<td>27 per cent</td>
<td>8.1 per cent</td>
<td>$27,309,765</td>
<td>7.4 per cent</td>
<td>$6,047,943</td>
</tr>
<tr>
<td>ICHIRP29</td>
<td>1 per cent</td>
<td>1.7 per cent</td>
<td>$5,777,418</td>
<td>1.5 per cent</td>
<td>$1,233,045</td>
</tr>
<tr>
<td>IRF30</td>
<td>1 per cent</td>
<td>0.4 per cent</td>
<td>$1,195,489</td>
<td>1 per cent</td>
<td>$824,984</td>
</tr>
<tr>
<td>Ngā Kanohi Kitea</td>
<td>3 per cent</td>
<td>0.5 per cent</td>
<td>$1,745,930</td>
<td>1 per cent</td>
<td>$850,336</td>
</tr>
</tbody>
</table>

26 Emerging Researcher First Grant.
27 International Investment Opportunities Fund.
28 Career Development Awards.
29 International Collaborative Indigenous Health Research Partnerships.
30 International Relationship Fund.
Annex A: Current investment profile

Investment Profile

Investment by Frascati Classification

The following figures show the HRC’s investment profile by Frascati classification. As the figures show, the majority of investment is in the area of applied research.

![Figure 1. Proportion of Contracts by Frascati Classification](image1)

![Figure 2. Proportion of Spend in Financial Year by Frascati Classification](image2)

An analysis of investment by Frascati classification was also undertaken for each RIS. This analysis showed as it did for the previous financial year, that a notably greater proportion of the research undertaken as part of the NZHD RIS is classified as experimental development (62 per cent of contracts and 54 per cent of investment in the financial year). The two main RIS (HWNZ and IOACC) showed a similar balance of research across the Frascati classification with close to 50 per cent of the investment applied research, and as with the previous financial year a greater proportion of HWNZ research was classified as targeted basic (30 per cent). This is primarily research that doesn’t address a specific condition. The RHM RIS had the largest proportion of investment classified as applied research (66 per cent), with the remainder of this investment predominantly experimental development research (32 per cent).

Investment in Translational Research

In addition to considering the Frascati Classification of HRC’s investment, a specific analysis is also undertaken to identify whether the research could be considered translational. In the 2013/14 financial year 43 per cent of contracts were classified as translational, with 44 per cent of spend on contracts classified as translational. This figure was slightly elevated from the previous year which saw 40 per cent of contracts and 40 per cent of spend on contracts classified as translational.

An analysis of investment in translational research was also undertaken for each RIS. The investment profile of the HWNZ and IOACC and RHM RIS are all relatively consistent with the overall profile. As with the 2012/13 financial year, the NZHD RIS shows a significantly greater level of investment in translational research (88 per cent of contracts and 73 per cent of investment). Evaluations of projects and programmes funded through the Annual Funding Round research, including analyses of research translation, have been undertaken since 2008. Results from this analysis showed a significant upward trend in research classified as translational (18 per cent in 2008, 36 per cent in 2010, 49 per cent in 2012). While the upward trend in contracts that could be classified as translational appeared to level off in 2013 (40 per cent of spend on contracts classified as translational), 2014 continued this upward trend with 44 per cent of spend on contracts classified as translational.
Investment by Portfolio Mapping Category

The following figure shows HRC’s investment by Portfolio Mapping Category. The distribution of investment across the portfolio mapping categories is very similar to the previous year’s analysis, with this year’s highest spend across the top 6 portfolio mapping categories consistent with the highest spend for these categories in the 2012/13 financial year. Again, the largest investment is in the areas of clinical trials, physiology and interventions.

Figure 3: Proportion of Spend in Financial Year by Portfolio Mapping Category

An analysis of investment by RIS was also undertaken. As might be expected, each RIS has a unique investment profile. The key features of each RIS are described below.

IOACC  The investment profile for IOACC in 2013/14 largely mirrored the profile for the 2012/13 financial year. The largest proportion of investment (22 per cent) was in physiology and significant investments were seen in pharmaceuticals/treatments (20 per cent) and clinical trials (20 per cent).

HWNZ  Over half the investment for HWNZ is in risk factors (31 per cent) and interventions (25 per cent). The other significant investments are physiology (14 per cent) and clinical trials (10 per cent).

NZHD  Clinical trials (31 per cent) makes up almost a third of the NZHD investment, followed by clinical services (21 per cent) and interventions (19 per cent).

RHM  In line with the RHM investment profile for 2012/13 the largest proportion of investment is in at-risk populations (51 per cent). Interventions (19 per cent)...
Annex A: Current investment profile

was the second largest investment, followed by Community Services (9 per cent) and Knowledge Resources (8 per cent).

**Investment by Health Issue**

The following table provides an overview of HRC investment in specific health issues. The table provides annual spend for all health issues that made up more than 1 per cent of annual spend for the 2013/14 financial year.

**Table 4: Investment by Health Issue**

<table>
<thead>
<tr>
<th>Health Issue</th>
<th>Contracts (n)</th>
<th>Investment ($)</th>
<th>Spend in 2013/14 Year (per cent)</th>
<th>Spend in 2013/14 Year ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cardio/Cerebrovascular Disease</td>
<td>23</td>
<td>$41,601,673.60</td>
<td>14 per cent</td>
<td>$10,594,773.00</td>
</tr>
<tr>
<td>Oncology and Cancer</td>
<td>31</td>
<td>$39,338,329.73</td>
<td>12 per cent</td>
<td>$9,178,078.20</td>
</tr>
<tr>
<td>CNS/Neurological Disorders</td>
<td>12</td>
<td>$23,159,308.85</td>
<td>6 per cent</td>
<td>$4,603,718.04</td>
</tr>
<tr>
<td>Infectious Diseases</td>
<td>10</td>
<td>$15,645,322.99</td>
<td>6 per cent</td>
<td>$4,426,130.47</td>
</tr>
<tr>
<td>Alcohol/drugs of dependence</td>
<td>11</td>
<td>$13,028,212.20</td>
<td>4 per cent</td>
<td>$3,115,119.54</td>
</tr>
<tr>
<td>Respiratory disease/asthma</td>
<td>13</td>
<td>$10,854,605.20</td>
<td>4 per cent</td>
<td>$2,678,046.18</td>
</tr>
<tr>
<td>Mental health</td>
<td>7</td>
<td>$9,626,649.31</td>
<td>3 per cent</td>
<td>$2,494,948.03</td>
</tr>
<tr>
<td>Environmental Health</td>
<td>5</td>
<td>$7,233,334.86</td>
<td>3 per cent</td>
<td>$2,478,119.54</td>
</tr>
<tr>
<td>Obesity</td>
<td>13</td>
<td>$12,707,303.21</td>
<td>3 per cent</td>
<td>$2,142,572.42</td>
</tr>
<tr>
<td>Obstetric complications</td>
<td>5</td>
<td>$8,160,591.29</td>
<td>3 per cent</td>
<td>$2,328,393.79</td>
</tr>
<tr>
<td>Immune system/atopy/allergy</td>
<td>3</td>
<td>$11,137,080.65</td>
<td>3 per cent</td>
<td>$2,287,413.78</td>
</tr>
<tr>
<td>Ageing</td>
<td>3</td>
<td>$7,431,363.74</td>
<td>3 per cent</td>
<td>$2,061,204.83</td>
</tr>
<tr>
<td>Health Services</td>
<td>7</td>
<td>$11,437,124.63</td>
<td>3 per cent</td>
<td>$2,142,572.42</td>
</tr>
<tr>
<td>Other</td>
<td>7</td>
<td>$4,852,066.89</td>
<td>3 per cent</td>
<td>$2,115,544.92</td>
</tr>
<tr>
<td>Reproduction/family planning/sexual health</td>
<td>8</td>
<td>$11,100,496.42</td>
<td>3 per cent</td>
<td>$2,075,582.08</td>
</tr>
<tr>
<td>Rheumatology/arthritis</td>
<td>5</td>
<td>$7,431,363.74</td>
<td>3 per cent</td>
<td>$2,061,204.83</td>
</tr>
<tr>
<td>Diabetes</td>
<td>7</td>
<td>$8,018,887.26</td>
<td>3 per cent</td>
<td>$1,933,043.39</td>
</tr>
<tr>
<td>Bone disease</td>
<td>1</td>
<td>$5,241,424.00</td>
<td>2 per cent</td>
<td>$1,747,141.32</td>
</tr>
<tr>
<td>Wellness</td>
<td>5</td>
<td>$6,452,656.54</td>
<td>2 per cent</td>
<td>$1,610,960.98</td>
</tr>
<tr>
<td>Occupational health</td>
<td>3</td>
<td>$5,209,346.42</td>
<td>2 per cent</td>
<td>$1,270,277.47</td>
</tr>
<tr>
<td>Injury (intentional and unintentional)</td>
<td>7</td>
<td>$4,459,830.89</td>
<td>2 per cent</td>
<td>$1,117,131.59</td>
</tr>
<tr>
<td>Renal diseases/urology</td>
<td>4</td>
<td>$3,480,479.52</td>
<td>1 per cent</td>
<td>$966,594.66</td>
</tr>
<tr>
<td>Nutrition</td>
<td>2</td>
<td>$6,181,748.00</td>
<td>1 per cent</td>
<td>$739,022.06</td>
</tr>
<tr>
<td>Pre-term birth</td>
<td>2</td>
<td>$2,078,303.62</td>
<td>1 per cent</td>
<td>$720,625.22</td>
</tr>
<tr>
<td>Gastrointestinal Diseases</td>
<td>4</td>
<td>$4,145,142.60</td>
<td>1 per cent</td>
<td>$705,034.20</td>
</tr>
<tr>
<td>Liver Disease</td>
<td>3</td>
<td>$2,338,106.00</td>
<td>1 per cent</td>
<td>$688,834.97</td>
</tr>
<tr>
<td>Mortality</td>
<td>2</td>
<td>$2,391,199.65</td>
<td>1 per cent</td>
<td>$664,881.10</td>
</tr>
<tr>
<td>Child Development</td>
<td>3</td>
<td>$2,550,140.29</td>
<td>1 per cent</td>
<td>$590,383.23</td>
</tr>
<tr>
<td>Vision/hearing/speech</td>
<td>3</td>
<td>$3,407,328.57</td>
<td>1 per cent</td>
<td>$562,109.95</td>
</tr>
<tr>
<td>Dental/oral health</td>
<td>1</td>
<td>$2,347,828.00</td>
<td>1 per cent</td>
<td>$457,711.68</td>
</tr>
<tr>
<td>Atopy</td>
<td>1</td>
<td>$1,917,659.71</td>
<td>1 per cent</td>
<td>$399,219.96</td>
</tr>
<tr>
<td>Skin diseases</td>
<td>1</td>
<td>$1,181,991.00</td>
<td>1 per cent</td>
<td>$393,996.96</td>
</tr>
</tbody>
</table>
An analysis of spend in the 2013/14 financial year by RIS was also undertaken. As might be expected, each RIS has a different investment profile. The key features of each RIS are described below.

**IOACC**
The largest proportion of investment is in oncology/cancer (22 per cent), with significant investments in cardio/cerebrovascular disease (17 per cent) and CNS/neurological disorders (12 per cent). This profile is very similar to the 2012/13 investment profile for IOACC.

**HWNZ**
The spread of investment is similar to the 2012/13 investment profile. The largest proportion of investment is in cardio/cerebrovascular disease (15 per cent), alcohol/drugs of dependence (11 per cent), environmental health (11 per cent) and ageing (10 per cent).

**NZHD**
Infectious diseases (18 per cent) make up the largest proportion of investment, followed by health services (15 per cent), other (12 per cent), cardio/cerebrovascular disease (10 per cent) and mental health (9 per cent).

**RHM**
Wellness (23 per cent) accounted for almost a quarter of investment, with additional significant investments in respiratory disease/asthma (9 per cent), dental/oral disease (7 per cent), health services (6 per cent) and diabetes (6 per cent).
# Annex B: Investment Pools and Mechanisms

<table>
<thead>
<tr>
<th>NAME</th>
<th>PURPOSE</th>
<th>EVALUATION FINDINGS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Explorer Grant</td>
<td><em>Seed support for transformative research ideas at an early stage.</em> The proposed research must advance ideas considered to be transformative, innovative, exploratory or unconventional, and have potential for major impact.</td>
<td>Process evaluation in 2014. Currently included in an evaluation of innovative research funding models by the University of Melbourne.</td>
</tr>
<tr>
<td>Feasibility Grant</td>
<td>Enabling <em>testing of research ideas</em> for feasibility before undertaking larger scale research (e.g. methodology, recruitment etc.)</td>
<td>Our 2010 evaluation showed that 37 per cent of feasibility studies went to full application.</td>
</tr>
<tr>
<td>Clinical Practitioner Research Fellowship</td>
<td><em>Support for our most experienced clinician researchers</em> to sustain or expand an existing programme of research. The grant is intended to strengthen health care practice and health services in New Zealand.</td>
<td>Not yet evaluated.</td>
</tr>
<tr>
<td>Hercus Fellowship</td>
<td><em>Support for emerging scientists</em> who have demonstrated <em>outstanding research potential.</em> The grant is intended to build New Zealand’s future capability to conduct world-class research.</td>
<td>Our 2009 evaluation showed that significant research discoveries have been made during Fellowships, resulting in several prizes, distinctions and publications in prestigious journals. The prestige of the Fellowship has secured opportunities such as further grants, collaborations and academic positions.</td>
</tr>
<tr>
<td>Emerging Research First Grant</td>
<td><em>Support for emerging researchers</em> who are seeking to establish independent careers in health research and who have not previously held a significant competitive research grant.</td>
<td>Not yet evaluated.</td>
</tr>
<tr>
<td>Ngā Kanohi Kitea Project Grant</td>
<td><em>Support for iwi, hapū and community groups to lead investigation</em> of a well-defined area of Māori health need or gain. The research must be clearly driven by the needs and focus of the community or community organization.</td>
<td>23 awards (value $4,544,870) have been distributed. Health issues commonly addressed include community wellbeing, improving health services for Māori, prevention of harm and disease, and environmental health.</td>
</tr>
<tr>
<td>Rangahau Hauora Award</td>
<td>Support for Māori active in their community, and with no prior research training to undertake practical research training on a large research project.</td>
<td>Not yet evaluated.</td>
</tr>
<tr>
<td>Sir Thomas Davis Te Patu Kite Rangi Ariki Health Research Fellowship</td>
<td><em>Support for high quality Pacific health research in priority areas.</em> The Fellowship provides up to three years support for a <em>Pacific researcher</em> whose field has the potential to contribute to both the health and economic goals for the Government’s investment in research, science and technology.</td>
<td>Not yet evaluated.</td>
</tr>
</tbody>
</table>