



Australian Government

National Health and  
Medical Research Council

N H M R C

# DISCUSSION PAPER HEALTH AND MEDICAL RESEARCH AND THE FUTURE IN NHMRC'S 75TH YEAR

The virtuous cycle and the economic benefits of health and medical research

# Discussion Paper

## Health and Medical Research and the Future in NHMRC's 75th Year

### The Virtuous Cycle and economic benefits of health and medical research

This discussion paper focuses on the economic benefits to Australia from public investment in health and medical research.

The support by governments and people of Australia through their taxes, as participants in research, through service on ethics committees and through donations to health and medical research charities is remarkable<sup>1</sup>. It is therefore important that, as health and medical researchers, we always take into account how society benefits from this support.

Benefits from health and medical research can be realised in several ways; prevention of ill health, better care of patients, a better health system itself, and through gains in our national economy and national wealth. In this paper, I have attempted to identify some of the economic benefits.

I look forward to robust feedback, as we here at NHMRC begin to think about the next 25 years – when we will be 100 years old!

I discuss below estimates of the value of health and medical research to the national economy, the effects of productivity increases, commercial returns, improving value for money in health expenditure and investment by international funding bodies, and the benefits of Australia being seen as a successful 21st century nation.

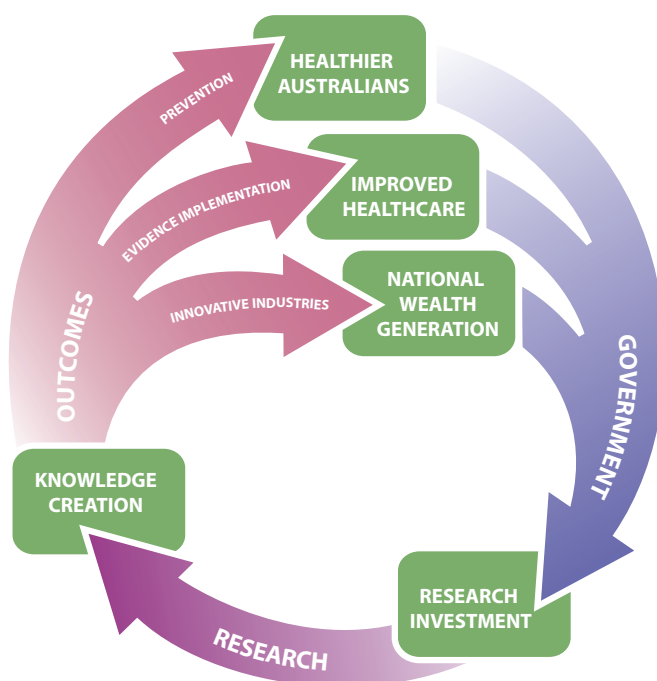
### Economic benefits of improved health

The economic benefits of improved health have helped Australia become a leading economy of the 21st century. There have been a number of studies to support this. A recent study by Lateral Economics<sup>2</sup>, commissioned by Research Australia, concluded that, between 1992-93 and 2004-05, expenditure on Australian research and development (R&D) returned a net benefit of approximately \$29.5 billion.

<sup>1</sup> A Recent Research Australia poll (2009) (<http://researchaustralia.org/Publications%20Public%20Opinion%20Polls/Research%20Australia%20Public%20Opinion%20Poll%202009.pdf>) showed that:

- 80% of Australians think more funding for health and medical research is an important priority for the Federal Government over the next 2–3 years
- 90% of Australians believe medical and health research on prevention, treatment and cures for illnesses and diseases will play an important role in Australia's future.
- 78% of Australians (up 6 points since 2008) agree that the rate of NHMRC funding should continue to substantially increase beyond 2010.
- 85% of Australian agree that by investing heavily in health and medical research and aiming to be the world's best we can attract the best and brightest people to Australia (80% agree that we should not aim for anything except the best, and 85% agree that by developing Australia as a leader, it will have a multiplier effect, bringing about economic benefits.)

<sup>2</sup> Lateral Economics report available at: <http://researchaustralia.org/Publications%20Special%20Reports/The%20Economic%20Value%20of%20Australias%20Investment%20in%20Health%20and%20Medical%20Research%20October%202010.pdf>

Figure 1: The Virtuous Cycle<sup>3</sup>

This report also noted that *“given the exceptional returns to investing in Australian health and medical research, it makes sound economic and social sense for Australian governments to commit to substantially expanding such investment, and to encourage other funders to do so as well.”*

This Lateral Economics report supported the results of the previous analysis from an Access Economics study<sup>4</sup> commissioned by the Australian Society for Medical Research. This study concluded that for every dollar invested in Australian health R&D, an average of \$2.17 in health benefits is returned (confidence range of \$0.57 to \$6.01).

These studies provide strong support for investment in health and medical research but it is also clear that we need to more effectively measure and document R&D activity and its role in economic growth. A recent Nature article pointed out that there needs to be more rigorous studies on how national investment in research drives economic growth<sup>5</sup>.

One particular area where we need a more rigorous approach is in the understanding of the long lead time between discovery and economic and health outcomes. Ben Bernanke, Chairman of the Board of Governors of the Federal Reserve System commented recently that *“Expanded government support for research and development over time could significantly boost economic growth,” though “...government support for innovation and R&D will be more effective if it is thought of as a long-run investment”*<sup>6</sup>.

<sup>3</sup> The link between health and medical research and the virtuous cycle is described in the 2004 Report: Sustaining the Virtuous Cycle for a healthy competitive Australia: Investment review of health and medical research ([http://www.health.gov.au/internet/main/publishing.nsf/Content/health-hsid-investreview/\\$FILE/Final\\_Report.pdf](http://www.health.gov.au/internet/main/publishing.nsf/Content/health-hsid-investreview/$FILE/Final_Report.pdf)). This representation of the virtuous cycle for health and medical research is from the NHMRC Strategic Plan 2010-12.

<sup>4</sup> Exceptional Returns: The value of Investing in Health R&D in Australia II, 2008 <http://www.asmr.org.au/ExcepiII08.pdf>

<sup>5</sup> Macilwain, C. (2010) What is science really worth. Nature 465: 682-684

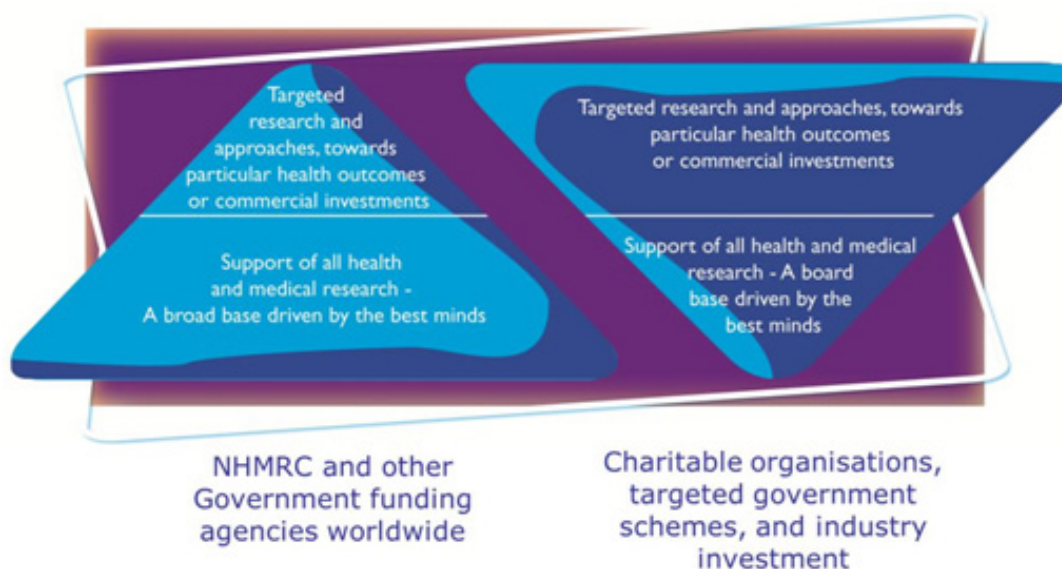
<sup>6</sup> Bernanke, B. (2011) Promoting Research and Development: The Government's Role. New Building Blocks for Jobs and Economic Growth conference, Georgetown University

Bernanke went on to say *“The primary economic rationale for a government role in R&D is that...the private market would not adequately supply certain types of research. This applies particularly strongly to basic or fundamental research where the full economic value of scientific advances is unlikely to accrue to its discoverer. If many people are able to exploit research done by others, then the total or social return to research may be higher than the private return to those who bear the cost. Market forces will lead to under-investment in R&D from society's perspective, providing a rationale for government intervention.”*

In the 1970's and 80's, Harald zur Hausen established a link between HPV and cervical cancer,<sup>7,8</sup> for which he won a Nobel Prize in 2008. In 1991, Ian Frazer published findings about the potential of synthesising virus-like particles from recombinantly expressed HPV capsid protein to resemble actual viral particles. This was followed by further animal studies and discussions with the pharmaceutical sector, until the vaccine technology was licensed to Merck in 1995. Merck developed and trialled the vaccine throughout the 1990's and early 2000's. Gardasil obtained FDA approval in 2005 and licensure in 2006.

However, governments are always faced with making difficult choices between areas that need government expenditure. Therefore, a detailed and sophisticated analysis of the benefits of investing in research needs to be made, which addresses both long and short-term benefits.

Figure 2: NHMRC's complementary role with other sources of support for research<sup>9</sup>



7 Durst, M., Gissmann, L., Ikenberg, H. and zur Hausen, H. (1983) A papillomavirus DNA from a cervical carcinoma and its prevalence in cancer biopsy samples from different geographic regions. PNAS 80: 3812-3815

8 Boshart, M., Gissmann, L., Ikenberg, H., Kleinheinz, A., Scheurlen, W. and zur Hausen, H. (1984) A new type of papillomavirus DNA, its presence in genital cancer biopsies and in cell lines derived from cervical cancer. EMBO J. 3(5): 1151-1157

9 Courtesy of Dr Toni Scarpa, Centre for Scientific Review, National Institutes of Health.

## Productivity

Healthier people are better able to participate in work, in society, and in family and community life. When there is less ill health in the community, national productivity can improve through reduced sick leave. It is important to acknowledge that the benefits from research do not automatically flow but are only realised if public policy settings and other conditions allow; for example, the productivity benefits from reduced cardiovascular disease incidence over the last three decades<sup>10,11</sup>, will only be gained if jobs are available. Chronic illness, mental health problems, and sudden infectious disease outbreaks (e.g. SARS) all reduce productivity by taking productive members of our workforce out of their jobs.

## Commercial return

Another way of looking at economic benefits to Australia is to consider research-based companies paying tax in Australia, purchasing goods here, and employing Australians in high quality and stimulating jobs.

- CSL Limited reported a profit for 2008/09 of \$1.15 billion. Of this, sales of Gardasil contributed \$185 million.
- Cochlear Pty Ltd, built on the original invention of the “bionic ear” from the work of Professor Graeme Clark and his colleagues, reported a net profit after tax of \$130 million for the 2008/09 financial year. Professor Clark’s research was supported by NHMRC (17 grants in total over 25 years including two Program Grants for studies on developing and improving ‘sensory prostheses’) and the Australian Research Council.
- ResMed Inc, a major international sleep apnoea company built upon the original work of Professor Colin Sullivan and his colleagues at the University of Sydney, reported a net profit after tax of \$190 million in the 2009/10 financial year and employs around 1200 Australians.

A recent Australian Financial Review article reported that *“Investor interest towards the [biotech] sector has picked up strongly over the past few years, as never before have so many Australian drug and equipment developers successfully commercialised or been in the final stages of commercialising their products”*.<sup>12</sup>

CSL, Cochlear and Resmed, three companies that have reaped the benefits of technology developed out of medical research, alone contribute in hundreds of millions of dollars to the Australian economy each year and provide great jobs. Let’s have many more like them!<sup>13</sup>

## Value for money in health expenditure

The aim of most clinical and health services research is to improve patient care, either through individual treatment or by addressing problems in the patient’s journey through the

<sup>10</sup> Returns on investment in public health. An epidemiological and economic analysis prepared for the Department of Health and Ageing. Applied Economics. March 2003

<sup>11</sup> Cadilhac, DA., Magnus, A., Cumming, T., Sheppard, L., Pearce, D and Carter, R. The health and economic benefits of reducing disease risk factors. VicHealth Briefing Note. September 2009

<sup>12</sup> The Weekend Financial review, August 6th, page 17.

<sup>13</sup> Dean, T. (2011) Australian Life Scientist 8(3): 24-28. There are new biotechnology companies that are contributing to the Australian economy. For example, Mesoblast is a regenerative medicine specialist company that recently made a major deal with US pharmaceutical company Cephalon, who paid US\$220 million for its stake in the company, plus US\$130 million upfront. Upon reaching key milestones, Mesoblast will receive potential payments up to US\$1.7 billion, contingent on obtaining Food and Drug Administration approval.

system. Developing new treatments or diagnostics to assist patients is the major motivation for many working in health research, whether for cancer or heart disease, or for those experiencing mental health problems, suffering from diabetes or multiple sclerosis.

One consequence of new treatments or diagnostics however may be increased cost, even though the new treatments may be more cost-effective than their predecessors. This produces a quandary for decision makers; better treatments emerge but the cost of running the health system increases too.

Recently, attention has turned to using research to restrain the growth in health care costs. One important new area is comparative effectiveness research which compares different existing treatments or health care procedures or processes in real life situations, using rigorous, high quality research. NHMRC already funds some investigator initiated research in this area. For example, Professor Rachele Buchbinder and her colleagues from Monash University have reported that vertebroplasty, a procedure whereby bone cement is injected into diseased vertebrae such as osteoporotic fractures, was no more beneficial than sham procedures performed in patients with osteoporotic vertebral fractures.<sup>14</sup>

### Ensuring the benefits of research are gained

To gain the full benefits of research and its uptake into care and public health policy, a wide range of activities and policies need to be in place. Research is a necessary but on its own not sufficient means of improving health. Evidence from research needs to be implemented through governmental, professional and community-based policies and practices and through commercial development.

Over the last decade or more, NHMRC has placed special emphasis on supporting some of the initial steps along this path from discovery to implementation. This has been through the development of Centres of Excellence in Clinical Research, Health Services Research and Public Health Research, the Partnership Projects scheme that promotes collaboration between researchers and bodies involved in health practice and policy, and Fellowships such as the Practitioner and Translating Research into Practice Fellowships.

Recently, we have begun the development of a **NHMRC Research Translation Network**, following an initial workshop on the idea.<sup>15</sup>

The importance of having a research culture at the heart of health care delivery is often undervalued. The health system is a knowledge-based system, one that needs to be quintessentially self-learning and self-improving. For this to occur, clinical and health services researchers, including general practitioners, nurses, allied health professionals and specialists who are research-savvy need to contribute to a culture of always asking “how can we deliver better outcomes based on what we have learned from research?”

Research-trained health professionals are pivotal in making use of all that we develop. In the

14 Buchbinder, R., Osborne, RH., Ebeling, PR., Wark, JD., Mitchell, P., Wriedit, C., Graves, S., Staples, MP., Murphy, B. (2009) A randomized trial of vertebroplasty for painful osteoporotic vertebral fractures. *NEJM* 361: 557-568. This study's conclusions were supported by another study in the same issue of the *New England Journal of Medicine*, by McHutchison and co-workers. Vertebroplasty is currently paid for by public funding, and was estimated by these authors to cost \$3,951 per patient (this is dependent on the number and length of hospital stays, which will affect the cost considerably). In Australia, the number of patients who have this treatment ranges from 520-1040 annually. Therefore, the annual burden on the health system could range from \$2-4 million, for a treatment that according to this research, lacks any benefit to the patient.

15 Towards a national network to enhance leadership in research translation and implementation – NHMRC workshop (20 April 2011) <http://www.nhmrc.gov.au/media/events/2011/towards-national-network-enhance-leadership-research-translation-and-implementation>

words of the Health and Hospitals Reform Commission in 2009<sup>16</sup> “we must aim for a ‘self-improving’ health system, one in which those responsible for patients are imbued with a culture of enquiry and with commitment to evidence based decisions.”

Such people are also essential when it comes to dealing quickly and effectively with suddenly emerging threats, particularly infectious diseases. A good example is Australia’s clinical researchers in virology who have played key roles in Australia’s effective responses to threats such as new strains of the influenza virus and AIDS.

NHMRC will shortly introduce the concept of **Advanced Health Research Centres** to promote leadership in the chain from discovery through translation and then implementation to improve patient care.

Another important contribution by NHMRC to implementing the findings of research in policy and practice is through our work on clinical and public health guidelines including setting standards for all guidelines and our public statements (for instance our public statements on fluoridation of water supplies<sup>17</sup>, and blood lead levels<sup>18</sup>).

## Leverage of international funds

An active and high quality research sector can also earn foreign income. NHMRC analysis of information provided in NHMRC end of grant reports shows that:

- 18% of NHMRC research grants report leveraged funds from international funding bodies. For example, in 2009 alone, Australian researchers received a total of \$13.9 million from 43 new and continuing US-National Institutes of Health grants.
- Of the NHMRC grants that do leverage funds from international sources, an average of \$0.53 in additional research funding is leveraged for every \$1 that NHMRC invests<sup>19</sup>.
- In 2008-09, the pharmaceutical sector spent approximately \$1.02 billion on research and development<sup>20</sup> in Australia and Medicines Australia reports that in 2008<sup>21</sup>. biopharmaceutical companies funded more than 70% of all ongoing clinical trials in Australia.<sup>22</sup> Though Australia is a small country with relatively high research costs compared to emerging economy countries, this sizable research investment by international pharmaceutical companies is due in no small part to the high quality clinical research conducted and high ethical standards and oversight in this country. Both of these capabilities have long been important areas of effort by NHMRC.
- Many international charitable research funding bodies provide Australian health and medical researchers with funding, in acknowledgement of the excellence of Australian research. For instance, the Juvenile Diabetes Research Foundation International has invested more than \$US35 million in Australia since 2000.

## Australia as a successful 21st century nation

Australian researchers bring prestige and recognition to Australia through their contributions

16 A healthier future for all Australians, Final report June 2009, Australian Government, National Health and Hospitals Reform Commission. <http://www.health.gov.au/internet/nhhrc/publishing.nsf/Content/nhhrc-report>

17 NHMRC Public Statement - The Efficacy and Safety of Fluoridation (2007) [http://www.nhmrc.gov.au/\\_files\\_nhmrc/file/media/media/re107/Fluoride\\_Flyer.pdf](http://www.nhmrc.gov.au/_files_nhmrc/file/media/media/re107/Fluoride_Flyer.pdf)

18 NHMRC Information Paper for Practitioners and Policy Makers – Blood Lead Levels for Australians (2009) [http://www.nhmrc.gov.au/\\_files\\_nhmrc/publications/attachments/gp2-lead-info-paper.pdf](http://www.nhmrc.gov.au/_files_nhmrc/publications/attachments/gp2-lead-info-paper.pdf)

19 NHMRC final reports for grants ending 2008.

20 Department of Innovation, Industry, Science and Research Portfolio Factsheets July 2011, pp 72-74

21 Medicines Australia submission to The Treasury regarding the implementation of the R&D Tax Credit program, February 2010

22 NHMRC funding for clinical trials was \$67M in 2010, or 9% of total NHMRC funding.

worldwide. These benefits include the social and health benefits of their discoveries, their leadership and participation in international organisations, discussions and actions in global health, and the reputational gains via the awarding of Nobel Prizes for Physiology or Medicine to Peter Doherty, Barry Marshall, Robin Warren and Elizabeth Blackburn since 1995.

Health and medical research is also an attractive career for many of the brightest and most altruistic of our young citizens and enables them to remain here in Australia rather than seek work elsewhere in the world. Many other countries lose many of the best of their young people to other countries because they cannot provide exciting, knowledge-based jobs.

In the 21st century, countries increasingly build their economies on high value jobs. Jobs in medical research are held by highly achieving individuals, working with sophisticated, advanced technologies characteristic of modern economies. Employees in medical research are typically young, from diverse cultural backgrounds, internationally connected, ambitious but also altruistic – great citizens for our nation. An NHMRC workforce demographic analysis study from 2009<sup>23</sup> indicated that more than 140,000 Australians work in health and medical research. In 2010, NHMRC estimates that more than 8,500 researchers are directly supported through NHMRC grants. Many other research and administrative jobs are leveraged against the \$700 million NHMRC annual expenditure.

The competition internationally for researchers is heating up, with many countries, including those in our region, competing strongly for the best research and researchers.

- **Singapore** is a regional leader in biotechnology and the pharmaceutical sector through a range of activities based on the support of bioscience. In 2008, gross expenditure on research and development was \$7.1 billion, equivalent to 2.77% of GDP<sup>24</sup>.
- **China** has increased its support for research hugely in recent years, for example a 30% increase from 2008-09 rising a further 8% in 2010<sup>25</sup>. It now houses the world's largest genome sequencing facility<sup>26</sup>. China now accounts for approximately 7% of all biomedical research publications and according to SCIMAGO was ranked fourth in terms of number of medical publications for 2010.
- **South Korea** has ambitious new governmental plans of becoming a science and technology powerhouse, with the aim of investing 5% of GDP in R&D by 2012, including basic and technological research in medicine<sup>27</sup>.
- Some emerging economies are starting to have an impact, with both **Brazil**<sup>28</sup> and **India** developing ambitious plans.
- The **USA** continues to be the major centre of attention for pursuing a career in health and medical research. For example, the state of California has invested US\$3 billion of health and medical research into regenerative medicine and stem cell biology alone.

Australia's reputation as an advanced 21st century nation is enhanced by the standing of its leading Universities. Their performances in medical research are key contributors to this

23 TNS Social Research (2009) Australian Health and Medical Research Workforce Demographic Analysis: Report. Prepared for the NHMRC

24 National Survey of R&D in Singapore 2009. Published by the Agency for Science, Technology and Research, Singapore. December 2010.

25 King D (2010) Spending review leaves research in the lurch. *Nature* 467: 1007-1009

26 Beijing Genomics Institute: <http://www.genomics.cn/en/index.php>

27 Cyranoski, D. (2009) South Korean R&D budget to soar. *Nature* 462 (7271) : 257

28 The Economist, 6 January 2011

standing<sup>29</sup>. Australia benefits directly from the high reputation of our Universities through attracting research funding from overseas and through the fees paid by International students.

## Final comment

Australians who work in health and medical research are motivated in most part by contributing to the growth of knowledge about the human condition and to the development of better ways to prevent ill health and treat patients who have become ill.

Increasingly, they are also motivated to work with the private sector to ensure that discoveries of potential benefit to human kind are successfully developed and made available. Of all NHMRC Project grant applications from 2005 to 2009, 48% reported that one or more applicants held patents for their work. For a decade, NHMRC has supported the initial steps in the development of products through our Industry Development Grants Schemes, and Industry Career Development Fellowships and we are currently evaluating the outcomes of this scheme.

In his statement on the establishment of the NHMRC Council 75 years ago, the Health Minister stated that *“Research must be actively pursued and developed and as fast as new knowledge is acquired it must be applied”*. It is inspiring to see that researchers now consider how to help the country ensure that the outcomes of research contribute to economic development, as well as to improved health.

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## YOUR COMMENTS AND FEEDBACK IS SOUGHT

Please help us refine and develop our ideas. For example,

- Have the main economic benefits been identified?
- Are there specific matters that NHMRC should address to accelerate the economic benefits from health and medical research?

Please email your ideas, comments and feedback to: [feedback.ceo@nhmrc.gov.au](mailto:feedback.ceo@nhmrc.gov.au)

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<sup>29</sup> The Times Higher Education (THE) and the QS World University Rankings are the leading ranking bodies for universities world-wide. On these rankings several Australian universities including the University of Melbourne, Australian National University, University of Sydney, University of Adelaide, University of Queensland, University of NSW and Monash University rank in the top 200 internationally. When assessing each University, Research-volume, income and reputation, as well as Citations-research influence, account for 62.5 per cent of the THE's overall ranking score.