



Australian Government
Cancer Australia

Cancer Research in Australia

An overview of funding initiatives
to support cancer research capacity
in Australia 2006 to 2011

*Evidence to inform strategic
investment in cancer research*



Cancer Research in Australia: an overview of funding initiatives to support cancer research capacity in Australia 2006 to 2011 was prepared and produced by:

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ISBN Print: 978-1-74127-289-5 ISBN Online: 978-1-74127-290-1

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Recommended citation

Cancer Australia, 2015. *Cancer Research in Australia: an overview of funding initiatives to support cancer research capacity in Australia 2006 to 2011*, Cancer Australia, Surry Hills, NSW.

Cancer Research in Australia: an overview of funding initiatives to support cancer research in Australia 2006 to 2011 can be downloaded from the Cancer Australia website: canceraustralia.gov.au or ordered by telephone: 1800 624 973.

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Acknowledgements

We sincerely thank all funding organisations that participated in this audit for the investment of time and effort in providing information.

All aspects of data collection, analysis and report preparation were overseen by the Audit Working Group. The Audit Working Group was comprised of members of Cancer Australia's Research and Data Advisory Group, cancer researchers and representatives from the Chairs of the National Cooperative Cancer Clinical Trials Groups and the National Health and Medical Research Council. Cancer Australia extends its thanks to the Audit Working Group for its oversight and input.

Cancer Australia would like to thank the Population Health Division, Australian Government Department of Health; the National Health and Medical Research Council; Cancer Institute NSW; the Victorian Cancer Agency; and the members of Cancer Australia's Research and Data Advisory Group for their review and feedback.

This audit was conducted and the resultant report prepared by staff in the Knowledge Management section of Cancer Australia. The main author was Dr Alan Woods, with assistance from Dr Paul Jackson and Dr Cleola Anderiesz. Guidance and review was provided by the Executive Director, Associate Professor Christine Giles, and the Chief Executive Officer, Professor Helen Zorbas. Coding and categorisation of funding data were performed by Dr Alan Woods and Dr Christopher Poon.



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Table of Contents

Acronyms.....	4
List of figures and tables.....	5
List of appendices	8
Foreword	9
Synopsis	11
Audit methodology.....	11
Key findings.....	11
Building cancer research capacity initiatives and infrastructure	12
National and international comparisons.....	13
Optimising investment in cancer research – considerations for the future	14
People support schemes.....	14
Building cancer research capacity initiatives and infrastructure	15
National and International funding.....	16
Chapter 1 – Introduction.....	17
1.1 Background	17
1.2 Objective of the new National Audit of funding for people support, building cancer research capacity initiatives and infrastructure.....	20
1.3 Scope of the new National Audit.....	20
Chapter 2 – Methodology.....	23
2.1 Approach to the National Audit of the period 2006 to 2011	23
2.2 Sources of data	23
2.3 Data collection	23
2.4 Which data are included in this National Audit?.....	25
2.5 Which data are not included in this National Audit?.....	25
2.6 Coding, classification and analysis of grants and awards.....	26
2.7 Coding verification	27
2.8 Ownership and subsequent access to data.....	27
2.9 Oversight of the National Audit.....	27
Chapter 3 – People support scheme funding for cancer research.....	29
3.1 Response to the National Audit	30
3.2 National research investment in people support.....	31
3.3 Sources of funding to people support in Australia.....	33
3.4 Co-funding of people support scheme awards	35
3.5 State and territory distribution of funding for people support	35
3.6 Broad Research Areas of people support scheme awards	38
3.7 Classification of Fellowships by career stage	42
3.8 Discussion	46



Chapter 4 - People support scheme awards - cancer research focus	49
4.1 People support scheme awards – classification by Common Scientific Outline.....	50
4.2 Tumour research focus of people support scheme awards.....	58
4.3 Multiple tumour streams focus of Scholarships and Fellowships	64
4.4 Tumour research focus of Fellowships across the career stages	66
4.5 Tumour-specific Fellowships across the career stages	67
4.6 Discussion	70
Chapter 5 – Funding for building cancer research capacity initiatives and infrastructure	73
5.1 Response to the National Audit	74
5.2 National research investment in building cancer research capacity initiatives and infrastructure.....	76
5.3 State and territory distribution of the funding to building cancer research capacity initiatives and infrastructure awards.....	77
5.4 Sources of funding for building cancer research capacity initiatives and infrastructure.....	78
5.5 Co-funding of awards for building cancer research capacity initiatives and infrastructure.....	81
5.6 Pattern of funding to individual building cancer research capacity initiatives and infrastructure categories.....	82
5.7 Discussion	87
Chapter 6 - Funding for building cancer research capacity initiatives and infrastructure - cancer research focus.....	91
6.1 Classification of funding awards for building cancer research capacity initiatives and infrastructure by Common Scientific Outline	92
6.2 Tumour research focus of building cancer research capacity initiatives and infrastructure awards	98
6.3 Funding for tumour-specific research	103
6.4 Discussion	108
Chapter 7 - Patterns of funding to cancer research: the combined national picture, and international comparisons.....	111
7.1 Funding to cancer research identified in the National Audits of 2006-2011	112
7.2 Combined pattern of funding to CSO categories in Australia	114
7.3 Comparison between the national pattern of funding to cancer research in Australia with international patterns of funding	117
7.4 Funding to tumour streams research.....	124
7.5 Funding to tumour type research compared to measures of disease impact and burden in Australia.....	128
7.6 Discussion	132

Appendix A - Organisations invited to provide details of their funding to support cancer research in Australia, 2006 to 2011	135
Appendix B - Email Introduction to the Audit.....	141
Appendix C - Invitation from CEO of Cancer Australia to cancer research funding organisation	143
Appendix D - Common Scientific Outline (CSO) classification of cancer research.....	145
Appendix E - Tumour streams and tumour types	155
References.....	157



Acronyms

AACR	Australian Association of Cancer Registries
ABS	Australian Bureau of Statistics
ACIM	Australian Cancer Incidence and Mortality
AIHW	Australian Institute of Health and Welfare
ANZ	Australia and New Zealand
AUD	Australian dollars
B	Billions
CAD	Canadian dollars
CCRA	Canadian Cancer Research Alliance
CI NSW	Cancer Institute New South Wales
CNS	Central Nervous System
CRC	Cooperative Research Centre
CSO	Common Scientific Outline
CUP	Cancer of Unknown Primary site
DALY	Disability-Adjusted Life Year
EU	European Union
GBP	British pounds
GI	Gastrointestinal
ICRP	International Cancer Research Partnership
M	Millions
NCI	National Cancer Institute
NCRI	National Cancer Research Institute
NHMRC	National Health and Medical Research Council
NIH	National Institute of Health
PdCCRS	Priority-driven Collaborative Cancer Research Scheme
RDAG	Research and Data Advisory Group
UK	United Kingdom
US	United States
USA	United States of America
USD	US Dollar
YLD	Years Lost due to Disability
YLL	Years of Life Lost (due to premature mortality)

List of figures and tables

- Figure 1.1 The estimated ten most commonly diagnosed cancers in Australia, 2014, and the percentage contribution of each cancer type to total incidence
- Figure 1.2 The estimated ten most common causes of cancer death in Australia, 2014, and the percentage contribution of each cancer type to total mortality
- Figure 1.3 Changes in 5-year relative survival over time for selected cancers
- Figure 3.1 Annual cancer research funding to people support in Australia, 2006 to 2011
- Figure 3.2 Proportion of funding to Scholarships by funding source in the period 2006 to 2011
- Figure 3.3 Proportion of funding to Fellowships by funding source in the period 2006 to 2011
- Figure 3.4 Proportion of funding to, and proportion of Scholarships awarded to, Broad Research Areas in the period 2006 to 2011
- Figure 3.5 Proportion of funding to, and proportion of Fellowships awarded to, Broad Research Areas in the period 2006 to 2011
- Figure 3.6 Proportion of funding to, and proportion of Academic Cancer Research Chairs awarded to, Broad Research Areas in the period 2006 to 2011
- Figure 4.1 The pattern of funding to Scholarships: proportional distribution of funding, level of funding and number of Scholarships in each CSO category
- Figure 4.2 The pattern of funding to Fellowships: proportional distribution of funding, level of funding and number of Fellowships in each CSO category
- Figure 4.3 The pattern of funding to Fellowship types in the period 2006 to 2011
- Figure 4.4 The pattern of funding to Academic Cancer Research Chairs: proportional distribution of funding, level of funding and number of Academic Cancer Research Chairs in each CSO category
- Figure 4.5 Funding to Scholarships in each tumour research focus category (A), and the major tumour types of focus (B)
- Figure 4.6 Funding to, and number of Scholarships for each funded tumour type, more than one tumour type, and multiple tumour streams
- Figure 4.7 Funding to Fellowships in each tumour focus category (A), and the major tumour types of focus (B)
- Figure 4.8 Funding to, and number of Fellowships for each funded tumour type, more than one tumour type, and for multiple tumour streams
- Figure 4.9 Tumour stream combinations researched through Fellowships which focused on multiple tumour streams
- Figure 4.10 Proportion of Fellowships in each career-stage category which was tumour-specific and not tumour-specific
- Figure 5.1 Annual investment in building cancer research capacity initiatives and infrastructure in Australia, 2006 to 2011
- Figure 5.2 Proportion of funding to building cancer research capacity initiatives and infrastructure awards by funding source
- Figure 5.3 Sources of funding and investment made in 2006–2008 and 2009–2011



- Figure 5.4 Level of funding to building cancer research capacity and infrastructure categories in 2006–2008 and 2009–2011
- Figure 5.5 The proportional distribution of funding to building cancer research capacity initiatives and infrastructure categories, by funding sources
- Figure 6.1 The pattern of funding to building cancer research capacity initiatives and infrastructure: proportional distribution of funding, level of funding and number of awards in each CSO category
- Figure 6.2 The level of funding to each CSO category for building cancer research capacity initiatives and infrastructure in 2006–2008 and 2009–2011
- Figure 6.3 The proportional distribution of funding within each building cancer research capacity initiatives and infrastructure category, by CSO focus of funding awards
- Figure 6.4 Level of funding to tumour-specific and not tumour-specific building cancer research capacity initiatives and infrastructure, in 2006–2008 and 2009–2011
- Figure 6.5 The proportional distribution of funding to tumour-specific, and not tumour specific, building cancer research capacity and infrastructure categories in the period 2006 to 2011
- Figure 6.6 Proportional funding to building cancer research capacity initiatives and infrastructure categories for tumour streams in the period 2006 to 2011
- Figure 7.1 Proportion of funding by funding source to cancer research projects and research programs, building cancer research capacity initiatives, and infrastructure awards
- Figure 7.2 The pattern of funding to cancer research in Australia in the period 2006 to 2011
- Figure 7.3 Comparison of the pattern of funding to cancer research in Australia, Canada and the UK in the period 2006 to 2011
- Figure 7.4 Pattern of funding to cancer research from the International Cancer Research Partnership (2008)
- Figure 7.5 International comparisons of the changes in the patterns of funding to cancer research
- Figure 7.6 Proportional funding to research for single tumour streams in Australia, Canada and the UK in the period 2006 to 2011
- Figure 7.7 Funding to tumour type-specific cancer research in Australia 2006 to 2011, compared with the top 20 cancers by incidence in Australia, 2011
- Figure 7.8 Funding to tumour type-specific cancer research in Australia 2006 to 2011, compared with the top 20 cancers by mortality in Australia, 2012
- Figure 7.9 Funding to tumour type-specific cancer research in Australia 2006 to 2011, compared with the top 20 cancers by DALYs in Australia, 2012
- Table 2.1 Cancer research funding data requested of funders for this National Audit.
- Table 3.1 Major funding sources that provided data for people support scheme awards
- Table 3.2 Funding to people support types in Australia in 2006–2008, 2009–2011 and for the period 2006 to 2011
- Table 3.3 Distribution to states and territories of funding to Scholarships in 2006–2008 and 2009–2011, and for the period 2006 to 2011

Table 3.4	Distribution to states and territories of funding to Fellowships in 2006–2008 and 2009–2011, and for the period 2006 to 2011
Table 3.5	Funding to and number of awards to Scholarships and Fellowships in the Broad Research Areas, classified by funding source
Table 3.6	Total funding to and number of Fellowships in each career stage category in 2006–2008 and 2009–2011, and for the period 2006 to 2011
Table 3.7	Major sources of funding to Fellowships – level of funding to and number of Fellowships in each career-stage category in the period 2006 to 2011
Table 3.8	Distribution to states and territories of funding to all Fellowships types
Table 4.1	Distribution of career-stage categories for tumour-specific and not tumour-specific Fellowships
Table 4.2	Funding to and number of tumour-specific Fellowships in each career stage category, for the top 20 funded tumour types, for research into more than one tumour type and across multiple tumour streams
Table 5.1	Major funding sources that provided data for building cancer research capacity initiatives and infrastructure awards
Table 5.2	Funding to building cancer research capacity initiatives and infrastructure in 2006–2008, 2009–2011 and for the period 2006 to 2011
Table 5.3	Distribution to states and territories of funding to building cancer research capacity initiatives and infrastructure in 2006–2008 and 2009–2011, for the period 2006 to 2011 and the proportion of funding to each state and territory
Table 5.4	Major sources of funding – total funding to and number of awards funded for building cancer research capacity initiatives and infrastructure categories in the period 2006 to 2011
Table 6.1	Total funding to, proportional distribution and number of awards funded for building cancer research capacity initiatives and infrastructure categories in each CSO category in the period 2006 to 2011
Table 6.2	Total funding and number of awards to tumour-specific, and not tumour-specific, building cancer research capacity and infrastructure categories in the period 2006 to 2011
Table 6.3	Total funding to and number of awards to single and multiple tumour types, in each tumour stream, and across multiple tumour streams for building cancer research capacity and infrastructure awards in 2006–2008 and 2009–2011, and for the period 2006 to 2011
Table 6.4	Total funding and number of awards to building cancer research capacity and infrastructure categories by tumour stream focus research in the period 2006 to 2011
Table 7.1	Combined funding identified by Cancer Australia’s National Audits of cancer research in 2006–2008 and 2009–2011, and the total for the period 2006 to 2011
Table 7.2	Level of cancer research funding in Australia, Canada in the UK 2006 to 2011, funding as a percentage of GDP and per capita funding
Table 7.3	Total identified funding to single tumour stream research in Australia in 2006–2008 and 2009–2011, and for the period 2006 to 2011



List of appendices

Appendix A – Organisations invited to provide details of their direct funding to support cancer research in Australia, 2006 to 2011

Appendix B – Email Introduction to the Audit sent to cancer research funding organisations

Appendix C – Invitation from CEO of Cancer Australia to cancer research funding organisations

Appendix D – Common Scientific Outline (CSO) classification of cancer research

Appendix E – Tumour streams and tumour types

Foreword

Cancer places a significant burden on the Australian population. In Australia, one in two men and one in three women will be diagnosed with cancer in their lifetime.¹

Cancer Australia was established by the Australian Government in 2006 to benefit all Australians who are diagnosed with cancer, their families and carers. Cancer Australia aims to reduce the impact of cancer, address disparities and improve outcomes for people affected by cancer, by leading and coordinating national, evidence-based interventions across the continuum of care.

The *Cancer Australia Act 2006* specifies a number of roles for Cancer Australia, including guiding scientific improvements to cancer prevention, treatment and care, and overseeing a dedicated budget for research into cancer. To inform research priorities, Cancer Australia has published two national audits of funding to cancer research projects and research programs, in 2008 and 2014.^{2,3} The recently released report, *Cancer Research in Australia: an overview of funding to cancer research projects and research programs in Australia 2006 to 2011*, identified the national pattern of investment in cancer research projects and research programs across the nine years covered by the two audits (2003 to 2011).

Cancer Research in Australia: an overview of funding initiatives to support cancer research capacity in Australia 2006 to 2011 is the first national report of its kind. The report describes the pattern of funding provided to people support schemes, initiatives which build cancer research capacity, and infrastructure. As the foundational report for cancer research support in Australia, this audit will be of interest and relevance to all funders of cancer research, policy makers, researchers, and consumers.

The report also combines data from the audit of direct funding awarded to cancer research projects and research programs in the period 2006 to 2011, to provide, for the first time, a national overview of funding to cancer research in Australia.

The findings in this report will provide Cancer Australia and other funders of cancer research with the evidence to inform research investment policy. It is vital to ensure that opportunities to support new and established cancer researchers continue to be available in Australia, and that resources and infrastructure are provided in the most efficient and cost-effective manner.

Looking to the future, it is important that Australia has a sufficient cancer research workforce and appropriate infrastructure to take advantage of rapid advances in our understanding of cancer to achieve improved outcomes for all Australians affected by this disease.

Approaches which bring together various funding sectors and encourage collaboration amongst funders will be important to increase and coordinate fellowship funding across the career spectrum.

National leadership to drive co-funding of large infrastructure and capacity building research initiatives could increase research investment by bringing together smaller funding organisations, new funders, or existing disease-specific funders to collectively support these types of research investment.

Targeted career Scholarships and Fellowships in Public Health and Health Services Research, would build workforce capacity in these fields and deliver improved cancer outcomes and cost-effective cancer care. Similarly, targeted funding in the areas of Cancer Control, Survivorship and Outcomes Research would expedite research in these fields improving care, quality of life, and outcomes.

With many preventable risk factors for cancer being common to other chronic diseases such as cardiovascular disease and diabetes, partnerships which fund collaborative research across disease areas provides a strategic opportunity to support the conduct of Prevention research which would benefit a range of chronic diseases.

Cancer research, however, is a global endeavour and a strategic, targeted, multi-national approach to prioritise, coordinate and co-fund quality collaborative international research will not only expedite improvements in cancer outcomes across countries, but will also ensure that Australian cancer researchers and the national research effort remain at the highest level of international standing and recognition.

A handwritten signature in black ink, appearing to read 'Helen Zorbas', with a large, stylized flourish at the end.

Helen Zorbas AO
CEO
Cancer Australia

Synopsis

Audit methodology

Cancer Research in Australia: an overview of funding initiatives to support cancer research capacity in Australia 2006 to 2011 is a descriptive analysis of the data from Cancer Australia's first National Audit of funding for people support, building cancer research capacity initiatives and infrastructure. The report includes a description of each category of research funding, the sources of funding to each category, and investment in each of the categories across the cancer research continuum, in specific tumour streams, and to specific tumour types. The report also describes for the first time, the investment in people support across the cancer research career pathway at a national level.

Combining data presented in *Cancer Research in Australia: an overview of funding to cancer research projects and research programs in Australia 2006 to 2011*, with data collected in the present audit, the report presents for the first time, a national overview of funding to cancer research in Australia and also includes international comparisons of overall funding to cancer research.

It should be noted that this audit does not capture funding of:

- ▶ People support, building research capacity and infrastructure for health and medical research in general;
- ▶ Internal funding of research staff by Cancer Councils, universities, medical research institutes and hospitals;
- ▶ Funding to individual staff positions which were not Scholarships, Fellowships or Academic Cancer Research Chairs;
- ▶ Funding to early and mid-career researchers where salary support is provided as part of a project or program grant; and
- ▶ In-kind support, routine clinical care, support services, data collection and ongoing monitoring of service delivery and outcomes, new buildings and laboratory fit-outs, and small pieces of equipment.

This audit also did not capture funding provided for cancer research projects and research programs; such funding has been captured in Cancer Australia's previous audit – *Cancer Research in Australia: an overview of funding to cancer research projects and research programs in Australia 2006 to 2011*.

Key findings

People support schemes

Funding

In the period 2006 to 2011, a total of \$304 million in funding was provided to 1,381 people support scheme awards in the form of Scholarships, Fellowships and Academic Cancer Research Chairs.

Funding increased year-on-year from \$33.3 million in 2006 to \$66.2 million in 2011.

From 2006–2008 to 2009–2011, the total number of, and total funding to, Scholarships, Fellowships and Academic Cancer Research Chairs increased, and the total number of, and total funding to, all Fellowship types increased.

Sources of funding

The Australian Government was the largest provider of funding to Scholarships (\$10.3 million, 37% of total funding) and Fellowships (\$158.5 million, 60% of total funding) in the period 2006 to 2011.

In the period 2006 to 2011, 95% of people support scheme awards were supported by a single identified funder.

Scholarships and Fellowships funded

In the period 2006 to 2011, the predominant focus of people support scheme awards was for cancer research in the Broad Research Areas of Basic Science, and Clinical Medicine and Science, which together accounted for 88% of both Scholarships and Fellowships funded. Seven percent of Scholarships and nine percent of Fellowships were awarded to individuals undertaking research in the area of Public Health. Five percent of Scholarships and three percent of Fellowships were awarded to individuals undertaking Health Services research.

From 2006 to 2011, Early career Fellowships were the most commonly awarded type of Fellowship, and Mid-career Fellowships were the least common Fellowship award.

Pattern of funding to cancer research areas – the Common Scientific Outline

In the period 2006 to 2011, Prevention research received the lowest level of funding for people support scheme awards.

Pattern of funding to cancer research areas – tumour research focus

In the period 2006 to 2011, three quarters (75%; \$20.6 million) of funding to Scholarships and more than half (52%; \$136 million) of funding to Fellowships was for tumour-specific research.

The top five tumour types researched in awarded Scholarships (breast cancer, leukaemia, colon and rectum cancer, prostate cancer and lung cancer including pleural mesothelioma) and Fellowships (breast cancer, leukaemia, prostate cancer, melanoma, and colon and rectum cancer) included the most commonly diagnosed cancers in Australia.¹

A 'tumour stream' comprises a collective group of like cancer types.

In the period 2006 to 2011, 10% of funding for tumour-specific Fellowships went to 42 Fellowships which involved research across multiple tumour streams. Almost half (19) had a focus on breast cancer and the most common combinations of tumour streams researched together were breast cancer, gynaecological cancers and genitourinary cancers.

Building cancer research capacity initiatives and infrastructure

Funding

In the period 2006 to 2011, a total of \$453 million in funding was provided for 437 awards for building cancer research capacity initiatives and infrastructure.

From 2006–2008 to 2009–2011, both the number of awards and total funding provided for building cancer research capacity initiatives and infrastructure increased, and the total funding and number of funded awards for building cancer research capacity initiatives and infrastructure increased in each state and territory, except for Tasmania, Australian Capital Territory and the Northern Territory.

Sources of funding

In the period 2006 to 2011, the Australian Government provided \$199 million (44% of total funding) for building cancer research capacity initiatives and infrastructure.

In 2006 to 2011, three quarters (75%) of funding for building cancer research capacity initiatives and infrastructure (387 individual awards) was provided by single funding sources. The remaining 25% of funding (50 individual awards) was co-funded by two or more funding sources.

Six or more different funding sources provided funding for 323 awards to support Biobanks, Data repositories, Centres of research, Capacity building initiatives, and Equipment and Partnerships awards. While Centres of research, Capacity building and Biobanks received funding from six different funding sources, the majority of funds were provided by only two or three of these funding sources.

Pattern of funding to cancer research areas – the Common Scientific Outline

In the period 2006 to 2011, 56% of funding for building cancer research capacity initiatives and infrastructure was provided to the CSO categories of Biology and Treatment. Funding for building cancer research capacity initiatives and infrastructure increased for all CSO categories except Aetiology.

Funding to Centres of research and Capacity building awards was predominantly for Biology (45%; \$59.9 million; and 48%; \$25.2 million, respectively) and Treatment (42%; \$56.8 million; and 32%; \$16.9 million).

Over two thirds of funding to Biobanks was for research in Early Detection, Diagnosis and Prognosis (\$20.8 million), and funding to Data repositories was mostly for research in Early Detection, Diagnosis and Prognosis (46%; \$11.3 million) and Aetiology (26%; \$6.4 million).

Funding to Partnerships were mostly for research in Biology (40%; \$4.4 million), followed by Treatment (29%; \$3.2 million) and Cancer Control, Survivorship and Outcomes Research (25%; \$2.7 million). Nearly two thirds of partnership awards were tumour-specific.

A single Strategic initiative provided 97% of the funding to research in the area of Prevention.

Pattern of funding to cancer research areas – tumour research focus

In the period 2006 to 2011, 61% of funding (\$277 million) for building cancer research capacity initiatives and infrastructure was for tumour-specific research.

Funding increased from 2006–2008 to 2009–2011 for most tumour types (colon and rectum, prostate, kidney, breast, melanoma, leukaemia, ovary, sarcoma, pancreas and oesophagus) and remained level for brain.

National and international comparisons

Combining data presented in *Cancer Australia's Cancer Research in Australia: an overview of funding to cancer research projects and research programs in Australia 2006 to 2011* with the data from the current audit allowed, for the first time, for the national pattern of funding to cancer research in Australia to be described.

Funding

In the period 2006 to 2011, a total of \$1.77 billion in funding was provided in Australia to 4,924 cancer research projects and research programs, people support scheme awards and building cancer research capacity initiatives and infrastructure.

Funding to cancer research per capita and as a percentage of GDP was similar in Australia, Canada and the UK.

Sources of funding

In the period 2006 to 2011, the Australian Government provided \$1.03 billion (58% of total funding) to cancer research projects and research programs, people support scheme awards and building cancer research capacity initiatives and infrastructure.

Overall, 441 of 4,924 (9%) of all awards as grants and initiatives captured across the research audits were co-funded.

Pattern of funding to cancer research areas – the Common Scientific Outline

From 2006–2008 to 2009–2011, the level of funding increased to each CSO category in Australia and 62% of all national funding to cancer research was provided to the CSO categories of Biology and Treatment.

The pattern of funding to CSO categories in Australia was broadly similar to international patterns of funding.

Pattern of funding to cancer research areas – tumour research focus

In the period 2006 to 2011, the level of funding increased for each individual tumour stream in Australia. Breast cancer, colorectal cancer, haematological cancers and genitourinary cancers received the highest levels of funding in Australia and were also the four highest proportionally funded tumour streams in Canada and the UK.

Colorectal cancer and skin cancers received higher levels of proportional funding in Australia than Canada and the UK in 2006 to 2011.

The proportional funding to research in many cancers was low compared to incidence, mortality and burden of disease on the Australian population. These cancers included cancers of the lung, lymphoma, pancreas, oesophagus, kidney, stomach, bladder, myeloma and cancer of unknown primary.

Optimising investment in cancer research - considerations for the future

Data provided in this report informs funders and policymakers of people support, building cancer research capacity initiatives and infrastructure investments to date, provides the evidence-base to inform future cancer research support funding investments in these areas, and lays the foundation for maximising the benefit and impact of cancer research funding efforts. Specific considerations for the future include:

People support schemes

Collaboration

This audit showed that across the career spectrum, Mid-career Fellowships were the least commonly awarded Fellowship type and 95% of people support scheme awards were funded by a single source.

New or expanded people support schemes that focus on awarding Fellowships to mid-career researchers could, in the short term, increase the number of Mid-career Fellowships; however, a national approach which brings together funders to co-ordinate their funding to people support could provide a more sustainable model to support Fellowships across the entire career spectrum. Whilst the NHMRC is the largest funder of people support scheme awards for cancer research, strategies which reduce the reliance on a single funder may improve our ability to support cancer researchers through the career continuum.

Investment in Public Health and Health Services Research can deliver both economic returns and health gains. With Public Health and Health Services Research Scholarships and Fellowships receiving between 11-12% of funding from 2006-2011, opportunities exist to better support career awards in these areas.

Research in these areas may encompass, but may not be specific to cancer. Approaches which bring together different funding sectors such as health insurers, industry, service providers, state and territory governments and chronic disease organisations to collaboratively fund awards, could provide a strategic approach to increasing the number of awards in these areas. A coordinated approach, to award funding to Scholarships and Fellowships across the career continuum in Public Health and Health Services Research, would build workforce capacity in these areas and provide a pathway for career funding support. Such an approach could follow the framework of Cancer Australia's Priority-driven Collaborative Cancer Research Scheme (PdCCRS), which brings together multiple funders to invest in cancer research in common priority areas.

The mapping of Scholarships and Fellowships for different tumour types in the audit provides the opportunity for tumour-specific funders to consider how to best support the career path of researchers in order to build or maintain the research workforce in these fields. Collaboration between funders of the same tumour type to support different Scholarships or Fellowships could provide an effective and efficient approach to supporting researchers along the career continuum.

Building cancer research capacity initiatives and infrastructure

Co-funding

In this audit, cancer research capacity building initiatives included funding to establish Centres of research, Clinical research networks, Biobanks and awards which support laboratories and facilities or teams of researchers conducting cancer research. Typically these types of initiatives require larger amounts of funding than people support scheme awards to individuals or project and program grants to small teams of investigators

This audit identified that in the period 2006 to 2011, three quarters of funding (and over 380 different awards) for building cancer research capacity initiatives and infrastructure was provided by single funding sources.

Opportunities to co-fund grants in these areas may allow smaller funding organisations, new funders, or existing disease-specific funders to collectively support building research capacity initiatives and infrastructure. The opportunity for smaller or new funders to co-fund with existing funders or other disease-specific funders would increase the available funding for these types of grants. The provision of Australia-wide co-funding opportunities could be achieved through the development of a new national collaborative funding scheme or through the expansion of an existing scheme.

A co-funding approach, with a single award to any one institution, would allow funders to continue to support infrastructure grants in these areas, while reducing the administrative burden associated with grant management for both researchers and individual funders.

Targeted research investment

The mapping of proportional funding to the CSO categories for each Building cancer research capacity initiatives and infrastructure category, presents opportunities for targeted research investment.



The incidence and prevalence of cancer in Australia is increasing while the associated mortality rate is decreasing¹; future improvements in cancer outcomes will be influenced by the effectiveness of our current and future cancer control strategies.

The provision of targeted funding to Centres of research and Capacity building initiatives in the areas of Cancer Control, Survivorship and Outcomes Research would accelerate research in these fields furthering the effectiveness of our cancer control strategies, and improving the care, quality of life, and outcomes of people diagnosed with cancer.

The majority of funding provided to Biobanks was principally for the purposes of Early Detection, Diagnosis and Prognosis. Given the increasing focus on the mutational status of tumours and the capacity of individual tumour genotypes to influence treatment response, targeted funding could be provided to researchers to access existing Biobank samples for the purpose of research into treatment response and improved clinical management.

Over 90% of funding Partnership awards went to the areas of Biology, Treatment and Cancer Control, Survivorship and Outcomes Research and 2% of funding to Partnership awards supported research in Prevention.

Many preventable risk factors for cancer are common to other chronic diseases such as cardiovascular disease and diabetes. Partnership awards which would bring together researchers from different chronic disease areas would accelerate the conduct of Prevention research, increase our knowledge of effective prevention approaches, and could improve outcomes and reduce the burden of disease across a range of chronic disease areas including cancer.

National and International funding

Research funding investment in Australia could be prioritised for cancers which have a high impact (incidence and mortality) and burden of disease – disability-adjusted life years (DALYs).

In the period 2006 to 2011, there was a similar cancer research funding pattern, both across the CSO continuum and also across tumour streams, in Australia, Canada and the United Kingdom. These funding patterns identify areas for potential international collaboration in the funding of cancer research. The lower proportional funding identified in common areas provides the opportunity for national funders to direct, co-operate and co-fund collaborative international research endeavours.

References

1. Australian Institute of Health and Welfare 2014. Cancer in Australia: an overview 2014. Cancer series No 90. Cat. no. CAN 88. Canberra: AIHW.
2. Cancer Australia 2008. Cancer research in Australia: an overview of cancer research projects and research programs in Australia 2003–2005. Canberra: Cancer Australia.
3. Cancer Australia 2014. Cancer Research in Australia: an overview of funding to cancer research projects and research programs in Australia 2006 to 2011. Surry Hills: Cancer Australia.

Chapter 1 – Introduction

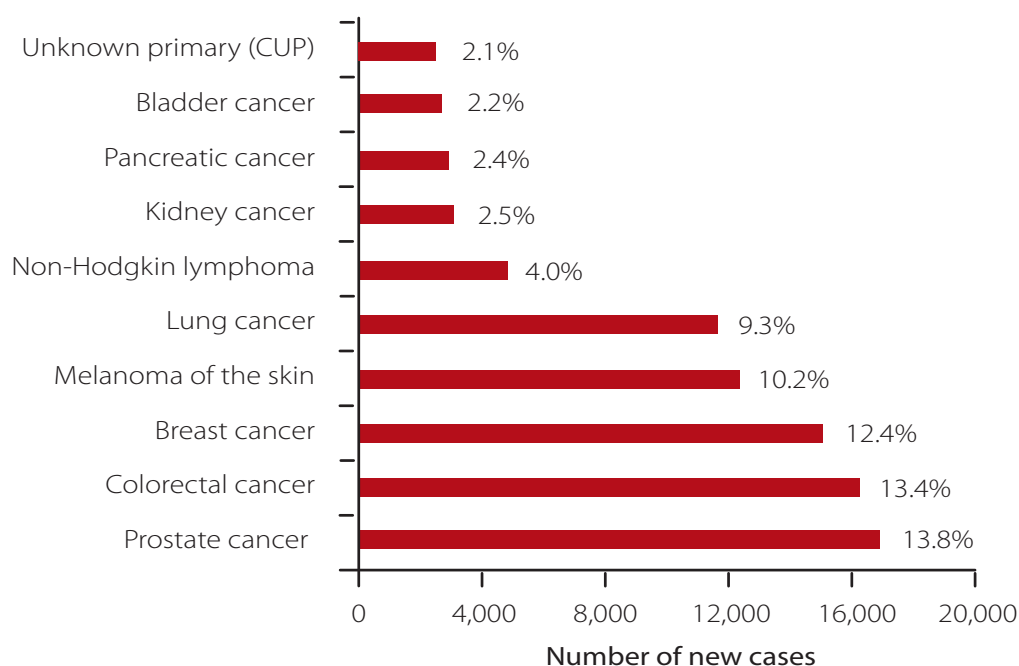
1.1 Background

Cancer in Australia

Incidence and Mortality

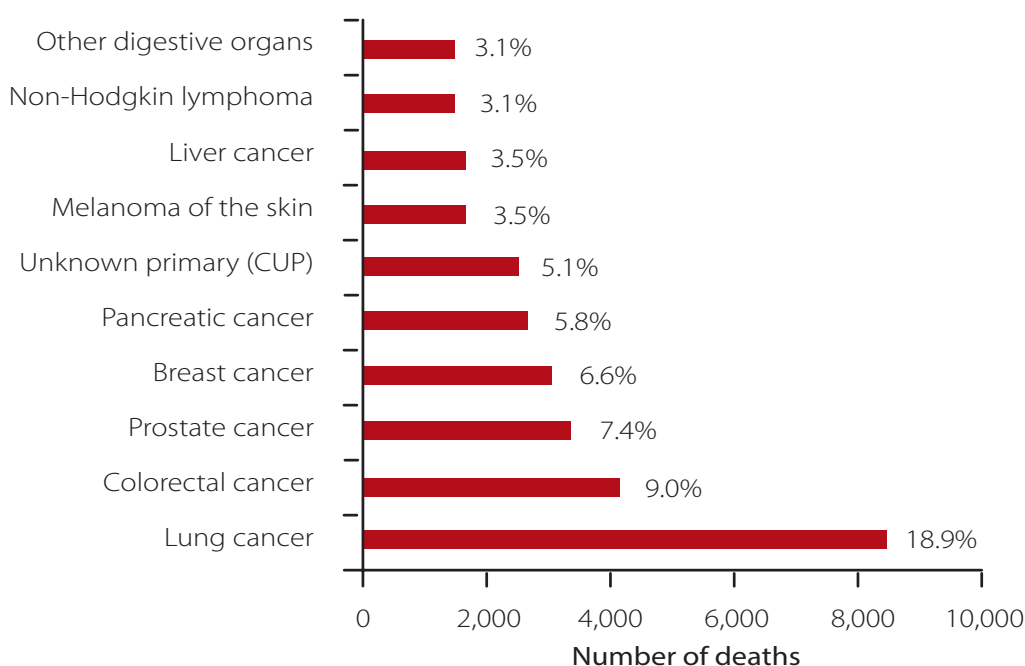
Approximately one in two Australian men and one in three Australian women will be diagnosed with cancer in their lifetime. In 2014, it was estimated that there would be 123,920 new cases of cancer diagnosed in Australia and 45,780 deaths due to this disease. Cancer accounts for 29% of deaths from all causes in Australia and is second only to cardiovascular disease as a cause of death.² The estimated ten most common cancers in Australia by incidence and mortality are shown in Figures 1.1 and 1.2.

Figure 1.1 The estimated ten most commonly diagnosed cancers in Australia, 2014, and the percentage contribution of each cancer type to total incidence



Note: The data in Figure 1.1 were sourced from: Australian Institute of Health and Welfare 2014. Cancer in Australia: an overview 2014. Cancer series No 90. Cat. no. CAN 88. Canberra: AIHW.

Figure 1.2 The estimated ten most common causes of cancer death in Australia, 2014, and the percentage contribution of each cancer type to total mortality



Note: The data in Figure 1.2 were sourced from: Australian Institute of Health and Welfare 2014. Cancer in Australia: an overview 2014. Cancer series No 90. Cat. no. CAN 88. Canberra: AIHW.

Between 1982 and 2010, the actual number of new cancer cases diagnosed in Australia more than doubled and the number of deaths from cancer increased by more than 70% from 1982 to 2011.³ When changes in the size and average age of Australia's population are taken into consideration (the age-standardised rate), this translates to a change in incidence rate from 383 to 488 persons per 100,000 from 1982 to 2010. The number of deaths from cancer increased from 24,922 in 1982 to 43,221 in 2011; however, the age-standardised mortality rate decreased from 209 to 173 deaths per 100,000 from 1982 to 2011.³

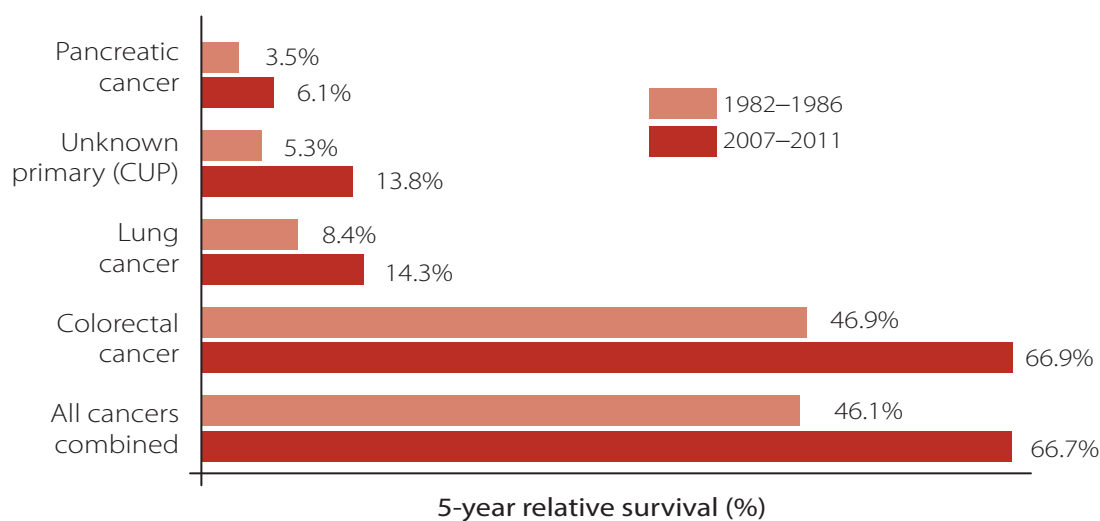
At the end of 2009, there were 861,057 people living in Australia who had been diagnosed with cancer in the previous 28 years. This figure included 340,474 people diagnosed with cancer in the previous 5 years.¹

Survival

Relative survival compares the survival of a group of people diagnosed with cancer to the expected survival of similarly aged people in the general population. Survival rates provide information on the likelihood that a person will be alive at a specified point in time (such as five years) following a diagnosis of cancer.

For the 2007–2011 period, the 5-year relative survival rate for all cancers combined was 67%, compared with 46% in 1982–1986 (Figure 1.3). Five-year relative survival rates from the 1982–1986 to the 2006–2011 periods have increased markedly for some cancers, for example, colorectal cancer (46.9% to 66.9%). By contrast, other cancers have shown a smaller absolute increase, albeit a larger proportional increase, in 5-year relative survival rate over the same period, such as lung cancer (8.4% to 14.3%; 70% proportional increase), cancer of unknown primary (CUP, 5.3% to 13.8%; 160% proportional increase) and pancreatic cancer (3.5% to 6.1%; 74% proportional increase).¹

Figure 1.3 Changes in 5-year relative survival over time for selected cancers



Note: The data in Figure 1.3 were sourced from: Australian Institute of Health and Welfare 2014. *Cancer in Australia: an overview 2014. Cancer series No 90. Cat. no. CAN 88. Canberra: AIHW.*

Cancer has a major impact on the Australian community and is the leading contributor to the burden of disease.⁴ The ‘disability-adjusted life year’ (DALY) is a measure of disease burden and combines data on the extent of premature death and non-fatal health impacts of disease. It is estimated that in 2012, cancer caused 551,300 DALYs to be lost, representing 19% of the burden of all diseases in Australia.¹ By comparison, cardiovascular disease contributed to 16% of the burden of disease, whilst nervous system and sense organ disorders accounted for 14% of the burden of disease and mental disorders accounted for 13% of the burden of disease.² In terms of health care expenditure, in 2008–09, cancer and other neoplasms accounted for \$5 billion or 7% of total recurrent health spending.²

Cancer Australia

Cancer Australia was established by the Australian Government in 2006 to benefit all Australians who are diagnosed with cancer, their families and carers. Cancer Australia aims to reduce the impact of cancer, address disparities and improve outcomes for people affected by cancer, by leading and coordinating national, evidence-based interventions across the continuum of care.

Cancer Australia builds the evidence base, analyses, interprets and translates the latest scientific cancer research and data to inform policy and practice. To this end, Cancer Australia has published national audits of funding to cancer research projects and research programs in 2008 and 2014.^{5,6} The recently released report, *Cancer Research in Australia: an overview of funding to cancer research projects and research programs in Australia 2006 to 2011*, identified the national pattern of investment in cancer research projects and research programs across the nine years covered by the two audits (2003 to 2005 and 2006 to 2011). The audits documented the direct funding provided to research in different tumour streams and on different tumour types, and provided valuable data about the areas of cancer research being funded and the extent of collaboration between investigators in the cancer research projects and research programs identified. Specific considerations for optimising cancer research funding were recommended in this report, including:

- ▶ Co-funding for cancer research to increase the impact and delivery timelines of a range of cancer research;
- ▶ Development of joint prevention or health services research funding initiatives by funders of different chronic diseases, which would build the evidence base to support strategies to reduce the risk of cancer and other chronic diseases, and provide more cost-effective models of care;
- ▶ Targeting funding to support cancer research for tumours which have a high impact or burden of disease, or for population groups that experience poorer cancer outcomes;
- ▶ Fostering research collaboration by developing and implementing funding models which value and reward national and international collaborations; and
- ▶ Creating opportunities to establish an international collaborative to fund priority research across different countries.

1.2 Objective of the new National Audit of funding for people support, building cancer research capacity initiatives and infrastructure

Cancer Australia's previous National Audits of cancer research have specifically focused on identifying the extent of direct funding to cancer research projects and research programs in Australia. However, these audits were not designed to capture the investment provided to support cancer research through other means. To provide a more comprehensive understanding of the breadth of cancer research funding activities in Australia, this present National Audit identifies the amount and pattern of funding awarded to people support schemes and initiatives which build cancer research capacity and infrastructure, in the period 2006 to 2011. The data captured by this current audit will complement the data collected in the audit of direct funding awarded to cancer research projects and research programs in the period 2006 to 2011, and provide, for the first time, an overview of the funding provided to cancer research in Australia. Results of this audit are expected to be of interest and value to funders of cancer research, policy makers, researchers and consumers.

1.3 Scope of this National Audit

This National Audit collected data on funding to the following activities for which the cancer research to be undertaken was clearly defined:

- ▶ **People support schemes** that support cancer researchers through their career path, specifically:
 - **Scholarships** to support researchers undertaking a research project towards qualification for a higher degree. Data provided were mostly for researchers undertaking a PhD, but some data was also collected for clinicians undertaking a research project for a higher medical degree;
 - **Fellowships** which provide higher degree graduates with salary support as they progress through their career path. Fellowship awards collected in this audit ranged in length from 1 to 5 years, for researchers working full-time or part-time, and some Fellowship awards also provided funding to support the research project or program to be undertaken; and

- **Academic Cancer Research Chairs**, which provide salary support for cancer researchers in a leadership position. It is important to note that some Fellowship awards were also for cancer research leaders.
- ▶ **Building cancer research capacity initiatives**; including:
 - **Centres of research** (including Cancer Research Centres, Centres of Research Excellence and Collaborative Research Centres), which encompass teams of researchers working collaboratively on a common research agenda;
 - **Capacity building** grants which encompass awards of funding which support laboratories and facilities or a team of researchers conducting cancer research;
 - **Clinical research networks**, such as co-operative cancer clinical trials groups;
 - **Laboratory research networks**, such as laboratory research-based consortiums;
 - **Partnerships** which encompass awards that support collaborative partnerships of researchers; and
 - **Strategic initiatives** which encompass large capacity building awards to support programs of research in areas of identified need.
- ▶ **Infrastructure**, including:
 - **Equipment** to support cancer research, funded by awards of \$10,000 or more;
 - **Biobanks**, including population-based and disease-based biobanks and tumour tissue repositories;
 - **Data repositories**, such as clinical trial databases and population databases for cancer research; and
 - **Platform services/resources**, such as animal facilities and facilities providing specialised technological services.

This audit did not seek information on in-kind support to cancer research, funding for routine clinical care, support services, funding for staff costs to support data collection, ongoing monitoring of service delivery and outcomes, funding of integrating authorities, cancer registries, new buildings and laboratory fit-outs or small pieces of equipment (i.e. less than \$10,000).



Chapter 2 - Methodology

2.1 Approach to this National Audit

As successfully used in Cancer Australia's previous audits of funding to cancer research projects and research programs, a 'top-down' methodology was adopted for this present audit to obtain funding data from organisations likely to provide grants to support cancer research in areas identified within the scope of this audit. This approach has also successfully been used by other international organisations, including the National Cancer Research Institute of the United Kingdom and the Canadian Cancer Research Alliance.^{7,8} Using a consistent approach to collecting cancer funding data, maximises our ability to make comparisons between this and other audits of cancer research funding. This approach has resulted in response rates ranging from 62–96%.^{5,6,7} In comparison, surveys using the 'bottom-up' approach of contacting recipients of funding have reported lower response rates of 32–42%.^{9,10}

2.2 Sources of data

It is not known exactly how many organisations and groups provide funding for people support, building cancer research capacity and infrastructure in Australia. In identifying major funding organisations to approach for this audit, we first referred to the government and non-government organisations invited to provide details of their funding for Cancer Australia's previous national audits, and then undertook a search for other potential funders of cancer research using the internet to research cancer funding websites and annual reports of organisations undertaking cancer research. In this way, we identified 149 Australian organisations, including the National Health and Medical Research Council (NHMRC) and the Australian Research Council (ARC), and non-government organisations (including Cancer Councils), cancer charities, foundations and medical research institutes that might provide funding support to Australian cancer research. In addition, 21 international funding agencies and organisations were identified as potentially funding people support, building cancer research capacity initiatives and infrastructure for cancer research in Australia.

2.3 Data collection

From January to March 2013, Cancer Australia contacted a total of 170 organisations and invited each to provide details of its funding to cancer research in areas of people support, and building cancer research capacity and infrastructure (see Appendix A for the list of recipients). The email and letter sent to each organisation is shown in Appendices B and C, respectively. Table 2.1 lists the information that was requested of funders to be supplied in the form of an electronic spread sheet or text document.

Approximately four weeks after the initial invitation, follow-up emails were sent to funding organisations which had not responded, in order to verify that the request had reached an appropriate organisational contact and to answer any questions arising from the request.

Following submission to Cancer Australia, data were checked to ensure that the data provided were appropriate for inclusion in the audit. Details of funding provided that did not fit the scope of the audit (e.g. cancer research projects and research programs) were removed from the final file. All data received were entered into a Microsoft Excel™ (2010) database for analysis.



Table 2.1 Cancer research funding data requested of funders for this National Audit

Table 2.1		
People Support	<ol style="list-style-type: none"> 1. PhD Scholarships 2. Fellowships (Early-, Mid- and Late-career stage) 3. Other researcher support schemes 	<ul style="list-style-type: none"> - Eligibility criteria for career-stage fellowships that you fund and type of researcher supported (e.g. Laboratory Researchers, Clinician Researchers, Health Service or Public Health Professionals); - Name of researcher, Host/Administering/Principal institution and any co-funder(s) for each grant; - Summary or abstract of the research to be undertaken (including the title and any key words) for each grant; and - Amount of funding provided for each calendar year (excluding GST).
Building Research Capacity	<ol style="list-style-type: none"> 1. Funding to Centres of research (including Research Centres, Centres of Excellence and Collaborative Research Centres) 2. Networks such as clinical trial groups 3. Partnership grants 4. Strategic or Priority-driven awards 	<ul style="list-style-type: none"> - Name of lead researcher and collaborators (i.e. named co-investigators); - Host/Administering/Principal institution and any co-funder(s); - Summary or abstract of the research to be undertaken (including the title and any key words); and - Level of funding provided for each calendar year (excluding GST), with the amount of funding apportioned to each of these categories: <ul style="list-style-type: none"> • Personnel salary costs; • Project costs; and • Infrastructure costs and equipment (items valued at \$10,000 or more).
Infrastructure support	<ol style="list-style-type: none"> 1. Equipment 2. Population-based biobanks 3. Disease-based biobanks 4. Tumour tissue repositories 5. Stem cell biobanks 6. Data repositories 	<ul style="list-style-type: none"> - Name of lead researcher and collaborators (i.e. named co-investigators); - Host/Administering/Principal institution and any co-funder(s); - Summary or abstract of the research to be undertaken (including the title and any key words); and - Amount of funding provided for each calendar year (excluding GST), with the amount of funding apportioned to each of these categories: <ul style="list-style-type: none"> • Personnel salary costs; • Project costs; and • Infrastructure costs and equipment (items valued at \$10,000 or more).

2.4 Which data are included in this National Audit?

This audit captures and reports on the amount and pattern of the funding provided to cancer research through people support schemes, and initiatives which build cancer research capacity and infrastructure in Australia from 2006 to 2011. Only funding awards for research activities which were specifically or predominantly cancer-focused were included in the audit.

People support in the form of Scholarships and Fellowships (see section 1.3) was captured in the data provided by funders; a separate follow-up request was required to capture data on cancer-specific Academic Cancer Research Chairs. For each funding award in the Building Research Capacity and Infrastructure categories (see Table 2.1), funders were asked to separately apportion budgets for supporting personnel, project costs, infrastructure costs and equipment. However, due to the difficulty many funders experienced in apportioning these costs, only the total budgets were included in the analyses presented in this report.

2.5 Which data are not included in this National Audit?

This audit did not capture funding provided for cancer research projects and research programs; such funding was captured in Cancer Australia's previous audit – *Cancer Research in Australia: an overview of funding to cancer research projects and research programs in Australia 2006 to 2011*.

Funding for people support, building research capacity and infrastructure for health and medical research in general but not specifically for cancer research, or in which the specific cancer research activity could not be determined, was not included in this audit. Such funding included:

- ▶ Australian Government Research Infrastructure Block Grants and Australian Postgraduate Awards;
- ▶ NHMRC Infrastructure Awards. These awards (Equipment grants and Independent Medical Research Institutes Infrastructure Support Scheme) were not specifically attributed by the NHMRC to cancer research);
- ▶ NHMRC Block Funded Awards for major medical research institutes and which ceased funding in 2006; and
- ▶ State and territory government building research capacity and infrastructure schemes which provide direct support to medical research institutes.

The audit also does not include internal funding of research staff by Cancer Councils, universities, medical research institutes and hospitals, except where these positions were funded from a building cancer research capacity or infrastructure award. It should be noted that other means of support exist for early and mid-career researchers, with many project grants providing salary support for PhD-qualified personnel and building cancer research capacity initiatives also providing employment opportunities. Funding to individual staff positions which were not Scholarships, Fellowships or Academic Cancer Research Chairs were not included as people support scheme awards. In addition, the audit does not include in-kind support, routine clinical care, support services, data collection and ongoing monitoring of service delivery and outcomes, new buildings and laboratory fit-outs, and small pieces of equipment (i.e. less than \$10,000).



2.6 Coding, classification and analysis of grants and awards

The funding provided for each grant or award was entered into the database as the annual amount of funding provided in each calendar year that the grant or award was active. However, some large awards of funding for building cancer research capacity initiatives and infrastructure were reported as a 'bloc' of funding awarded in a single year, although the award was for multiple years of activity. Where 'bloc' funding was awarded to an initiative with a defined period of activity, the amount of funding was apportioned equally to each year in which the initiative was reported as being active.

All funding awards to support cancer research entered into the Cancer Australia database were coded by Cancer Australia staff according to the International Cancer Research Partnership's (ICRP) internationally recognised coding system for cancer research: the Common Scientific Outline,¹¹ and the ICRP's cancer type list.¹²

Common Scientific Outline

The Common Scientific Outline (CSO) is a classification system specific to cancer research. The CSO was developed by the ICRP which includes the United States' (US) National Institutes of Health (including the National Cancer Institute), other USA cancer research funding agencies and the UK's National Cancer Research Institute. The ICRP maintains the CSO classifications system as well as a database of funded research classified by CSO categories.

The CSO system classifies cancer research into seven broad areas:

1. Biology;
2. Aetiology;
3. Prevention;
4. Early Detection, Diagnosis, and Prognosis;
5. Treatment;
6. Cancer Control, Survival and Outcomes Research; and
7. Scientific Model Systems.

Each of these codes is then subdivided into more specific areas of cancer research giving a final figure of 38 individual CSO codes (listed in Appendix D).

In the majority of cases, the description of the grants and awards provided to Cancer Australia consisted of a media or lay summary, rather than a scientific abstract. An analysis of the title, keywords and the summary was used to classify the research to the single CSO code which best reflected the primary focus of the research to be undertaken.^a

Tumour stream and tumour type

Following allocation to a CSO code, individual awards were classified by the tumour stream(s) of focus, i.e. breast cancer, central nervous system cancers, colorectal cancer, genitourinary cancers, gynaecological cancers, haematological cancers, head and neck cancers, lung cancers, musculo-skeletal cancer, skin cancers, cancer of unknown primary (CUP) and upper gastrointestinal cancers), and tumour type or types (see Appendix E). Funding awards for research activities which were not specific to any tumour type were classified as 'not tumour-specific'.

^a In a small minority of cases, a summary of the research undertaken could not be provided. In such cases, internet searches were conducted to confirm the focus of the research undertaken.

Location of research and co-funding

Each award was allocated to the state or territory location of the Chief Investigator's institution or Administering Institution. It was also recorded whether the award was co-funded and the names of the organisation(s) involved in co-funding the award.

People support schemes

Scholarships, Fellowships and Academic Cancer Research Chairs were also classified according to the NHMRC's Broad Research Areas:

- ▶ Basic Science;
- ▶ Clinical Medicine and Science;
- ▶ Public Health Research; and
- ▶ Health Services Research.

Analysis of the eligibility criteria provided by funders of Fellowships allowed classification of Fellowships as:

- ▶ Early career Fellowships;
- ▶ Early/Mid-career Fellowships;
- ▶ Mid-career Fellowships;
- ▶ Senior/Principal Fellowships; and
- ▶ Not career stage-specific Fellowships.

2.7 Coding verification

Following entry of details of funding awards by the coder, all entries were cross-checked by the team leader. Where discrepancies occurred in CSO coding (in approximately 10% of cases), consensus was sought through discussions with the project team and executive to allow re-classification. Analysis of audit data was undertaken using Microsoft Excel™ (2010).

2.8 Ownership and subsequent access to data

The data supplied by participants are held in confidence by Cancer Australia. Access to identifiable information is limited to Cancer Australia staff involved in the audit.

2.9 Oversight of the National Audit

The initial scope and methodology of the audit were determined after discussions with members of Cancer Australia's Research and Data Advisory Group (RDAG). This group is composed of members with extensive expertise across the cancer research, data, policy and cancer control spectrum, and includes consumer representation.

Through the data collection, analysis and report drafting stages, advice was sought from an expert Working Group (Table 1). This Working Group advised on specific data items to be collected, potential funding sources to be approached and data to be included or excluded from analysis. The Working Group and members of the RDAG reviewed and provided input on drafts of the audit report.





Chapter 3 - People support scheme funding for cancer research

KEY FINDINGS

In the period 2006 to 2011:

- ▶ \$304 million in funding was provided to 1,381 people support scheme awards in the form of Scholarships, Fellowships and Academic Cancer Research Chairs
- ▶ Funding for people support scheme awards increased year on year, from \$33.3 million in 2006 to \$66.2 million in 2011
- ▶ Only 5% of people support scheme awards were co-funded by two or more funders
- ▶ The Australian Government co-funded more than half (53%) of all co-funded people support scheme awards

Scholarships

- ▶ The Australian Government was the largest provider of funding to Scholarships
- ▶ New South Wales, Queensland and Victoria together received 92% of funding for Scholarships
- ▶ The Scholarships funded were predominantly for cancer research in the Broad Research Areas of Basic Science (46%), and Clinical Medicine and Science (42%)

Fellowships

- ▶ The Australian Government was the largest provider of funding for Fellowships
- ▶ New South Wales, Queensland and Victoria together received 92% of funding for Fellowships
- ▶ The Fellowships funded were predominantly for cancer research in the Broad Research Areas of Basic Science (57%) and Clinical Medicine and Science (31%)
- ▶ The NHMRC provided 66% of funding provided to Fellowships in Basic Science and 76% of funding provided to Public Health. By contrast, the majority of funding for Clinical Medicine and Science and Health Services Research was from non-NHMRC sources
- ▶ Early career Fellowships were the most commonly awarded type of Fellowship
- ▶ Mid-career Fellowships were the least commonly awarded type of Fellowship

Academic Cancer Research Chairs

- ▶ Academic Cancer Research Chairs were mostly funded in the Broad Research Area of Clinical Medicine and Science (66%)

From 2006–2008 to 2009–2011:

- ▶ The total number of, and total funding to, Scholarships, Fellowships and Academic Cancer Research Chairs increased

3.1 Response to the National Audit

Cancer Australia contacted 149 Australian and 21 international organisations known to support cancer research. In total, 81 (73 Australian and 8 international) organisations provided funding data, and all known major funders of cancer research people support, capacity building and infrastructure, responded.

A total of 63 organisations (56 Australian and 7 international) provided data on funding to people support scheme awards in cancer research. Some respondents provided data on behalf of other funders, thus this audit contains data from 70 individual funders of cancer research people support scheme awards. Table 3.1 lists the major funding sources which provided people support data for the audit, the people support scheme types supported and the proportion of people support scheme awards funded.

It is important to note that support for researchers can also come in other forms, such as personnel salary support in research grants, university positions such as lectureships and as salary support in building cancer research capacity initiatives. People support awards which were provided to staff to support general research activities or services (e.g. animal facility managers, general data managers, statisticians etc.) were not included in the scope of this data collection.

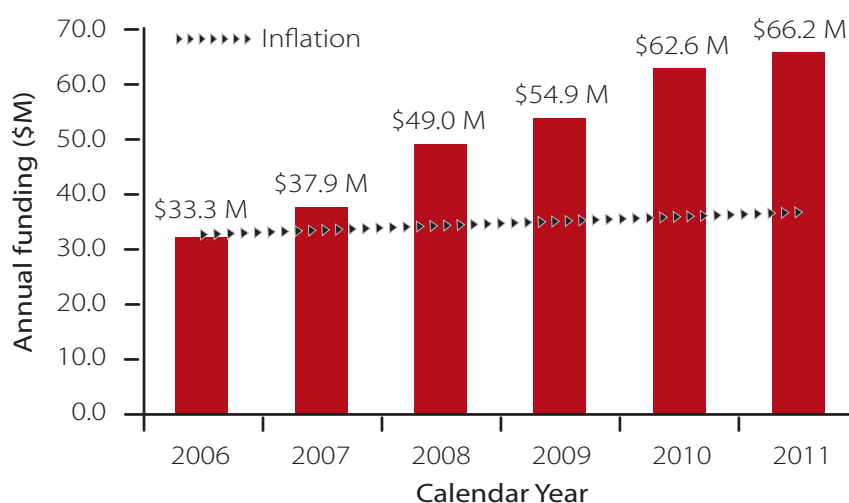
Table 3.1 Major funding sources that provided data for people support scheme awards

Table 3.1		
Funding source (no. funders)	People Support Schemes	Proportion of all funded people support scheme awards
NHMRC	Scholarships Fellowships	47%
Other Australian Government sources (4)	Scholarships Fellowships Academic Cancer Research Chairs	3%
State and territory governments (6)	Scholarships Fellowships Academic Cancer Research Chairs	23%
Cancer Councils (5)	Scholarships Fellowships Academic Cancer Research Chairs	9%
Cancer foundations (10)	Scholarships Fellowships Academic Cancer Research Chairs	8%
Medical research institutes, hospitals and foundations (15)	Scholarships Fellowships	5%
International sources (7)	Scholarships	2%
Universities (7)	Scholarships Fellowships	2%
Philanthropy (8)	Scholarships	2%

3.2 National research investment in people support

This audit identified 1,381 awards for people support in cancer research in the period 2006 to 2011, with total funding of \$304 million. The annual funding to people support (i.e. funds allocated in each year of a people support scheme award) is shown in Figure 3.1. In 2011, the annual funding to people support scheme awards was almost double the annual funding in 2006. The annual increase in funding exceeded the increase which would have been expected due to the impact of inflation alone.¹³

Figure 3.1 Annual cancer research funding to people support in Australia, 2006 to 2011




In the period 2006 to 2011, the total funding provided, and the number of people support scheme awards^b funded, were as follows:

- ▶ Scholarships – \$27.5 million (9% of funding to people support), 475 awards;
- ▶ Fellowships – \$262 million (88% of funding), 888 awards; and
- ▶ Academic Cancer Research Chairs – \$14.3 million (3% of funding), 18 awards.

Table 3.2 details the funding provided to, and the number of awards funded, for each people support type in the trienniums 2006–2008 and 2009–2011, and the total funding for the period 2006 to 2011.

^b Some people support scheme awards were 'top-up' grants. Rather than count multiple awards to an individual Scholarship or Fellowship, these were counted as one Scholarship or Fellowship with multiple co-funders – see section 3.6.

Table 3.2 Funding to people support scheme awards in Australia in 2006–2008, 2009–2011 and for the period 2006 to 2011

Table 3.2			
People support scheme	2006–2008	2009–2011	2006 to 2011
Scholarships	\$10.8 M	\$16.6 M	\$27.5 M
	261	335	475
Fellowships	\$104 M	\$158 M	\$262 M
	508	661	888
Academic Cancer Research Chairs	\$5.0 M	\$9.3 M	\$14.3 M
	10	18	18
Total funding	\$120 M	\$184 M	\$304 M
	779	1,014	1,381
 Awards of funding			

Note: Many people support scheme awards overlapped trienniums. Thus, 121 Scholarships, 284 Fellowships and 10 Academic Cancer Research Chairs were funded in both trienniums. Due to rounding, funding for 2006 to 2011 may not equal the sum of funding in 2006–2008 and 2009–2011 for each row.

Funding for multi-year people support scheme awards was apportioned to each year that the award was active, and these data were provided by funders. Where a people support scheme award overlaps trienniums, it is counted as being active in both. Some people support scheme awards were 'top-up' grants. Rather than count multiple awards to an individual Scholarship or Fellowship, these were counted as one Scholarship or Fellowship with multiple co-funders – see section 3.6.

In the triennium 2009–2011, funding to people support schemes was 53% higher than in 2006–2008, and the number of people support grants funded in 2009–2011 was 30% higher than in 2006–2008.

The change in funding from 2006–2008 to 2009–2011 for each people support type was as follows:

- ▶ The level of funding to Scholarships in 2009–2011 (\$16.6 million) was 54% higher than in 2006–2008 (\$10.8 million), and the number of funded Scholarships in 2009–2011 (335) was 28% higher than in 2006–2008 (261);
- ▶ The level of funding to Fellowships in 2009–2011 (\$158 million) was 52% higher than in 2006–2008 (\$104 million), and the number of funded Fellowships in 2009–2011 (661) was 30% higher than in 2006–2008 (508); and
- ▶ The level of funding to Academic Cancer Research Chairs in 2009–2011 (\$9.3 million) was 86% higher than in 2006–2008 (\$5.0 million), and the number of funded Academic Cancer Research Chairs in 2009–2011 (18) was 80% higher than in 2006–2008 (10).

3.3 Sources of funding to people support in Australia

In section 3.3 of this chapter and in subsequent chapters, where a people support award was co-funded, the total funding amount has been allocated to the funding partner that provided the majority of funds. For co-funded people support scheme awards where the majority funder was not identified, the total funding was allocated to the funder that submitted the funding data to Cancer Australia.

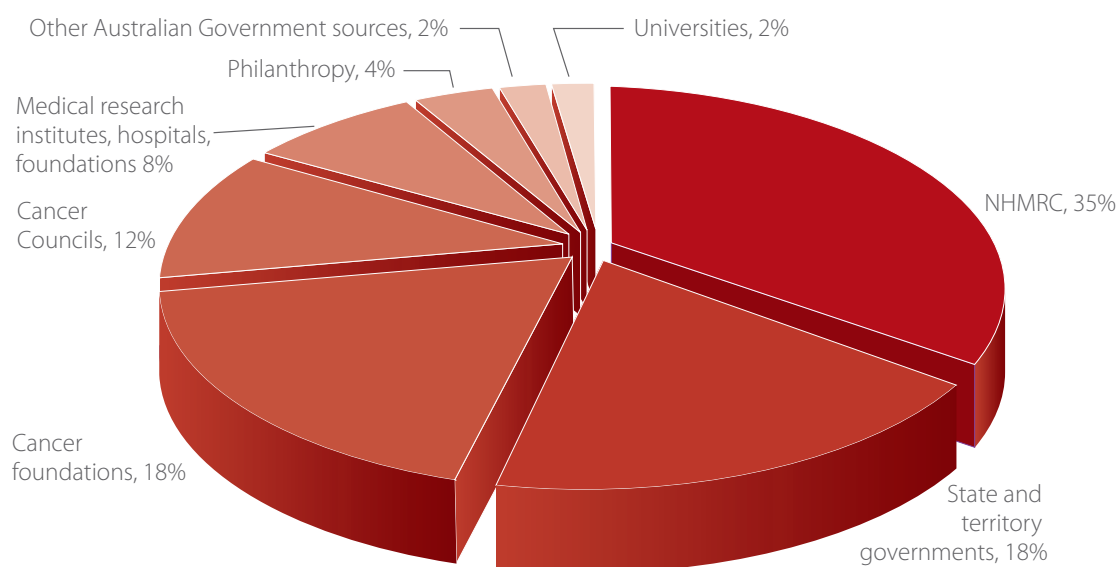
Scholarships

In the period 2006 to 2011, the major funders of Scholarships, the proportion of funding provided by each source (see Figure 3.2) and the total funding amounts provided, and the number of Scholarships funded, were as follows:

- ▶ NHMRC – \$9.7 million (35% of total funding) to 175 Scholarships;
- ▶ State and territory governments – \$5.0 million (18% of funding) to 104 Scholarships;
- ▶ Cancer foundations – \$5.1 million (18% of funding) to 58 Scholarships;
- ▶ Cancer Councils – \$3.2 million (12% of funding) to 50 Scholarships;
- ▶ Medical research institutes, hospitals and foundations – \$2.2 million (8% of funding) to 40 Scholarships;
- ▶ Philanthropy – \$1.1 million (4% of total funding) to 28 Scholarships;
- ▶ Other Australian Government sources – \$0.62 million (2% of funding) to 8 Scholarships; and
- ▶ Universities – \$0.56 million (2% of funding) to 12 Scholarships.

As funding to Scholarships through Universities as Australian Government Australian Postgraduate Awards was not available for this audit, support from the latter two funding sectors is likely to have been underestimated.

Figure 3.2 Proportion of funding to Scholarships by funding source in the period 2006 to 2011



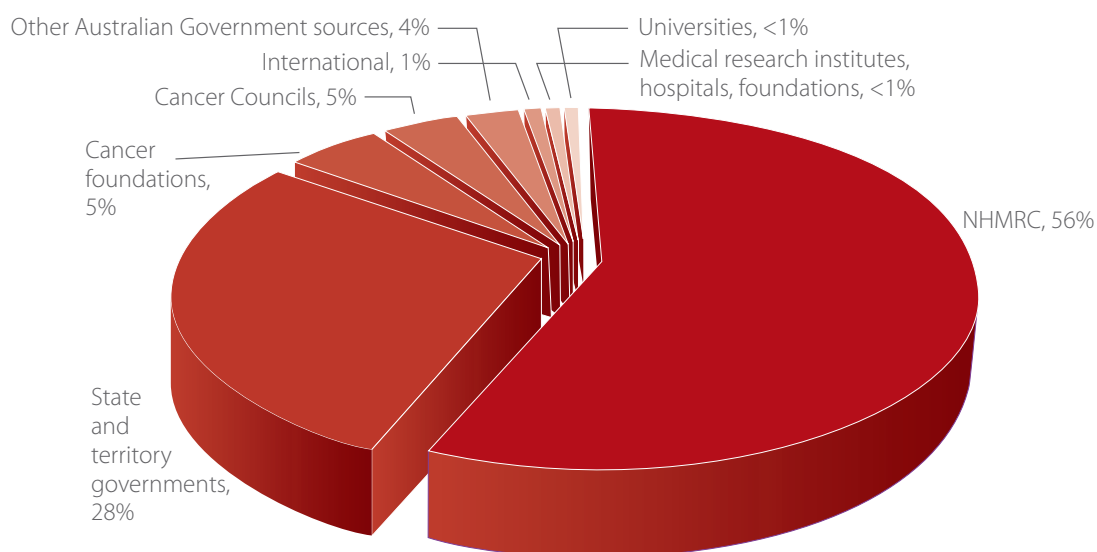
Fellowships

In the period 2006 to 2011, the major funders of Fellowships, the proportion of funding provided by each source (see Figure 3.3) and the total funding amounts provided and the number of Fellowships funded, were as follows:

- ▶ NHMRC – \$148 million (56% of total funding) to 473 Fellowships;
- ▶ State and territory governments – \$73.6 million (28% of total funding) to 204 Fellowships;
- ▶ Cancer foundations^c – \$12.9 million (5% of total funding) to 57 Fellowships;
- ▶ Cancer Councils – \$12.4 million (5% of total funding) to 64 Fellowships;
- ▶ Other Australian Government sources^d – \$10.5 million (4% of total funding) to 31 Fellowships;
- ▶ International funders – \$2.8 million (1% of total funding) to 26 Fellowships;
- ▶ Medical research institutes, hospitals and foundations – \$1.3 million (<1% of total funding) to 23 Fellowships; and
- ▶ Universities – \$1.1 million (<1% of total funding) to 10 Fellowships.

Please note that many Medical research institutes, hospitals and foundations and Universities did not keep sufficient data on Fellowships that were specifically for cancer research, and thus the funding provided will be an under-estimate in this Audit Report.

Figure 3.3 Proportion of funding to Fellowships by funding source in the period 2006 to 2011



^c Cancer foundations include foundations that provide funds specifically to cancer research, e.g. National Breast Cancer Foundation, Leukaemia Foundation and the Prostate Cancer Foundation of Australia.

^d Other Australian Government sources include many Australian Government departments and agencies. The major sources of funding were the Department of Industry (including the Australian Research Council), Cancer Australia and the Department of Health.

Academic Cancer Research Chairs

In the period 2006 to 2011, \$14.3 million in funding was identified for 18 awards to Academic Cancer Research Chairs. The major funders and the number of awards to Academic Cancer Research Chairs were as follows:

- ▶ Cancer Councils – \$6.3 million to 7 Academic Cancer Research Chairs;
- ▶ State and territory governments – \$6.2 million to 8 Academic Cancer Research Chairs;
- ▶ Cancer foundations – \$1.1 million to 1 Academic Cancer Research Chair; and
- ▶ Other Australian Government sources – \$0.73 million to 2 Academic Cancer Research Chairs.

3.4 Co-funding of people support scheme awards

In the period 2006 to 2011, 95% of awards to people support awards (1,306) were supported by a single funding source. The remaining 5% of awards to people support (75) were supported by co-funding from two or more funding sources. Of the 75 co-funded people support scheme awards:

- ▶ Almost three-quarters (15/21) of the co-funded Scholarships were co-funded by Australian Government sources (including the NHMRC) and/or State and territory governments;
- ▶ Almost two-thirds (30/48) of the co-funded Fellowships were co-funded by Australian Government sources (including the NHMRC) and/or State and territory governments; and
- ▶ All (6) of the co-funded Academic Cancer Research Chairs were co-funded by State and territory governments.

Overall, the Australian Government co-funded 53% (40) of all co-funded people support scheme awards.

3.5 State and territory distribution of funding for people support

The state and territory distribution of funding to people support was determined by allocating the funding to each Scholarship, Fellowship and Academic Cancer Research Chair to the geographical location of the recipient's place of study or work.



Scholarships

A comparison of the funding provided for Scholarships in each state and territory in 2006–2008 and 2009–2011, and for the period 2006 to 2011, is shown in Table 3.3.

In the period 2006 to 2011, cancer researchers in Victoria, New South Wales and Queensland together were awarded 92% of identified funding for Scholarships. From 2006–2008 to 2009–2011, both the funding provided, and the number of Scholarships, increased for New South Wales, South Australia, Victoria and the Australian Capital Territory. There was a similar level of funding and number of Scholarships identified in Queensland in each triennium. No Scholarships were identified in the Northern Territory, and in Tasmania there was one Scholarship identified in each triennium.

Table 3.3 Distribution to states and territories of funding to Scholarships in 2006–2008 and 2009–2011, and for the period 2006 to 2011

Table 3.3			
State or territory	2006–2008	2009–2011	2006 to 2011
New South Wales	\$4.1 M	\$6.5 M	\$10.6 M (39%)
	106	131	193
Queensland	\$1.8 M	\$1.9 M	\$3.7 M (13%)
	39	39	58
South Australia	\$0.63 M	\$0.78 M	\$1.4M (5%)
	11	16	20
Tasmania	\$0.05 M	\$0.03 M	\$0.08 M (<1%)
	1	1	2
Victoria	\$3.7 M	\$7.2 M	\$10.9 M (40%)
	92	141	187
Western Australia	\$0.39 M	\$0.11 M	\$0.49 M (2%)
	10	3	11
Australian Capital Territory	\$0.15 M	\$0.22 M	\$0.37 M (1%)
	2	4	4
Northern Territory	None identified	None identified	None identified
<div style="display: flex; align-items: center;"> <div style="width: 15px; height: 15px; background-color: #ccc; margin-right: 5px;"></div> Scholarships </div>			

Note: Many Scholarships overlap trienniums, thus the total number of Scholarships from 2006 to 2011 does not equal the sum of Scholarships for 2006–2008 and 2009–2011.

Due to rounding, funding for 2006 to 2011 may not equal the sum of funding in 2006–2008 and 2009–2011 for each row.

Fellowships

A comparison of the funding provided for Fellowships in each state and territory in 2006–2008 and 2009–2011, and for the period 2006 to 2011, is shown in Table 3.4.

In the period 2006 to 2011, cancer researchers in Victoria, New South Wales and Queensland together were awarded 92% of identified funding for Fellowships. From 2006–2008 to 2009–2011, both the funding provided, and the number of Fellowships, increased in New South Wales, Queensland, South Australia, Victoria, and Western Australia. There was a similar level of funding and number of Fellowships identified in the Australian Capital Territory in each triennium. No Fellowships were identified in the Northern Territory and in Tasmania one Fellowship was identified in 2006–2008.

Table 3.4 Distribution to states and territories of funding to Fellowships in 2006–2008 and 2009–2011, and for the period 2006 to 2011

Table 3.4			
State or territory	2006–2008	2009–2011	2006 to 2011
New South Wales	\$45.5 M	\$52.2 M	\$97.7 M (37%)
	190	197	315
Queensland	\$14.4 M	\$28.4 M	\$42.8 M (16%)
	76	116	137
South Australia	\$3.8 M	\$7.0 M	\$10.8 M (4%)
	22	42	50
Tasmania	\$0.04 M	None identified	\$0.04 M (<1%)
	1		1
Victoria	\$36.9 M	\$65.5 M	\$102 M (39%)
	194	279	349
Western Australia	\$2.0 M	\$3.4 M	\$5.4 M (2%)
	15	17	24
Australian Capital Territory	\$1.5 M	\$1.4 M	\$2.9 M (1%)
	10	10	12
Northern Territory	None identified	None identified	None identified
	■ Fellowships		

Note: Many Fellowships overlap trienniums, thus the total number of Fellowships from 2006 to 2011 does not equal the sum of Fellowships for 2006–2008 and 2009–2011.

Due to rounding, funding for 2006 to 2011 may not equal the sum of funding in 2006–2008 and 2009–2011 for each row.

Academic Cancer Research Chairs

In the period 2006 to 2011, 18 awards for Academic Cancer Research Chairs were identified. These were awarded to cancer researchers in:

- ▶ New South Wales (\$8.0 million to 11 Academic Cancer Research Chair awards), where funding increased from:
 - \$2.3 million to 5 awards in 2006–2008; to
 - \$5.6 million to 11 awards in 2009–2011.
- ▶ South Australia (\$3.2 million, 4 Academic Cancer Research Chair awards), where funding increased from:
 - \$1.1 million to 2 awards in 2006–2008; to
 - \$2.0 million to 4 awards in 2009–2011.
- ▶ Western Australia (\$3.1 million, 3 Academic Cancer Research Chair awards), where funding increased from:
 - \$1.5 million to 3 awards in 2006–2008; to
 - \$1.6 million to 3 awards in 2009–2011.

No Academic Cancer Research Chairs were identified in Queensland, Tasmania, Victoria, the Australian Capital Territory or the Northern Territory during this time period. It should be noted, however, that this is likely to be an underestimate of the number and funding to Academic Cancer Research Chairs because many Academic Cancer Research Chairs may not be cancer-specific. Rather, they may cover a broad field of study in health and medical research, but may have relevance to cancer (e.g. surgery, pharmacology).

3.6 Broad Research Areas of people support scheme awards

Each Scholarship, Fellowship and Academic Cancer Research Chair was classified according to the Broad Research Area classification of the candidate's intended area of research. The Broad Research Area classifications were:

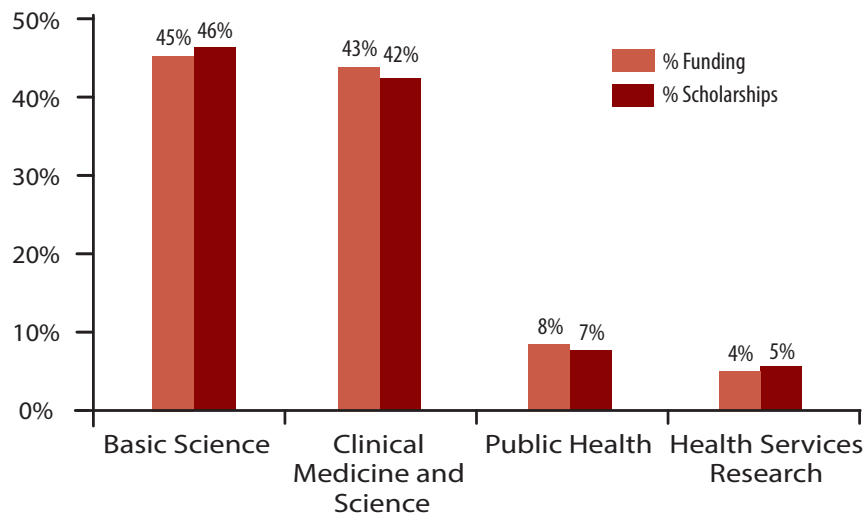
- ▶ Basic Science;
- ▶ Clinical Medicine and Science;
- ▶ Public Health; and
- ▶ Health Services Research.

Scholarships

The proportion of funding to, and the proportion of Scholarships awarded in, each Broad Research Area in the period 2006 to 2011 is shown in Figure 3.4. The Broad Research Areas, the proportion of funding to and proportion of Scholarships awarded to each, was as follows:

- ▶ Basic Science received 45% (\$12.3 million) of the funding to 219 (46%) Scholarships;
- ▶ Clinical Medicine and Science received 43% (\$11.8 million) of the funding to 199 (42%) Scholarships;
- ▶ Public Health received 8% (\$2.2 million) to 35 (7%) Scholarships; and
- ▶ Health Services Research received 4% (\$1.1 million) of the funding to 22 (5%) Scholarships.

Figure 3.4 Proportion of funding to, and proportion of Scholarships awarded to, Broad Research Areas in the period 2006 to 2011

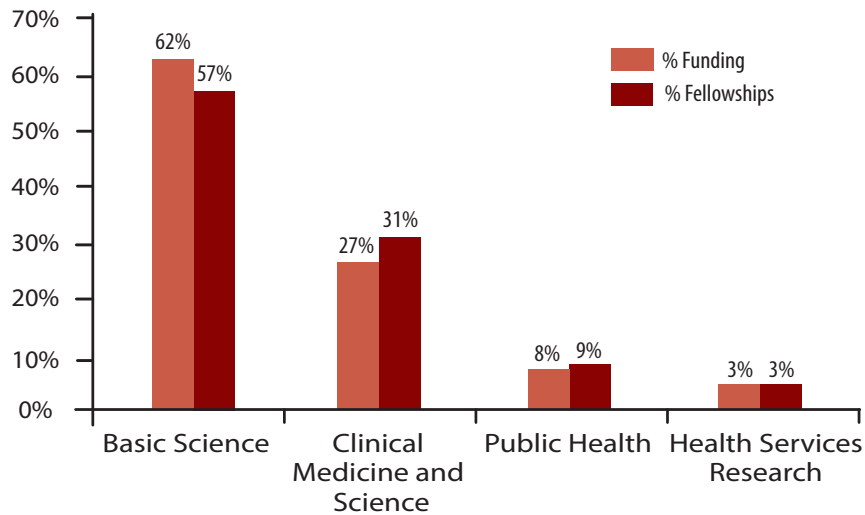


Fellowships

The proportion of funding to, and the proportion of Fellowships awarded in, each Broad Research Area is shown in Figure 3.5. The Broad Research Areas, the proportion of funding and the proportion of Fellowships awarded to each, was as follows:

- ▶ Basic Science received 62% (\$162 million) of the funding to 503 (57%) Fellowships;
- ▶ Clinical Medicine and Science received 27% (\$71.7 million) of the funding to 275 (31%) Fellowships;
- ▶ Public Health received 8% (\$21.7 million) to 81 (9%) Fellowships; and
- ▶ Health Services Research received 3% (\$6.8 million) of the funding to 29 (3%) Fellowships.

Figure 3.5 Proportion of funding to, and proportion of Fellowships awarded to, Broad Research Areas in the period 2006 to 2011

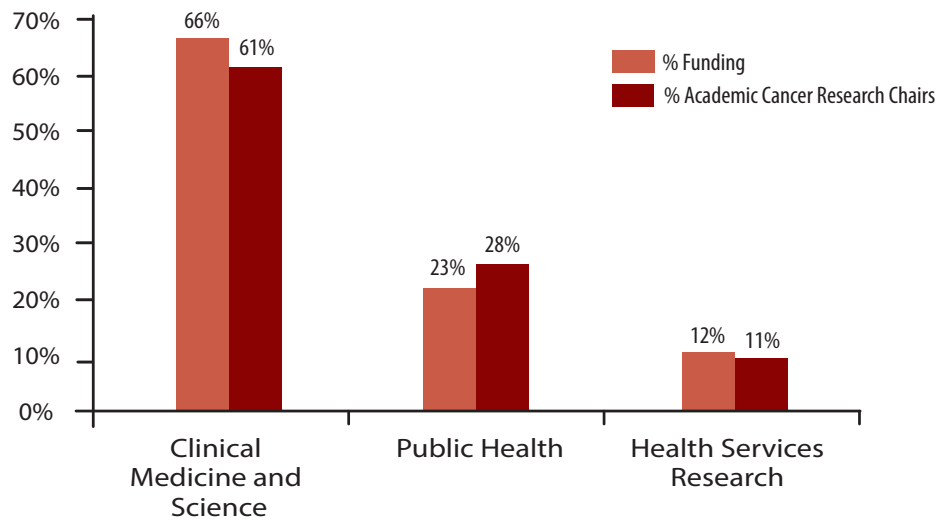


Academic Cancer Research Chairs

The proportion of funding to, and the proportion of Academic Cancer Research Chairs awarded in, each Broad Research Area is shown in Figure 3.6. The Broad Research Areas, the proportion of funding and the proportion of Academic Cancer Research Chairs awarded to each was as follows:

- ▶ Clinical Medicine and Science received 66% (\$9.4 million) of the funding to 11 (61%) Academic Cancer Research Chairs;
- ▶ Public Health received 23% (\$3.2 million) to 5 (28%) Academic Cancer Research Chairs; and
- ▶ Health Services Research received 12% (\$1.7 million) of the funding to 2 (11%) Academic Cancer Research Chairs.

Figure 3.6 Proportion of funding to, and proportion of Academic Cancer Research Chairs awarded to, Broad Research Areas in the period 2006 to 2011



Funding of Broad Research Areas by NHMRC and other sources

The NHMRC was the largest single funder of cancer research Scholarships and Fellowships in Australia in the period 2006 to 2011. The funding provided to Scholarships and Fellowships in the each of the Broad Research Areas, was analysed by whether funding was provided by the NHMRC or other funding sources, and is shown in Table 3.5.

In summary, within each Broad Research Area, the proportion of funding provided by the NHMRC was as follows:

- ▶ For Scholarships, the NHMRC provided approximately one-third of the funding to Basic Science (32%), Clinical Medicine and Science (37%) and Health Services Research (33%). By contrast, the NHMRC provided almost half (45%) of the funding to Scholarships in Public Health; and
- ▶ For Fellowships, the NHMRC provided between approximately two-thirds and three-quarters of the funding to Fellowships in the Broad Research Areas of Basic Science (66%) and Public Health (76%). By contrast, the NHMRC provided approximately one-third of the funding for Fellowships in the Broad Research Areas of Clinical Medicine and Science (30%) and Health Services Research (29%).

Table 3.5 Funding to, and number of awards to Scholarships and Fellowships in the Broad Research Areas, classified by funding source

Table 3.5				
Broad Research Area	Scholarships		Fellowships	
	NHMRC	Other sources	NHMRC	Other sources
Basic Science	\$4.0 M (32%)	\$8.4 M (68%)	\$107 M (66%)	\$54.5 M (34%)
	76	143	321	182
Clinical Medicine and Science	\$4.4 M (37%)	\$7.4 M (63%)	\$21.8 M (30%)	\$50.0 M (70%)
	72	127	89	186
Public Health	\$1.0 M (45%)	\$1.2 M (55%)	\$16.4 M (76%)	\$5.3 M (24%)
	20	15	55	26
Health Services Research	\$0.34 M (33%)	\$0.73 M (67%)	\$2.0 M (29%)	\$4.8 M (71%)
	7	15	8	21
	■ Scholarships		■ Fellowships	

3.7 Classification of Fellowships by career stage

The eligibility criteria for Fellowships were requested from funders and analysed to determine whether each Fellowship was specific to a career stage. The career stage classifications developed for this audit were those which provided the best natural fit for the breadth of Fellowships identified. These career stage classifications were as follows:

- ▶ **Early career Fellowships.** These Fellowships were designated as ‘Early career Fellowships’ by the funding body and/or were defined as being for cancer researchers for whom up to 5 years had elapsed since they had been awarded a PhD or equivalent degree. A researcher may be eligible for multiple sequential Early career Fellowships, depending on the eligibility criteria of the different Fellowship schemes and the length of the Fellowships, as well as recognition given for career breaks.
- ▶ **Early/Mid-career Fellowships.** These Fellowships were defined as being for cancer researchers for whom between a minimum of 2 years and a maximum of 9 years had elapsed since they had been awarded a PhD or equivalent degree. This definition enabled inclusion of the different Fellowships schemes which were either defined as ‘Early career Fellowships’ or described as being for researchers in the ‘early-mid career phase’.
- ▶ **Mid-career Fellowships.** These Fellowships were designated as ‘Mid-career Fellowships’ by the funding body and/or were defined as being for cancer researchers for whom between 5 and 15 years had elapsed since they had been awarded a PhD or equivalent degree.
- ▶ **Senior/Principal Fellowships.** These Fellowships were designated as ‘Senior Fellowships’ or ‘Principal Fellowships’ by the funding body and/or had a minimum restriction on years elapsed since the researcher had been awarded a PhD, but did not have a maximum restriction.
- ▶ **Not career stage-specific Fellowships.** These Fellowships were not designated as being specific to a career stage by the funder, nor were they defined in terms of a minimum nor maximum restriction on the number of years elapsed since the researcher had been awarded a PhD or equivalent qualification. Accordingly, these Fellowships were categorised as Not career stage-specific.

The total funding to, and the number of Fellowships awarded, in each career stage category in 2006–2008 and 2009–2011, and for the period 2006 to 2011, are shown in Table 3.6.

Table 3.6 Total funding to, and number of Fellowships in each career stage category in 2006–2008 and 2009–2011, and for the period 2006 to 2011

Table 3.6			
Fellowship category	2006–2008	2009–2011	2006 to 2011
Early career	\$34.2 M	\$39.6 M	\$73.9 M
	239	265	378
Early/Mid-career	\$10.2 M	\$14.0 M	\$24.2 M
	51	67	86
Mid-career	\$0.51 M	\$15.0 M	\$15.6 M
	4	49	49
Senior/Principal	\$37.3 M	\$63.1 M	\$100 M
	129	165	205
Not career stage-specific	\$22.0 M	\$26.1 M	\$48.1 M
	85	115	170
	■ Fellowships		

Note: Many Fellowships overlap trienniums, thus the total number of Fellowships from 2006 to 2011 does not equal the sum of Fellowships for 2006–2008 and 2009–2011. Due to rounding, funding for 2006 to 2011 may not equal the sum of funding in 2006–2008 and 2009–2011 for each row.

Sources of funding to Fellowship career stages

Table 3.7 lists the funding to, and number of Fellowships which were funded by each funding source, and the number that were Early career, Early/Mid-career, Mid-career, Senior/Principal and Not career stage-specific.

In the period 2006 to 2011, the largest providers of funding and number of Fellowships funded in each career stage category were as follows:

- ▶ NHMRC was the largest provider of both funding to, and number of Fellowships, in the Early career, Early/Mid-career and Senior/Principal Fellowships categories;
- ▶ Other Australian Government sources were the largest provider of funding to and number of Mid-career Fellowships; and
- ▶ State and territory governments were the largest provider of funding to and number of Not career stage-specific Fellowships.

Table 3.7 Major sources of funding to Fellowships - level of funding to and number of Fellowships in each career stage category in the period 2006 to 2011

Table 3.7					
Funding Source	Early career Fellowships	Early/ Mid-career Fellowships	Mid-career Fellowships	Senior/ Principal Fellowships	Not career stage-specific Fellowships
NHMRC	\$36.9 M	\$21.0 M	\$4.8 M	\$84.8 M	None identified
	198	75	18	182	
State and territory governments	\$24.0 M	None identified	None identified	\$7.8 M	\$41.7 M
	86			5	113
Cancer foundations	\$7.1 M	\$3.1 M	\$1.2 M	None identified	\$1.4 M
	34	11	2		10
Cancer Councils	\$1.9 M	None identified	\$0.31 M	\$7.6 M	\$2.6 M
	27		3	17	17
Other Australian Government sources	\$1.1 M	None identified	\$9.1 M	\$0.28 M	None identified
	5		25	1	
International sources	\$2.0 M	None identified	None identified	None identified	\$0.77 M
	16				10
Medical research institutes, hospitals and foundations	\$0.26 M	None identified	None identified	None identified	\$1.1 M
	8				15
Universities	\$0.45 M	None identified	\$0.10 M	None identified	\$0.54 M
	4		1		5
	■ Fellowships				

State and territory distribution of funding to Fellowship career stages

A detailed comparison of the funding provided to all Fellowship types in each state and territory in the period 2006 to 2011 is shown in Table 3.8.

In summary, across the states and territories:

- ▶ Early career Fellowships were most commonly awarded to researchers in New South Wales, Victoria, and Queensland;
- ▶ Early/Mid-career Fellowships were most commonly awarded to researchers in Victoria;
- ▶ Mid-career Fellowships were most commonly awarded to researchers in Victoria and Queensland;
- ▶ Senior/Principal Fellowships were most commonly awarded to researchers in Victoria and Queensland; and
- ▶ Not career stage-specific Fellowships were most commonly awarded to researchers in New South Wales.

Table 3.8 Distribution to states and territories of funding to all Fellowships types

Table 3.8					
State or Territory	Early career Fellowships	Early/ Mid-career Fellowships	Mid-career Fellowships	Senior/ Principal Fellowships	Not career stage-specific Fellowships
New South Wales	\$35.2 M	\$4.7 M	\$2.9 M	\$18.1 M	\$36.8 M
	160	15	8	35	97
Queensland	\$9.5 M	\$5.1 M	\$3.3 M	\$23.5 M	\$1.3 M
	48	48	13	50	9
South Australia	\$2.5 M	\$2.2 M	\$0.95 M	\$3.2 M	\$2.0 M
	13	8	5	10	14
Tasmania	\$0.04 M	None identified	None identified	None identified	None identified
	1		3	17	17
Victoria	\$23.6 M	\$11.2 M	\$7.6 M	\$53.0 M	\$7.2 M
	139	43	21	102	44
Western Australia	\$1.5 M	\$0.20 M	\$0.85 M	\$2.1 M	\$0.79 M
	8	1	2	7	6
Australian Capital Territory	\$1.6 M	\$0.84 M	None identified	\$0.45 M	None identified
	9	2		1	
Northern Territory	None identified	None identified	None identified	None identified	None identified
TOTAL	\$73.9 M	\$24.2 M	\$15.6 M	\$100 M	\$48.1 M
	378	86	49	205	170
	■ Fellowships				

3.8 Discussion

This audit of the period 2006 to 2011 has identified funding to people support of \$304 million to 1,381 Scholarships, Fellowships and Academic Cancer Research Chairs. A sustained annual increase in funding to people support scheme awards was observed from 2006 to 2011, and the level of funding in the triennium 2009–2011 was 53% higher than in 2006–2008. In addition, the number of funded Scholarships, Fellowships and Academic Cancer Research Chairs increased by 30% from 2006–2008 to 2009–2011.

Further sustained increases in funding to people support in future years should not be assumed on the basis of the findings in this audit. The principal funder of cancer research in Australia is the NHMRC, and the average annual increase in its funding to cancer research was 12% from 2006 to 2011. However, in the two years hence (2012 and 2013), NHMRC funding to cancer research in the form of grants for projects and programs, people support, building research capacity and infrastructure, increased by an average annual amount of 2.9%. The average annual inflation over the same period was 2.1%.¹³

As governments around the world manage resources in a difficult global economic environment, measures which ensure that Australia continues to be an international leader of research will be important. The finding that only 5% of people support scheme awards were co-funded in the period 2006 to 2011, demonstrates the need to ensure that the provision of funding for people support is well co-ordinated, and strategies that increase the national funding pool are developed and implemented collaboratively by government and non-government funders of cancer research.

Fellowship career stages

For the Fellowships funded in the period 2006 to 2011, each Fellowship was classified into one of four career stage categories which best fit the eligibility criteria provided by the different funders of cancer research Fellowships: Early career (43% of Fellowships), Early/Mid-career (10%), Mid-career (6%) and Senior/Principal (23%). Fellowships that were Not career stage-specific accounted for 19% of Fellowships. Some Not career stage-specific Fellowship schemes may have been intended by the funder to target researchers in specific career stages. Two Cancer Institute NSW Fellowship schemes, the Career Development Fellowship and the Future Research Leader schemes, were included in the Not career stage-specific category for this Audit, but since 2011 have had their eligibility criteria tailored more specifically to mid-career and senior career researchers, respectively.

Harmonisation of eligibility classification criteria for Fellowships may ensure the clearest pathway is available for cancer researchers as they progress through their careers. The career-stage categories with the most Fellowships were Early career and Senior/Principal; specific funding schemes for mid-career researchers would increase the number of Fellowships available for this career stage. It should be acknowledged that the introduction by the NHMRC of a Level 2 for their Career Development Award Scheme in 2008 has enabled an increase in the number of available Mid-career Fellowships. In addition, State and territory governments, particularly through Cancer Institute NSW and the Victorian Cancer Agency, were the largest supporter of Not career stage-specific Fellowships which provide support for researchers in many different career stages. This suggests that State and Territory governments have identified a need to support cancer researchers across the career spectrum.

It should be noted that other means of support exist for early and mid-career researchers, with many project grants providing salary support for PhD-qualified personnel, and building cancer research capacity initiatives also providing employment opportunities. Nonetheless, a harmonised system for supporting cancer researchers through their career would best enable the development of a pool of highly skilled cancer researchers for future national leadership in cancer control. The NHMRC is the largest funder of people support scheme awards for cancer research. Strategies which reduce the reliance on a single funder may improve our ability to support cancer researchers through the career continuum.

Geographical distribution of funding for people support

The Eastern Australian states of New South Wales, Queensland and Victoria together received 92% of funding for Fellowships and 92% of funding for Scholarships. This observation is consistent with the finding that 87% of direct funding to cancer research projects and research programs in the period 2006 to 2011 was awarded to researchers in these states⁶, and is a reflection of the geographical location of Australia's health and medical research workforce.

The level of funding for Academic Cancer Research Chairs increased from 2006–2008 to 2009–2011 for the states where they were identified – New South Wales, South Australia and Western Australia. The combined level of funding for Scholarships and Fellowships increased from 2006–2008 to 2009–2011 for New South Wales, Queensland, South Australia, Victoria and Western Australia. Funding to these people support schemes decreased for Tasmania and the Australian Capital Territory, and no funding was identified for the Northern Territory. Caution is advised when interpreting changes in the level of funding or number of awards for people support in states and territories with a smaller health and medical research workforce. The duration of an award and/or the timing of the funding provided to an award can affect how the award is counted over individual trienniums.

New South Wales received 39% of funding for Scholarships and 37% of funding for Fellowships, proportions which are higher than was observed during the same period for direct funding to cancer research projects and research programs (29%), and is attributable, in part, to the funding activities of Cancer Institute NSW, which provides significant funding for people support in that state.

Victoria received 40% of funding for Scholarships and 39% of funding for Fellowships, proportions which are similar to that observed during the same period for direct funding to cancer research projects and research programs (41%). Historically, despite Victoria's smaller population than New South Wales, it is the location of a higher number of medical research institutes¹⁵ and thus a larger workforce base. The Cancer Council Victoria and the Victorian Cancer Agency also contributed significantly to the amount of funding to cancer research Scholarships and Fellowships during this period.

The opportunity exists to identify support for cancer researchers in lower population centres like the Northern Territory, to ensure that future capability for cancer research across Australia is enhanced.



Broad Research Areas

The Broad Research Areas used to classify Scholarships and Fellowships in this audit are the four classifications used by the NHMRC to categorise health and medical research: Basic Science; Clinical Medicine and Science; Public Health; and Health Services Research.

Basic Science and Clinical Medicine and Science, together, received 88% of the proportional funding for Scholarships, and 89% of funding for Fellowships.

This investment in people support should ensure that Australia has strong capacity for supporting research projects and programs in these Broad Research areas, and these results highlight the opportunity to invest in areas which have received lower levels of funding.

Public Health and Health Services Research

The proportion of funding to Public Health and Health Services Research Scholarships and Fellowships identified in this audit was low compared with that of Basic Science and Clinical Medicine and Science.

For Fellowships, the proportion of funding in Public Health and Health Services Research identified in this audit was 8% and 3%, respectively. For NHMRC-funded cancer research Fellowships, the proportions were 11% and 1% respectively. The reason for the lower levels of funding to Public Health and Health Services Research noted in this Audit may, in part, be due to much of the research in these areas being not cancer-specific, and therefore not captured and coded for analysis. An example of this can be found in the NHMRC database of funding for health and medical research, where there are listed 14 Public Health and Health Services Research Fellowships funded in the period 2006 to 2011.¹⁴ These particular Fellowships were for researchers investigating tobacco control and smoking cessation, but were not classified by the NHMRC as being cancer-specific, due to cancer or related words not being used in the Key Words, or in the Scientific Title and Lay Summary. In addition, some cancer researcher-associated Public Health and Health Services Research may be supported through intra-mural research programs within government and non-government agencies.

Even considering that some Public Health and Health Services Research Fellowships may not have been captured in this Audit, the number of Fellowships in these Research Areas would likely still be lower than the number of Fellowships in Basic Science, and Clinical Medicine and Science.

The national health system can be expected to be under increasing pressure to deliver greater efficiencies in a difficult fiscal environment. Increased investment in Scholarships and Fellowships in Public Health and Health Services Research, with improved data linkage to support such research, may improve the nation's capacity for research in areas which may pay a future dividend through improved public health and a more efficient health system. People support schemes in these areas may be of mutual benefit to multiple funders, and schemes which enable collaboration and co-funding, could increase and leverage research investment for these Scholarships and Fellowships.

Chapter 4 – People support scheme awards – cancer research focus

KEY FINDINGS

In the period 2006 to 2011:

Common Scientific Outline

- ▶ More than one-third (37%) of funding to Scholarships and more than half (52%) of funding to Fellowships was in the CSO category of Biology
- ▶ More than two-thirds (69%) of funding to Academic Cancer Research Chairs was in the CSO categories of Treatment and Cancer Control, Survivorship and Outcomes Research
- ▶ People support scheme awards which focused on Prevention research received the lowest level of proportional funding

Tumour research focus

- ▶ Three quarters (75%) of funding to Scholarships and more than half (52%) of funding to Fellowships was for tumour-specific research
- ▶ The top 5 tumour types researched through Scholarships were breast cancer, leukaemia, colon and rectum cancer, prostate cancer and lung cancer (including pleural mesothelioma)
- ▶ The top 5 tumour types researched through Fellowships were breast cancer, leukaemia, prostate cancer, melanoma, and colon and rectum cancer
- ▶ Most funding (92%) provided to Academic Cancer Research Chairs was for research which was not tumour-specific

Multiple tumour streams research

- ▶ \$14.9 million was provided to 42 Fellowships which involved research across multiple tumour streams.
- ▶ Almost half (19) of the Fellowships which researched multiple tumour streams had a focus on breast cancer
- ▶ The tumour streams most commonly researched together were combinations of breast cancer, and/or gynaecological cancers and/or genitourinary cancers

Tumour research and Fellowship career stages

- ▶ Majority of Early career (61%) and Not career stage-specific (73%) Fellowships were for research which was tumour-specific
- ▶ Majority of Mid-career (73%) and Senior/Principal Fellowships (53%) were for research which was not tumour-specific
- ▶ Only 3% of tumour-specific Fellowships were for Mid-career Fellowships

4.1 People support scheme awards – classification by Common Scientific Outline

Each Scholarship, Fellowship and Academic Cancer Research Chair was classified using the Common Scientific Outline (CSO) category that best reflected the primary focus of the type of research to be undertaken or supported⁹. As described in Chapter 2 (Methodology), the CSO categories used for this analysis were:

1. Biology;
2. Aetiology;
3. Prevention;
4. Early Detection, Diagnosis and Prognosis;
5. Treatment;
6. Cancer Control, Survivorship and Outcomes Research; and
7. Scientific Model Systems.

Scholarships

Figure 4.1 shows the proportional distribution of funding, the level of funding to, and number of Scholarships in each CSO category. In the period 2006 to 2011, more than one-third (37%) of funding for Scholarships was provided to Biology.

In summary, the proportional funding to Scholarships in each CSO category was as follows:

- ▶ The proportional funding to Biology was 37%;
- ▶ The proportional funding to Aetiology was 7%;
- ▶ The proportional funding to Prevention was 2%;
- ▶ The proportional funding to Early Detection, Diagnosis and Prognosis was 16%;
- ▶ The proportional funding to Treatment was 23%;
- ▶ The proportional funding to Cancer Control, Survivorship and Outcomes Research was 13%; and
- ▶ The proportional funding to Scientific Model Systems was 2%.

The largest number of Scholarships was awarded in the area of Biology and the smallest number of Scholarships was awarded in the area of Scientific Model Systems. However, the average value of funding to Scholarships was highest for those studying in the category of Scientific Model Systems (approximate average funding of \$70,000). The average funding per Scholarship across all other CSO categories ranged from approximately \$52,000 (Prevention) to approximately \$60,000 (Treatment).

⁹ Each CSO category covers a broad range of research topics (see Appendix D). In some cases, the research described for a particular people support scheme award was relevant to multiple CSO categories. In such cases, the award was allocated to the CSO category which best represented the primary focus of the research undertaken.

Fellowships

Figure 4.2 shows the proportional distribution of funding, the level of funding to, and number of Fellowships in each CSO category. In the period 2006 to 2011, more than half (52%) of funding for Fellowships was provided to Biology.

In summary, the proportional funding to Fellowships in each CSO category was as follows:

- ▶ The proportional funding to Biology was 52%;
- ▶ The proportional funding to Aetiology was 7%;
- ▶ The proportional funding to Prevention was 2%;
- ▶ The proportional funding to Early Detection, Diagnosis and Prognosis was 9%;
- ▶ The proportional funding to Treatment was 17%;
- ▶ The proportional funding to Cancer Control, Survivorship and Outcomes Research was 10%; and
- ▶ The proportional funding to Scientific Model Systems was 3%.

The largest number of Fellowships was awarded in the area of Biology and the smallest number of Fellowships was awarded in the area of Prevention. The average value of funding to Fellowships was highest for those working in Biology (approximate average funding of \$342,000). The average funding per Fellowship across all other CSO categories ranged from approximately \$240,000 (Early Detection, Diagnosis and Prognosis) to approximately \$311,000 (Scientific Model Systems). Figure 4.3 A–E shows the proportional distribution, the level of funding to, and number of Fellowships in each CSO category, for each of the Fellowship career stage categories (i.e. Early career, Early/Mid-career, Mid-career, Senior/Principal and Not career stage-specific).

In summary, across the Fellowship categories:

- ▶ Biology received the largest level of proportional funding for each Fellowship type, ranging from 35% (Not career stage-specific Fellowships) to 67% (Senior/Principal Fellowships) of the proportional funding;
- ▶ Aetiology received a relatively lower proportional level of funding for each Fellowship type, ranging from 5% (Early career Fellowships) to 8% (Senior/Principal Fellowships) of the proportional funding;
- ▶ Prevention received the lowest level of proportional funding for each Fellowship type, ranging from no funding reported for Mid-career Fellowships to 2% (Early career and Senior/Principal Fellowships) of the proportional funding;
- ▶ Proportional funding to Early Detection, Diagnosis and Prognosis varied across the Fellowship types, ranging from 2% (Senior/Principal Fellowships) to 23% (Not career stage-specific Fellowships);
- ▶ Proportional funding to Treatment varied proportionally from 11% (Early/Mid-career Fellowships) to 24% (Early career Fellowships);
- ▶ Cancer Control, Survivorship and Outcomes Research received a relatively lower proportional level of funding for each Fellowship type, ranging from 6% (Senior/Principal Fellowships) to 14% (Early career Fellowships); and
- ▶ Proportional funding to Scientific Model Systems ranged from less than 1% (Not career stage-specific Fellowships) to 4% (Early career and Senior/Principal Fellowships).

Early career Fellowships

The largest number of Early career Fellowships was awarded in the area of Biology and the smallest number of Fellowships was awarded in the area of Prevention. The average value of funding to Early career Fellowships was highest for those working in Scientific Model Systems (approximate average funding of \$300,000). The average funding per Early career Fellowship across all other CSO categories ranged from approximately \$145,000 (Early Detection, Diagnosis and Prognosis) to approximately \$211,000 (Biology).

Early/Mid-career Fellowships

The largest number of Early/Mid-career Fellowships was awarded in the area of Biology and the smallest number of Fellowships was awarded in the area of Prevention. The average value of funding to Early/Mid-career Fellowships was highest for those working in Cancer Control, Survivorship and Outcomes Research (approximate average funding of \$356,000). The average funding per Early/Mid-career Fellowship across all other CSO categories ranged from approximately \$150,000 (Prevention) to approximately \$300,000 (Biology).

Mid-career Fellowships

The largest number of Mid-career Fellowships was awarded in the area of Biology and the smallest number of Fellowships was awarded in the area of Prevention. The average value of funding to Mid-career Fellowships was highest for those working in Scientific Model Systems (approximate average funding of \$420,000). The average funding per Mid-career Fellowship across all other CSO categories (aside from Prevention which did not receive funding) ranged from approximately \$210,000 (Early Detection, Diagnosis and Prognosis) to approximately \$370,000 (Aetiology).

Senior/Principal Fellowships

The largest number of Senior/Principal Fellowships was awarded in the area of Biology and the smallest number of Fellowships was awarded in the area of Prevention. The average value of funding to Senior/Principal Fellowships was highest for those working in Cancer Control, Survivorship and Outcomes Research (approximate average funding of \$740,000). The average funding per Senior/Principal Fellowship across all other CSO categories ranged from approximately \$286,000 (Early Detection, Diagnosis and Prognosis) to approximately \$408,000 (Prevention).

Not career stage-specific Fellowships

The largest number of Not career-stage Fellowships was awarded in the area of Biology and the smallest number of Fellowships was awarded in the areas of Prevention and Scientific Model Systems. The average value of funding to Not career stage-specific Fellowships was highest for those working in Early Detection, Diagnosis and Prognosis (approximate average funding of \$350,000). The average funding per Not career stage-specific Fellowship across all other CSO categories ranged from approximately \$100,000 (Scientific Model Systems) to approximately \$283,000 (Biology).

Some caution is advised when interpreting the average funding for Fellowships, as some Fellowships include funding for research support as well as salary support. This particularly impacted on the average funding of Senior/Principal Fellowships, the maximum value of which ranged up to \$3.6 million. By contrast, the maximum value of a Fellowship in each of the other categories was \$600,000 (Early career Fellowships), \$710,000 (Early/Mid-career Fellowships), \$720,000 (Mid-career Fellowships), and \$970,000 (Not career stage-specific Fellowships). In addition, funding to Fellowships is counted in the years the Fellowship is active, so if part of the Fellowship was outside of the years 2006 to 2011, only the funding provided to the Fellowship in the period 2006 to 2011 was counted.

Academic Cancer Research Chairs

Figure 4.4 shows the proportional distribution of funding to, the level of funding, and number of Academic Cancer Research Chairs in each CSO category. In the period 2006 to 2011, the highest level of proportional funding for Chairs was provided to Academic Cancer Research Chairs conducting research in the area of Treatment.

In the period 2006 to 2011, of the 18 Academic Cancer Research Chairs identified:

- ▶ The proportional funding to Biology was 16%;
- ▶ The proportional funding to Prevention was 16%;
- ▶ The proportional funding to Treatment was 38%; and
- ▶ The proportional funding to Cancer Control, Survivorship and Outcomes Research was 31%.

No funding was identified for Academic Cancer Research Chairs in the CSO categories of Aetiology, Early Detection, Diagnosis and Prognosis, and Scientific Model Systems.

The largest number of Academic Cancer Research Chairs was awarded in the area of Biology and the smallest number of Academic Cancer Research Chairs was awarded in the areas of Treatment and Cancer Control, Survivorship and Outcomes Research. The average value of funding to Academic Cancer Research Chairs was highest for those working in Biology and Treatment (approximate average funding of \$1.15 million). The average funding per Academic Cancer Research Chair for the other two CSO categories was approximately \$630,000 (Cancer Control, Survivorship and Outcomes Research), and approximately \$770,000 (Treatment).



Figure 4.1 The pattern of funding to Scholarships: proportional distribution of funding, level of funding and number of Scholarships in each CSO category

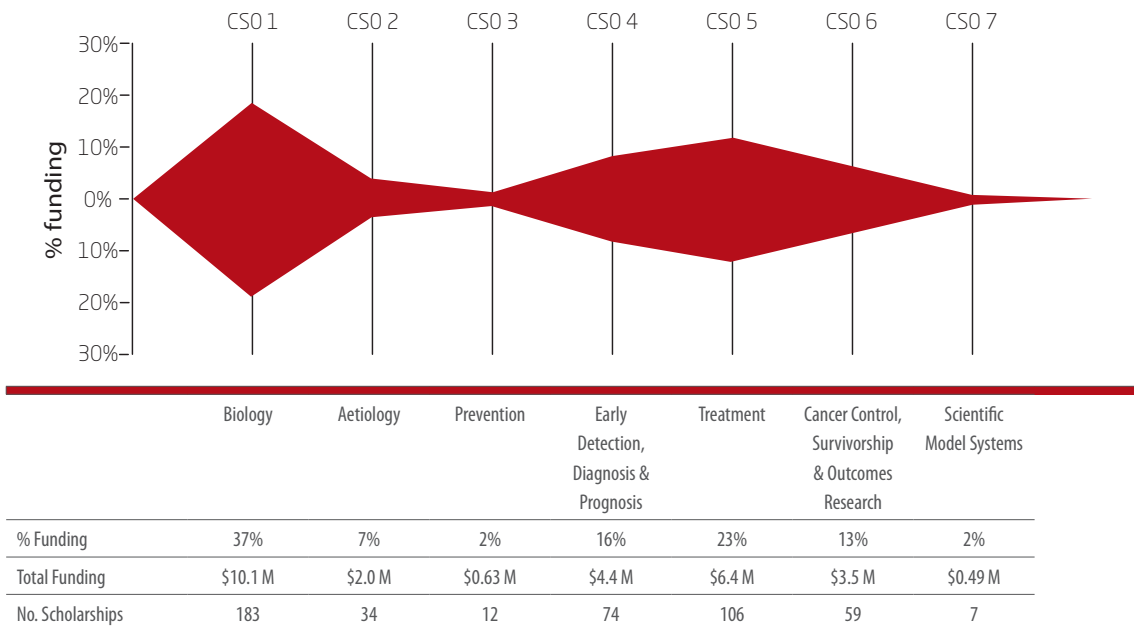


Figure 4.2 The pattern of funding to Fellowships: proportional distribution of funding, level of funding and number of Fellowships in each CSO category

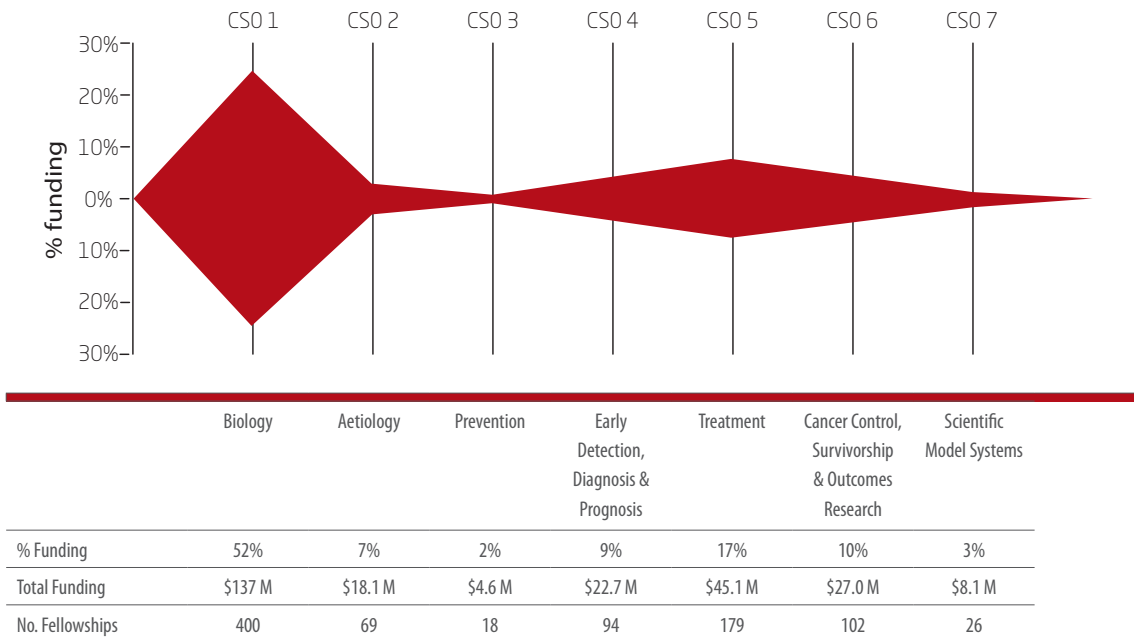
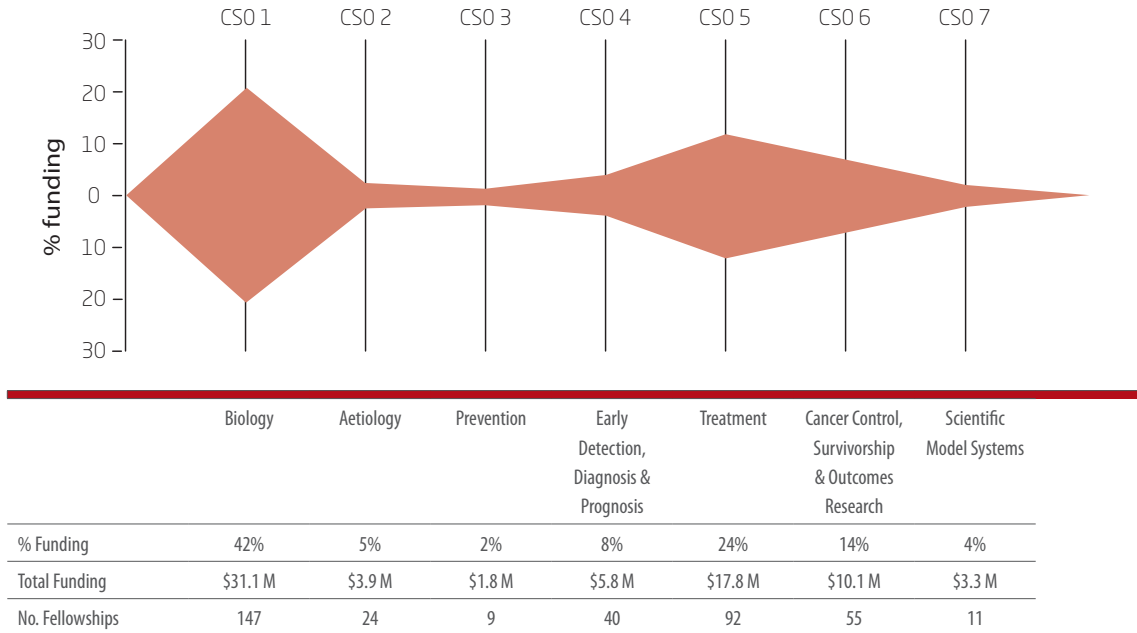


Figure 4.3 The pattern of funding to Fellowships in the period 2006 to 2011:

A. Proportional distribution of funding, level of funding and number of Early career Fellowships in each CSO category



B. Proportional distribution of funding, level of funding and number of Early/Mid-career Fellowships in each CSO category

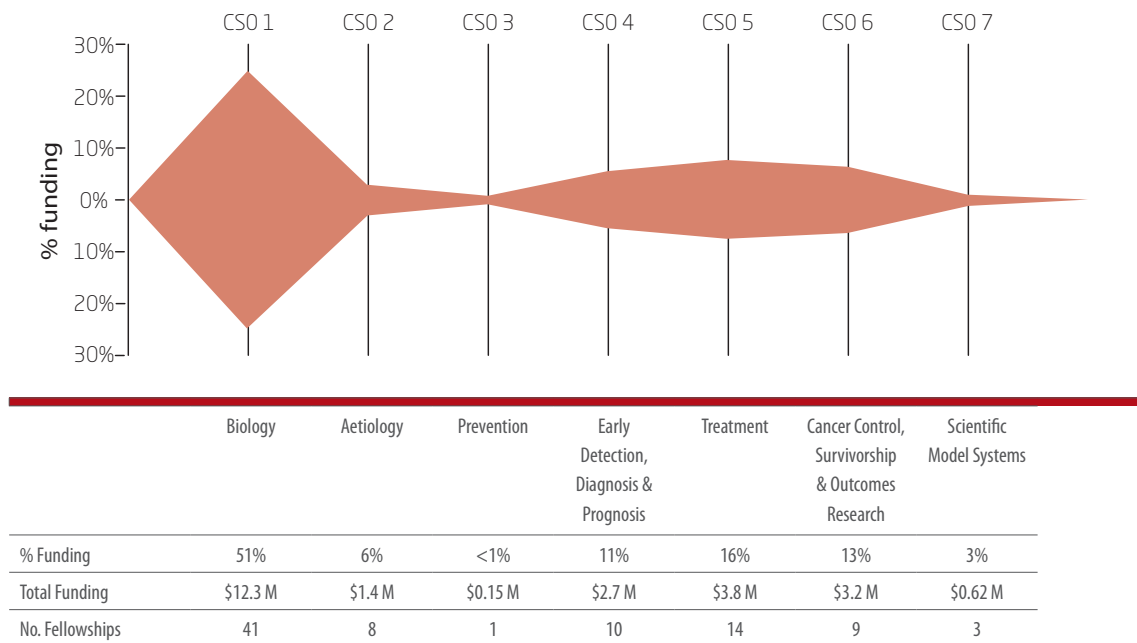
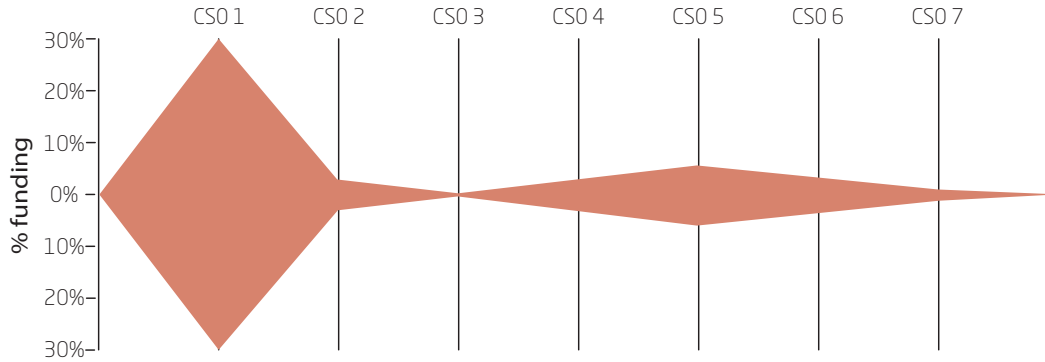


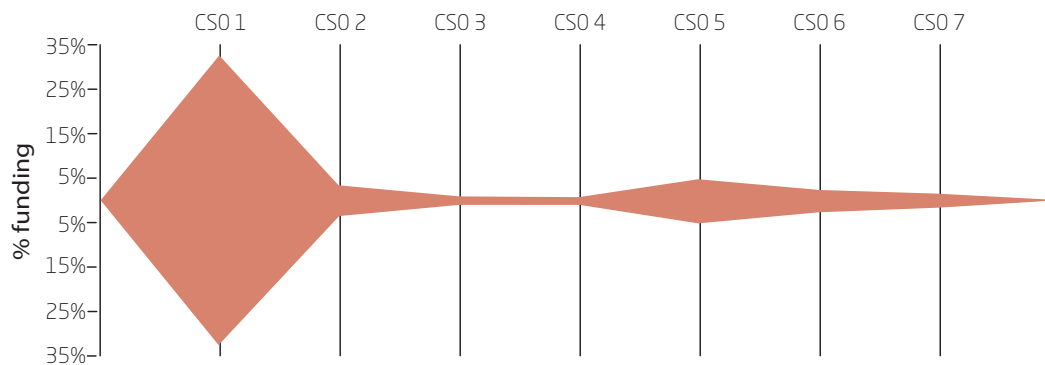
Figure 4.3 (cont.) the pattern of funding to Fellowships in the period 2006 to 2011

C. Proportional distribution of funding, level of funding and number of Mid-career Fellowships in each CSO category



	Biology	Aetiology	Prevention	Early Detection, Diagnosis & Prognosis	Treatment	Cancer Control, Survivorship & Outcomes Research	Scientific Model Systems
% Funding	60%	7%	0%	8%	13%	9%	3%
Total Funding	\$9.3 M	\$1.1 M	\$0 M	\$1.3 M	\$2.1 M	\$1.3 M	\$0.42 M
No. Fellowships	26	3	0	6	7	6	1

D. Proportional distribution of funding, level of funding and number of Senior/Principal Fellowships in each CSO category



	Biology	Aetiology	Prevention	Early Detection, Diagnosis & Prognosis	Treatment	Cancer Control, Survivorship & Outcomes Research	Scientific Model Systems
% Funding	67%	8%	2%	2%	12%	6%	4%
Total Funding	\$67.1 M	\$8.1 M	\$2.0 M	\$2.0 M	\$11.8 M	\$5.9 M	\$3.5 M
No. Fellowships	127	21	5	7	29	8	8

Figure 4.3 (cont.) the pattern of funding to Fellowships in the period 2006 to 2011

E. Proportional distribution of funding, level of funding and number of Not career stage-specific Fellowships in each CSO category

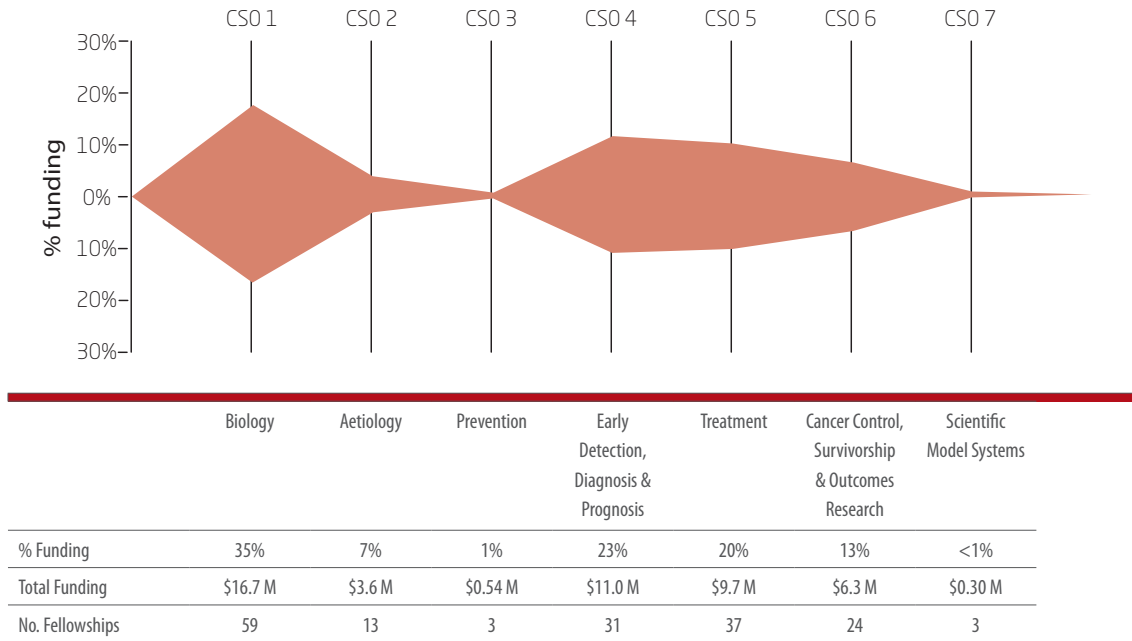
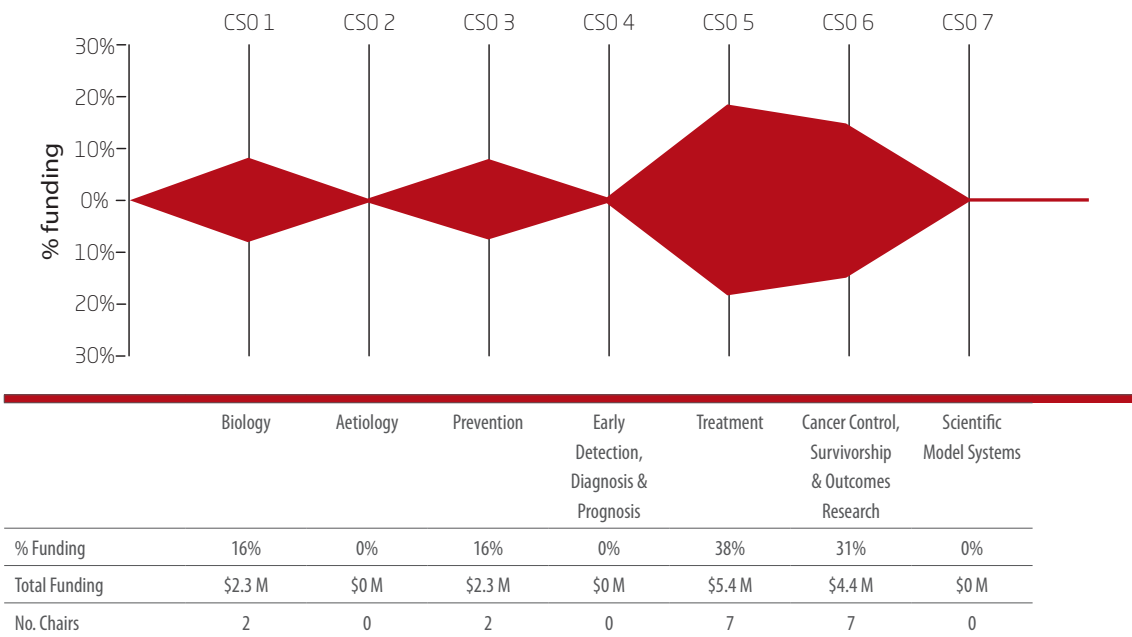


Figure 4.4 The pattern of funding to Academic Cancer Research Chairs: proportional distribution of funding, level of funding and number of Academic Cancer Research Chairs in each CSO category



4.2 Tumour research focus of people support scheme awards

Each people support scheme award was categorised by whether the research to be undertaken was:

- ▶ Tumour specific, i.e.:
 - specific to a single tumour type; or
 - related to different tumour types within a single tumour stream; or
 - related to different tumour types across multiple tumour streams; or
- ▶ Not tumour-specific.

A 'tumour stream' comprises a collective group of tumour types that are common to an anatomical area or function of the body. The tumour streams and tumour types used in this audit are listed in Appendix E. Not tumour-specific research refers to cancer research which did not have a focus on any particular tumour type or stream, but rather was relevant to a broad range of tumour types.

Scholarships

The funding provided to tumour-specific and not tumour-specific Scholarships, and the major tumour types of focus, are shown in Figure 4.5 A&B.

In the period 2006 to 2011:

- ▶ \$20.6 million (75%) was provided to 338 Scholarships, the recipients of which were undertaking research which was tumour-specific; and
- ▶ \$6.9 million (25%) was provided to 137 Scholarships, the recipients of which were undertaking research which was not tumour-specific.

Tumour-specific research

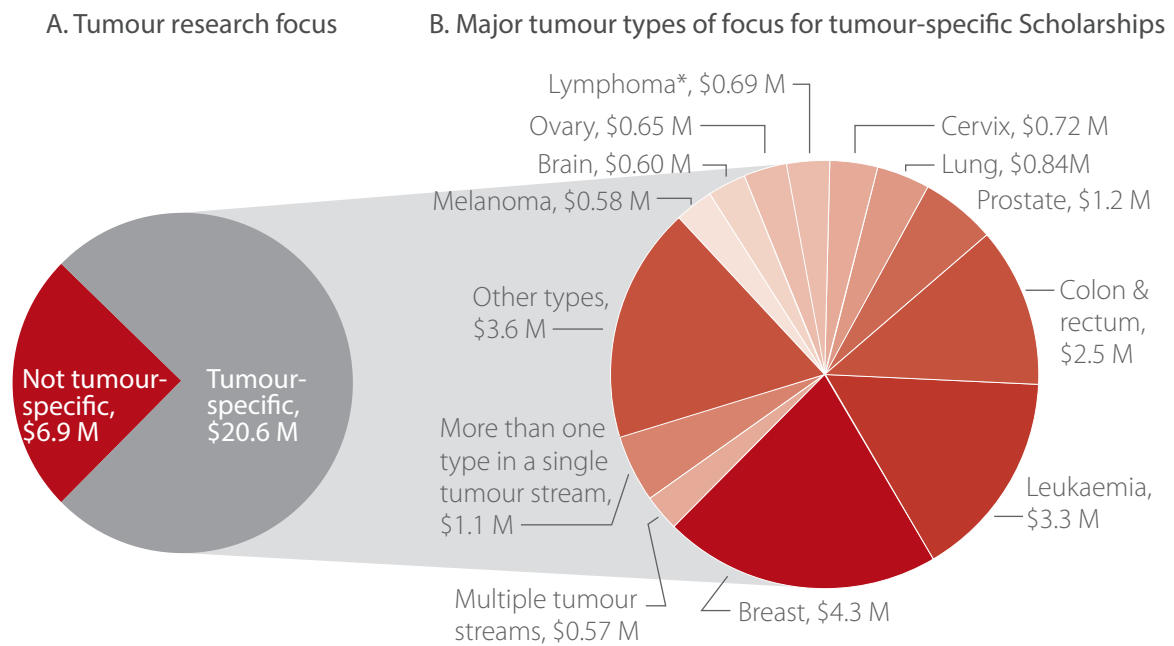
A total of \$19.0 million of funding was provided to 311 Scholarships, the recipients of which were undertaking research into single tumour types. Breast cancer, leukaemia, and colon and rectum cancer, together accounted for almost half (49%) of all funding to tumour-specific Scholarships.

Funding of \$0.57 million was provided to 7 Scholarships, the recipients of which were undertaking research which was related to multiple tumour streams, and a further \$1.1 million was provided to 20 Scholarships, the recipients of which were undertaking research focusing on different tumour types within a single tumour stream. Of this total of 27 Scholarships researching more than one tumour type in both single and multiple tumour streams:

- ▶ 11 Scholarships (\$0.71 million) involved research into haematological cancers;
- ▶ 7 Scholarships (\$0.57 million) involved research across multiple tumour streams^h;
- ▶ 4 Scholarships (\$0.20 million) involved research into head and neck cancers;
- ▶ 3 Scholarships (\$0.14 million) involved research into skin cancers;
- ▶ 1 Scholarship (\$0.02 million) involved research into upper gastrointestinal cancers; and
- ▶ 1 Scholarship (\$0.01 million) involved research into genitourinary cancers.

The funding provided to all tumour-specific Scholarships, and the tumour types of focus, are shown in Figure 4.6.

Figure 4.5 Funding to Scholarships in each tumour research focus category (A), and the major tumour types of focus (B)



Note: *Lymphoma represents the sum of funding to Scholarships which focused on either Hodgkin's lymphoma or non-Hodgkin's lymphoma or both.

^h An analysis of the tumour streams researched in multiple tumour streams Scholarships is provided in Section 4.3.

Figure 4.6 Funding to, and number of Scholarships for each funded tumour type, more than one tumour type, and multiple tumour streams



Note: Lymphoma represents the sum of funding to Scholarships which focused on either Hodgkin's lymphoma or non-Hodgkin's lymphoma or both.

Fellowships

The funding provided to tumour-specific and not tumour-specific Fellowships, and the major tumour types of focus, are shown in Figure 4.7.

In the period 2006 to 2011:

- ▶ \$136 million (52%) was provided to 509 Fellowships, the recipients of which were undertaking research which was tumour-specific; and
- ▶ \$126 million (48%) was provided to 379 Fellowships, the recipients of which were undertaking research which was not tumour-specific.

Tumour-specific research

Of the \$136 million provided to Fellowships focusing on tumour-specific research, \$108 million was provided to 424 Fellowships, the recipients of which were undertaking research into single tumour types. Breast cancer, leukaemia, prostate cancer, melanoma and colon and rectum cancer together accounted for more than half (58%) of all funding to tumour-specific Fellowships.

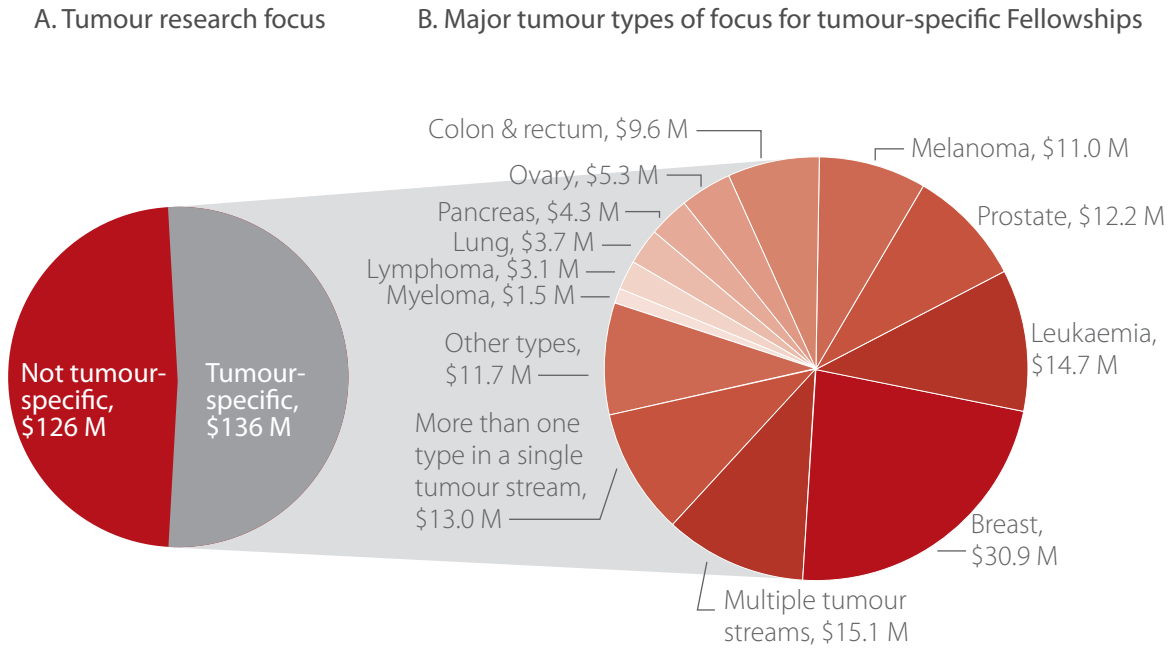
Funding of \$14.9 million was provided to 42 Fellowships, the recipients of which were undertaking research which was related to multiple tumour streams, and a further \$13.0 million was provided to 43 Fellowships, the recipients of which were undertaking research focusing on different tumour types within a single tumour stream. Of this total of 85 Fellowships researching more than one tumour type in both single and multiple tumour streams:

- ▶ 42 Fellowships (\$14.9 million) involved research across multiple tumour streams;
- ▶ 24 Fellowships (\$8.3 million) involved research into haematological cancers;
- ▶ 5 Fellowships (\$1.6 million) involved research into skin cancers;
- ▶ 5 Fellowships (\$0.55 million) involved research into head and neck cancers;
- ▶ 4 Fellowships (\$1.51 million) involved research into gynaecological cancers;
- ▶ 2 Fellowships (\$0.64 million) involved research into genitourinary cancers;
- ▶ 2 Fellowships (\$0.23 million) involved research into upper gastrointestinal cancers; and
- ▶ 1 Fellowship (\$0.20 million) involved research into musculoskeletal cancers.

The funding provided to all tumour-specific Fellowships, and the tumour types of focus, is shown in Figure 4.8.

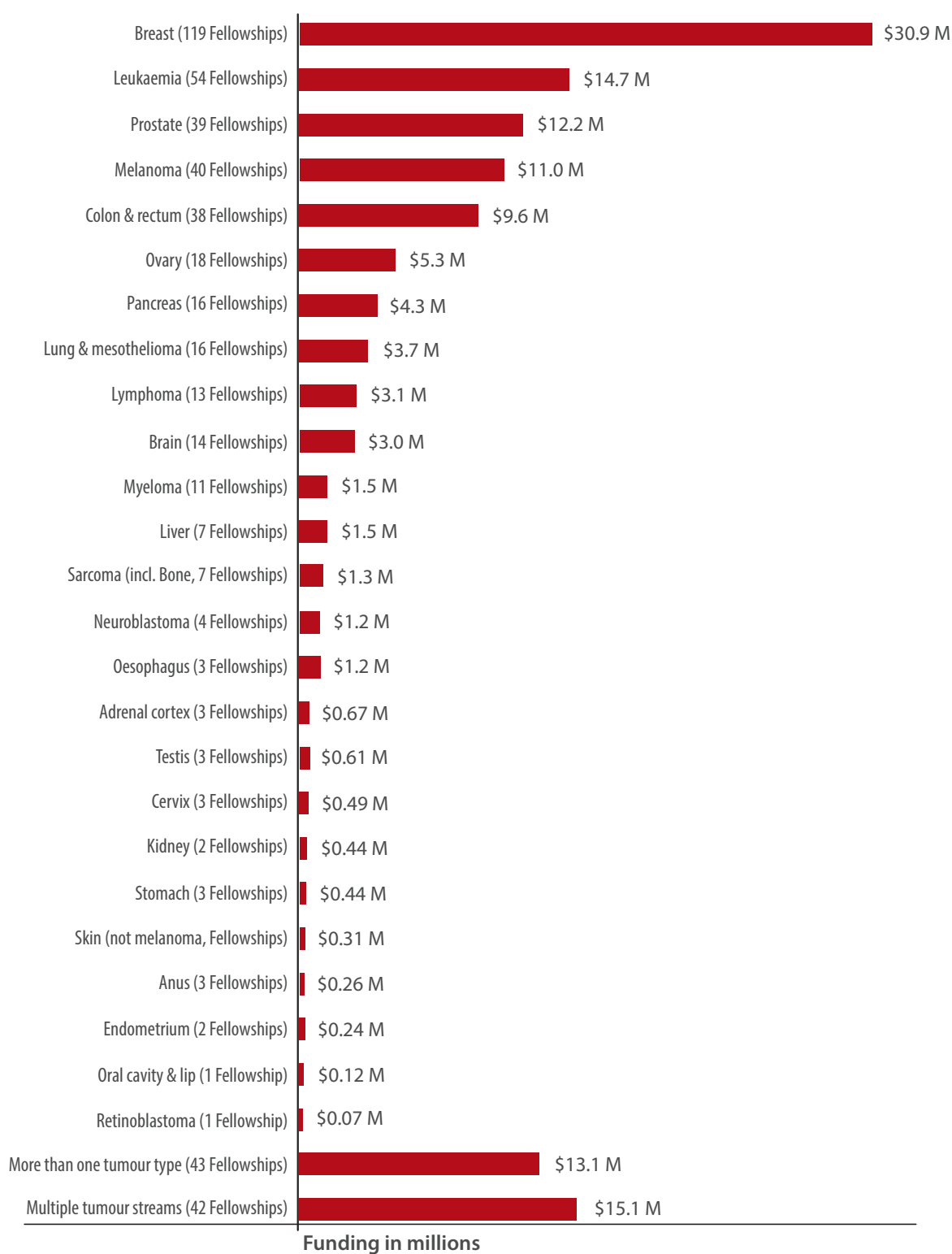
ⁱAn analysis of the tumour streams researched in multiple tumour streams Fellowships is provided in Section 4.3.

Figure 4.7 Funding to Fellowships in each tumour focus category (A), and the major tumour types of focus (B)



*Note: *Lymphoma represents the sum of funding to Fellowships which focused on either Hodgkin's lymphoma or non-Hodgkin's lymphoma or both.*

Figure 4.8 Funding to, and number of Fellowships for each funded tumour type, more than one tumour type, and for multiple tumour streams



Note: Lymphoma represents the sum of funding to Fellowships which focused on either Hodgkin's lymphoma or non-Hodgkin's lymphoma or both.

Academic Cancer Research Chairs

In the period 2006 to 2011, \$13.2 million (92%) was provided to 17 awards for Academic Cancer Research Chairs, who were undertaking not tumour-specific research, and \$1.1 million (8%) was provided to one Chair, who was undertaking tumour-specific research.

4.3 Multiple tumour streams focus of Scholarships and Fellowships

For Scholarships and Fellowships, where the recipient of the award was undertaking research which was specific to multiple tumour streams, the primary, secondary and (if applicable) tertiary tumour stream of interest were determined from the research abstract or summary and key words. Where the primary tumour stream of interest for the research to be conducted for a particular Scholarship or Fellowship was not apparent, tumour streams were recorded in the order that they were listed in the abstract or summary and key words (i.e. the first named tumour stream was deemed to be the primary tumour stream). The most common combinations of tumour stream research conducted through the awarding of Scholarships and Fellowships are described below.

Scholarships

In the period 2006 to 2011, there were 7 Scholarships for which the research to be conducted focused on multiple tumour streams. Of these, 3 involved a focus on gynaecological cancers, 2 involved a focus on breast cancer, 2 involved a focus on skin cancers, and 2 involved a focus on central nervous system cancers. Genitourinary cancers and upper gastrointestinal cancers were each a focus of one Scholarship.

Fellowships

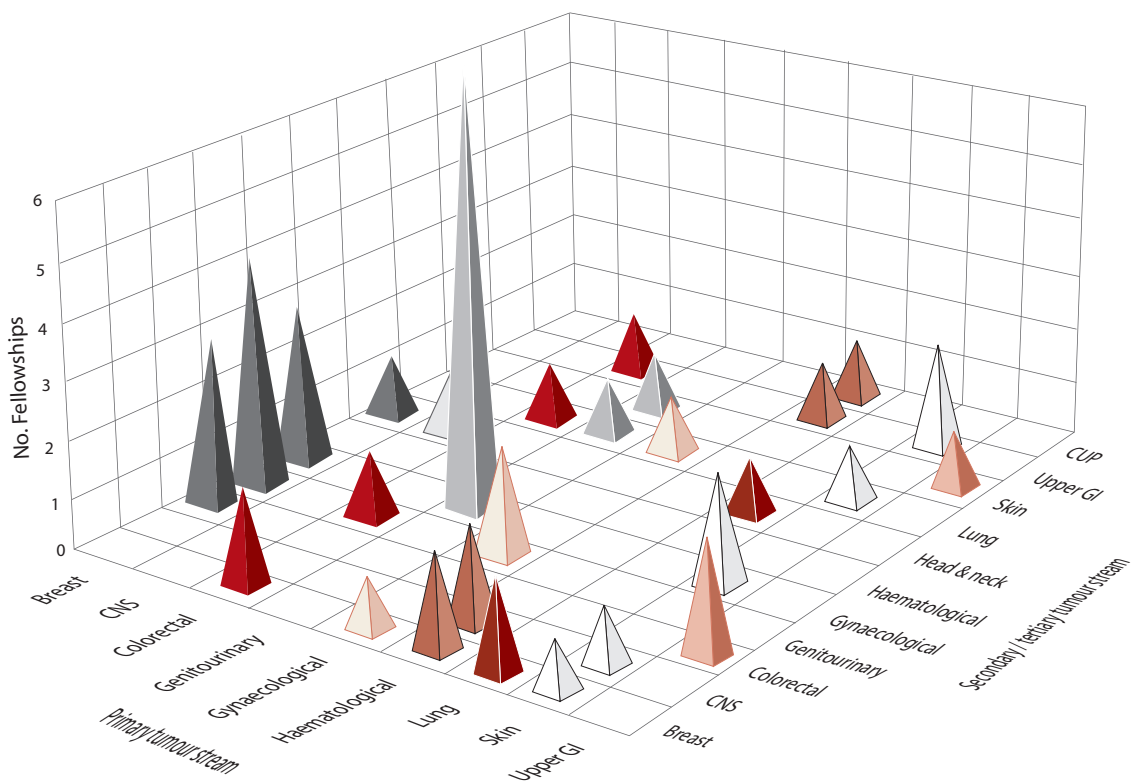
In the period 2006 to 2011, there were 42 Fellowships for which the research to be conducted focused on multiple tumour streams. Figure 4.9 details the combinations of tumour streams researched through these Fellowships, by showing the combination of primary tumour stream on one axis, with the secondary and tertiary tumour streams combined on the second axis.

Of the 42 Fellowships which focused on multiple tumour streams, almost half (19) involved breast cancer. A summary of the most common multiple tumour stream combinations for each primary tumour stream is provided below:

- ▶ Breast cancer was the primary tumour stream in 11 multiple tumour stream Fellowships, of which:
 - 4 also focused on genitourinary cancers as a secondary or tertiary stream;
 - 3 also focused on gynaecological cancers as a secondary or tertiary stream; and
 - 3 also focused on colorectal cancer as a secondary or tertiary stream.
- ▶ Genitourinary cancers was the primary tumour stream in 7 multiple tumour stream Fellowships, of which:
 - 6 also focused on gynaecological cancers as a secondary or tertiary stream.

- ▶ Haematological cancers was the primary tumour stream in 5 multiple tumour stream Fellowships, of which:
 - 2 also focused on breast cancer as a secondary or tertiary stream; and
 - 2 also focused on central nervous system cancers as a secondary or tertiary tumour stream.
- ▶ Skin cancers was the primary stream in 5 multiple tumour stream Fellowships, of which:
 - 2 also focused on upper gastrointestinal cancers as a secondary or tertiary tumour stream; and
 - 2 also focused on gynaecological cancers as a secondary or tertiary tumour stream.
- ▶ Colorectal cancer was the primary stream in 3 multiple tumour stream Fellowships, of which:
 - 2 also focused on breast cancer as a secondary or tertiary tumour stream.
- ▶ Upper gastrointestinal cancers was the primary stream in 3 multiple tumour stream Fellowships, of which:
 - 2 also focused on colorectal cancer as a secondary or tertiary tumour stream.

Figure 4.9 Tumour stream combinations researched through Fellowships which focused on multiple tumour streams



4.4 Tumour research focus of Fellowships across the career stages

A detailed analysis of the number and proportion of tumour-specific and not tumour-specific Fellowships, in each career stage category, is shown in Table 4.1. The number of awarded Fellowships in each career stage category was emphasised for this analysis, rather than levels of funding, due to the impact of larger average funding amounts to some Senior/Principal and Not career stage-specific Fellowships. Figure 4.10 shows, for each Fellowship type, the proportion which was tumour-specific and not tumour-specific.

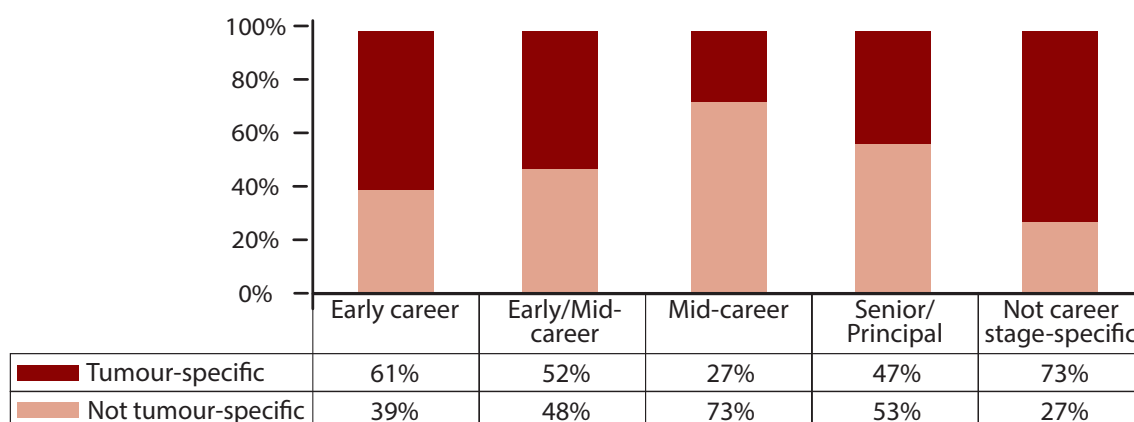
In summary:

- ▶ The majority of Early career Fellowships (61% of all Early career Fellowships) and Not career stage-specific Fellowships (73% of all Not career stage-specific Fellowships) were awarded to recipients conducting research which was tumour-specific;
- ▶ The majority of both Mid-career Fellowships (36, 73% of all Mid-career Fellowships) and Senior/Principal Fellowships (109, 53% of all Senior/Principal Fellowships) were awarded to recipients conducting research which was not tumour-specific; and
- ▶ There were a similar number of Early/Mid-career Fellowships conducting tumour-specific and not tumour-specific research.
- ▶ For tumour-specific Fellowships, the proportion which were Mid-career Fellowships was 3%, and the proportion which were Early/Mid-career Fellowships was 9%; and
- ▶ For not tumour-specific Fellowships, the proportion which was Mid-career Fellowships was 9%, and the proportion which was Early/Mid-career Fellowships was 11%.

Table 4.1 Distribution of career stage categories for tumour-specific and not tumour-specific Fellowships

Table 4.1					
Tumour research focus	Early career Fellowships	Early/ Mid-career Fellowships	Mid-career Fellowships	Senior/ Principal Fellowships	Not career stage-specific Fellowships
Tumour-specific	\$46.0 M (45%)	\$12.2 M (9%)	\$14.4 M (3%)	\$39.9 M (19%)	\$33.8 M (24%)
	231	45	13	96	124
Not tumour-specific	\$28.1 M (39%)	\$12.0 M (11%)	\$11.2 M (9%)	\$60.6 M (29%)	\$14.4 M (12%)
	147	41	36	109	46
	■ Fellowships				

Figure 4.10 Proportion of Fellowships in each career stage category which was tumour-specific and not tumour-specific



4.5 Tumour-specific Fellowships across the career stages

A detailed comparison of the funding provided to all Fellowship career stage categories, for the top 20 funded individual tumour types, for research into more than one tumour type in a single tumour stream, and across multiple tumour streams, is shown in Table 4.2.

Single tumour types

Fellowships across all career stage categories conducted research in breast cancer, leukaemia, prostate cancer, colon and rectum cancer, and sarcoma (incl. bone).

In summary, across the tumour types:

- ▶ Early career Fellowships were awarded to 19 of the top 20 funded tumour types, and this was the largest Fellowship category by funding for:
 - breast - \$12.6 million;
 - prostate - \$5.2 million;
 - melanoma - \$3.3 million;
 - colon and rectum - \$3.0 million;
 - pancreas - \$2.0 million;
 - lymphoma - \$1.3 million;
 - cervix - \$0.39 million; and
 - stomach - \$0.29 million.

- ▶ Early/Mid-career Fellowships were awarded to 14 of the top 20 tumour types, and this was the largest Fellowship category by funding for sarcoma (incl. bone, \$0.55 million);
- ▶ Mid-career Fellowships were awarded to only 5 of the top 20 tumour types (breast, leukaemia, prostate, colon and rectum and sarcoma)
- ▶ Senior/Principal Fellowships were awarded for 12 of the top 20 tumour types, and this was the largest Fellowship category by funding for:
 - leukaemia - \$7.5 million;
 - lung and pleural mesothelioma - \$2.2 million;
 - sarcoma - \$0.18 million;
 - testis - \$0.38 million;
 - more than one tumour type - \$5.2 million; and
 - multiple tumour streams - \$7.7 million.
- ▶ Not career stage-specific Fellowships were awarded to 17 of the top 20 tumour types, with the exceptions being sarcoma (incl. bone), and cancers of the testis and cervix.

Table 4.2 Funding to, and number of tumour-specific Fellowships in each career stage category, for the top 20 funded tumour types, for research into more than one tumour type and across multiple tumour streams

Table 4.2					
Tumour type	Early career Fellowships	Early/ Mid-career Fellowships	Mid-career Fellowships	Senior/ Principal Fellowships	Not career stage-specific Fellowships
Breast	\$12.6 M	\$4.4 M	\$1.6 M	\$7.2 M	\$5.0 M
	61	16	3	20	19
Leukaemia	\$4.4 M	\$0.36 M	\$0.61 M	\$7.5 M	\$1.8 M
	26	3	3	12	10
Prostate	\$5.2 M	\$0.53 M	\$0.37 M	\$2.3 M	\$3.8 M
	19	2	1	4	13
Melanoma	\$3.3 M	\$0.58 M	None identified	\$3.0 M	\$4.1 M
	17	3		11	9
Colon & rectum	\$3.0 M	\$0.57 M	\$0.58 M	\$2.7 M	\$2.7 M
	18	20	2	7	9
Ovary	\$1.9 M	\$0.47 M	None identified	\$0.80 M	\$2.2 M
	6	2		3	7
Pancreas	\$2.0 M	\$0.37 M	None identified	None identified	\$1.9 M
	9	1			6
Lung & mesothelioma	\$1.1 M	None identified	None identified	\$2.2 M	\$0.43 M
	7			5	4

Table 4.2 contd.					
Tumour type	Early career Fellowships	Early/ Mid-career Fellowships	Mid-career Fellowships	Senior/ Principal Fellowships	Not career stage-specific Fellowships
Lymphoma*	\$1.3 M	\$1.2 M	None identified	\$0.27 M	\$0.34 M
	6	5		2	2
Brain	\$0.49 M	None identified	None identified	None identified	\$2.5 M
	1				13
Myeloma	\$0.52 M	None identified	None identified	None identified	\$0.99 M
	3				8
Liver	\$0.62 M	\$0.10 M	None identified	\$0.07 M	\$0.71 M
	4	1		1	1
Sarcoma (incl. Bone)	\$0.29 M	\$0.55 M	\$0.21 M	\$0.18 M	\$0.06 M
	1	2	1	2	1
Neuroblastoma	\$0.28 M	None identified	None identified	None identified	\$0.96 M
	2				2
Oesophagus	\$0.24 M	\$0.29 M	None identified	None identified	\$0.65 M
	1	1			1
Adrenal cortex	\$0.12 M	None identified	None identified	None identified	\$0.55 M
	160				2
Testis	\$0.03 M	\$0.19 M	None identified	\$0.38 M	None identified
	1	1		1	
Cervix	\$0.39 M	\$0.10 M	None identified	None identified	None identified
	2	1			
Kidney	None identified	\$0.37 M	None identified	None identified	\$0.08 M
		1			1
Stomach	\$0.29 M	None identified	None identified	\$0.12 M	None identified
	1			1	
Other types	\$0.46 M	None identified	None identified	\$0.17 M	None identified
	8			1	
More than one type in a single tumour stream	\$4.1 M	\$0.97 M	\$0.11 M	\$5.2 M	\$2.6 M
	23	3	1	8	8
Multiple tumour streams	\$2.8 M	\$1.1 M	\$0.86 M	\$7.7 M	\$2.5 M
	12	3	2	17	8
	■ Fellowships				

Note: *Lymphoma represents the sum of funding to Fellowships which focused on either Hodgkin's disease or non-Hodgkin lymphoma or both.

4.6 Discussion

The cancer research focus of Scholarships, Fellowships and Academic Cancer Research Chairs was determined by analysing the Common Scientific Outline (CSO focus), the tumour research focus and the tumour types of interest of the recipient's proposed area of research.

Common Scientific Outline (CSO)

The pattern of funding to CSO categories for Scholarships and Fellowships broadly reflected the dominant areas of cancer research in Australia, and is similar to the pattern of proportional funding observed for cancer research projects and research programs in the period 2006 to 2011.⁶

The pattern of funding to Academic Cancer Research Chairs was markedly different to the patterns observed for Scholarships and Fellowships, with the CSO categories of Treatment and Cancer Control, Survivorship and Outcomes Research accounting for more than two-thirds (69%) of proportional funding. This finding may reflect the priorities of the funders, however, the relatively small number of Academic Cancer Research Chairs identified in this audit limits analysis of research focus in this people support scheme category.

Prevention research received the lowest level of funding of all CSO categories. This observation is consistent with the finding of Cancer Australia's previous audit of direct funding to cancer research projects and research programs, which found 2% of proportional funding to Prevention research over the same time period.⁶ This may be due, in part, to the fact that much Prevention research is not cancer-specific, and as discussed in Chapter 3, in relation to the Broad Research Areas of Public Health and Health Services Research, is often not categorised as cancer research by the funder.

The proportional funding to the more patient-focused CSO categories of Early Detection, Diagnosis and Prognosis, and Treatment, varied across the Fellowships categories, with the highest levels of proportional funding going to Early career and Not career stage-specific Fellowships. Fellowships which were called 'Clinical Fellowships' by the funder, tended to be either Early career or Not career stage-specific, and the largest funding source for these Clinical Fellowships was State and territory governments. Cancer Institute NSW and the Victorian Cancer Agency were the two largest State and territory government funders, thus the proportionally higher level of funding to Early Detection, Diagnosis and Prognosis, and Treatment in Early career and Not career stage-specific Fellowships likely reflects strategic priorities of these funders of 'Clinical Fellowships', i.e. to support researchers in more patient-focused areas of cancer research, with an aim of strengthening and supporting clinical research by providing opportunities for cancer clinicians, and academic researchers working directly on clinical problems, to develop and sustain long-term careers in cancer research.

Tumour-specific research

The proportion of funding for Scholarships which focused on tumour-specific research was 75%, whereas the proportion of funding to Fellowships which focused on tumour-specific research was 52%. This difference is due, in part, to the higher proportional contribution of Cancer foundations to Scholarships funding that was observed in Chapter 3. This sector entirely funded tumour-specific research through people support scheme awards (the largest funders were the National Breast Cancer Foundation and the Leukaemia Foundation), and this funding sector provided 19% of funding to Scholarships and 5% of funding to Fellowships in the period 2006 to 2011. Almost half of all funding to Scholarships and Fellowships for tumour-specific research was for research with a focus on breast or haematological cancers, reflecting the impact of the Cancer foundations in funding Scholarships and Fellowships.

Tumour type research

Funding to individual tumour types broadly reflected the pattern of funding observed for cancer research projects and research programs in the period 2006 to 2011, with breast cancer, leukaemia, prostate cancer, melanoma and cancer of the colon and rectum being the top five funded tumour types for Fellowships in this audit, and for cancer research projects and research programs in the previous audit.⁶

Cancer foundations were the largest non-government funder of single tumour type Fellowships, thus the level of funding to breast cancer and leukaemia, is likely due, in part, to the positive impact of this funding sector.

The proportion of tumour-specific Fellowships which were for Early/Mid-career and Mid-career research was low at 9% and 3%, respectively, and many tumour types did not have any Fellowships in these categories. The provision of a greater proportion of Fellowships in these career stage categories may ensure the retention of mid-career researchers and enhance the research work-force base for tumour types that receive lower levels of funding.

The number of Fellowships awarded for tumour-specific research varied notably across the career stage continuum for several cancer types. The strong support for Fellowships for early-career researchers was not maintained through the subsequent career stages. Interestingly, the number of Senior/Principal Fellowships for several tumour types was also greater than the number of Fellowships for mid-career researchers. It is possible that salary support for mid-career researchers can be derived through other funding mechanisms, such as salary support packages within project grants. However, in supporting a strong cancer research workforce, consideration should be given to strategies which provide a pathway of funding for researchers along the career stage continuum.

Multiple tumour streams research

Almost half of all Fellowships which researched tumour types across multiple tumour streams included a focus on breast cancer research, and the most common combinations of multiple tumour streams were breast cancer, gynaecological cancers and genitourinary cancers. These combinations of tumour streams researched together were also observed for cancer research projects and research programs⁶, and are notable for the fact that these cancers can be caused by common gene mutations. Having the genes BRCA1 and BRCA2 in mutated form increases a person's risk of developing breast, ovarian or prostate cancer¹⁶, and the focus on these combinations of tumour streams suggests a growing recognition of the importance of the specific molecular make-up of cancers over the traditional approach of studying cancers of a single tumour stream or type.





Chapter 5 - Funding for building cancer research capacity initiatives and infrastructure

KEY FINDINGS

In the period 2006 to 2011:

- ▶ \$453 million was provided to 437 building cancer research capacity initiatives and infrastructure awards
- ▶ Recipients of funding in New South Wales, Queensland and Victoria together received 94% of identified funding for building cancer research capacity initiatives and infrastructure
- ▶ 75% of funding for building cancer research capacity initiatives and infrastructure (387 individual awards) was provided by single funding sources. The remaining 25% of funding (50 individual awards) were co-funded by two or more funding sources
- ▶ Almost two-thirds (62%) of all co-funded awards were for Equipment and Centres of research.
- ▶ The Australian Government (NHMRC and other Australian Government sources) provided \$199 million (44% of total funding) for building cancer research capacity initiatives and infrastructure, including:
 - 99% of identified funding for Strategic initiatives
 - 64% of identified funding for Clinical research networks
 - 53% of identified funding to Platform services/resources
- ▶ Almost one-third (30%) of funding for building cancer research capacity initiatives and infrastructure was awarded to Centres of research
- ▶ Centres of research, Capacity building, Biobanks, Data repositories and Partnerships awards were all funded by six or more funding sources
- ▶ Clinical research networks, Centres of research, Capacity building and Biobanks were mostly funded by two or three funding sources

From 2006–2008 to 2009–2011:

- ▶ Funding to building cancer research capacity initiatives and infrastructure increased 25%, from \$201 million in 2006–2008, to \$252 million in 2009–2011
- ▶ The number of funded awards increased 35%, from 226 in 2006–2008, to 305 in 2009–2011
- ▶ The total funding and number of funded awards for building cancer research capacity initiatives and infrastructure increased in each state and territory, except for Tasmania, Australian Capital Territory and the Northern Territory

5.1 Response to the National Audit

Cancer Australia contacted 149 national and 21 international organisations who were known to support cancer research in Australia. In total, 81 (73 Australian and 8 international) organisations provided funding data, and all known major funders of cancer research people support and capacity building responded.

A total of 55 organisations (53 Australian and 2 international) provided data on awards of funding to building cancer research capacity initiatives and infrastructure in the period 2006 to 2011. Some respondents provided data on behalf of other funders, thus this audit contains data from 60 individual funders of building cancer research capacity initiatives and infrastructure.

Building cancer research capacity initiatives and infrastructure categories

Chapters 5 and 6 of this report address funding awarded to initiatives which build cancer research capacity, and funding provided for infrastructure to support cancer research. The data summarised in these chapters was originally requested of funders as details of their funding to two discrete areas of investment support (building research capacity and infrastructure) and each of these investment areas included several categories of support (see Chapter 2, Table 2.1). Due to complexity of the data provided, and that the distinction between what constituted 'building research capacity' and 'infrastructure' was interpreted in different ways by different funding organisations, the data across these two investment areas have been analysed and presented together. The types of activities and programs of support that were captured in this audit of building cancer research capacity initiatives and infrastructure were as follows:

- ▶ Biobanks (i.e. population- and disease-based biobanks and tumour tissue repositories);
- ▶ Capacity building awards (i.e. awards of funding which support laboratories and facilities or a team of researchers conducting cancer research);
- ▶ Centres of research (i.e. funding to provide support for teams of researchers working collaboratively on a common research agenda; e.g. awards of funding through the Australian Government's Australian Prostate Cancer Research Centres Program and the NHMRC Centres of Research Excellence Scheme);
- ▶ Clinical research networks (e.g. cooperative cancer clinical trials groups);
- ▶ Data repositories (e.g. clinical trial databases and cancer population databases, but not population-based cancer registries);
- ▶ Equipment (i.e. funding awards for equipment of \$10,000 or more);
- ▶ Laboratory research networks (i.e. laboratory-based research consortia);
- ▶ Partnerships (i.e. awards which specifically support collaborative partnerships of researchers, for example NHMRC Partnerships awards);
- ▶ Platform services/resources (e.g. animal facilities and facilities providing specialised technological services); and
- ▶ Strategic initiatives (large capacity building awards to support programs of research in areas of identified need, e.g. funding to CSIRO's Preventative Health Flagship for colorectal cancer and gut health).

Table 5.1 lists the major funding sources which provided data on funding for building cancer research capacity initiatives and infrastructure for this audit, the building cancer research capacity initiatives and infrastructure categories that were supported, and the proportion of funding awards that were attributable to each funding source. It should be noted that funding from Medical research institutes, hospitals and foundations, Universities and Philanthropic sources are under-represented in this audit because much of their support is not specific for cancer research.

Table 5.1 Major funding sources that provided data for building cancer research capacity initiatives and infrastructure awards

Table 5.1			
Funding source (no. funders)	Building cancer research capacity initiatives and infrastructure categories funded		Proportion of all funding awards provided by source
State and territory government sources (9)	<ul style="list-style-type: none"> - Biobanks - Capacity building - Centres of research - Clinical research networks - Data repositories 	<ul style="list-style-type: none"> - Equipment - Laboratory research networks - Partnerships - Platform services/resources 	49%
Cancer foundations (9)	<ul style="list-style-type: none"> - Biobanks - Capacity building - Centres of research 	<ul style="list-style-type: none"> - Data repositories - Equipment - Partnerships 	12%
Other Australian Government sources (5)	<ul style="list-style-type: none"> - Centres of research - Clinical research networks 	<ul style="list-style-type: none"> - Platform services/resources - Strategic initiatives 	11%
NHMRC	<ul style="list-style-type: none"> - Biobanks - Capacity building - Centres of research - Clinical research networks 	<ul style="list-style-type: none"> - Data repositories - Partnerships - Platform services/resources - Strategic initiatives 	6%
Cancer Councils (4)	<ul style="list-style-type: none"> - Biobanks - Capacity building - Centres of research - Clinical research networks - Data repositories 	<ul style="list-style-type: none"> - Equipment - Laboratory research networks - Partnerships - Platform services/resources 	6%
Universities (7)	<ul style="list-style-type: none"> - Biobanks - Capacity building - Centres of research 	<ul style="list-style-type: none"> - Equipment - Partnerships - Platform services/resources 	5%
Medical research institutes, hospitals and foundations (10)	<ul style="list-style-type: none"> - Biobanks - Capacity building - Centres of research 	<ul style="list-style-type: none"> - Data repositories - Equipment 	5%
International (3)	<ul style="list-style-type: none"> - Biobanks - Centres of research 	<ul style="list-style-type: none"> - Strategic initiatives 	4%
Philanthropic sources (7)	<ul style="list-style-type: none"> - Capacity building - Data repositories - Equipment 	<ul style="list-style-type: none"> - Laboratory research networks - Partnerships - Platform services/resources 	3%

5.2 National research investment in building cancer research capacity initiatives and infrastructure

This audit identified an investment of \$453 million in building cancer research capacity initiatives and infrastructure in the period 2006 to 2011, funded through 437 individual awards.

The annual funding to building cancer research capacity initiatives and infrastructure is shown in Figure 5.1. In 2011, the annual funding to building cancer research capacity initiatives and infrastructure was almost 50% higher than the annual funding in 2006. In each of the years 2007 through 2011, the difference in the level of funding from 2006 exceeded the increase which would have been expected due to the impact of inflation alone.¹³

Figure 5.1 Annual investment in building cancer research capacity initiatives and infrastructure in Australia, 2006 to 2011

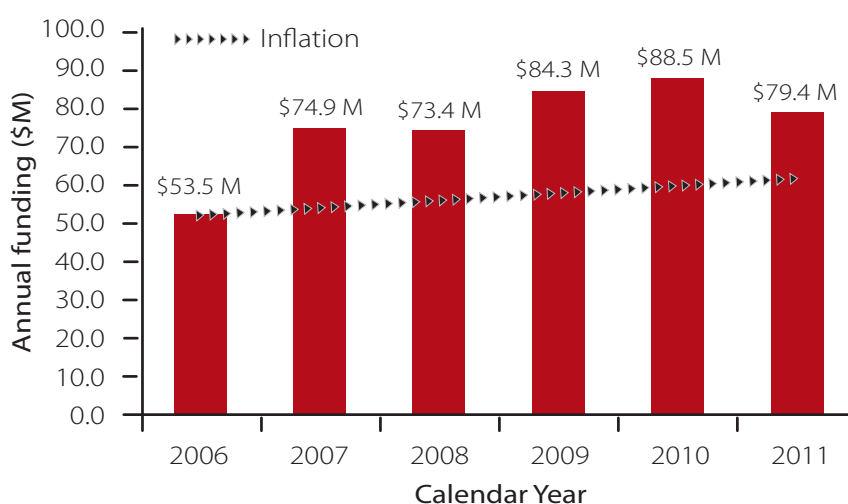


Table 5.2 details the funding provided to and the number of awards funded, for building cancer research capacity initiatives and infrastructure in the trienniums 2006–2008 and 2009–2011 and the total funding for the period 2006 to 2011.

In the triennium 2009–2011, total funding for awards to building cancer research capacity initiatives and infrastructure was \$252 million, 25% higher than for 2006–2008 (\$201 million). The total number of awards funded increased by 35% from 226 in 2006–2008 to 305 in 2009–2011. However, it is important to note that many awards are funded in more than one triennium and can vary markedly in size.

Table 5.2 Funding to building cancer research capacity initiatives and infrastructure in 2006–2008, 2009–2011 and for the period 2006 to 2011

Triennium	Funding	No. awards*
2006–2008	\$201 million	226
2009–2011	\$252 million	305
2006 to 2011	\$453 million	437

Note: *Some awards overlap trienniums.

5.3 State and territory distribution of the funding to building cancer research capacity initiatives and infrastructure

A comparison of the funding provided for building cancer research capacity initiatives and infrastructure in each state and territory in 2006–2008 and 2009–2011, and for the period 2006 to 2011, is shown in Table 5.3.

In the period 2006 to 2011, researchers in New South Wales, Queensland and Victoria together were awarded 94% of identified funding for building cancer research capacity initiatives and infrastructure. From 2006–2008 to 2009–2011, the total funding for building cancer research capacity initiatives and infrastructure increased in New South Wales, Queensland, South Australia, Victoria, Western Australia, and the Australian Capital Territory. Funding decreased in Tasmania, and no funding awards were identified in the Northern Territory during this time period.

Table 5.3 Distribution to states and territories of funding to building cancer research capacity initiatives and infrastructure in 2006–2008 and 2009–2011, for the period 2006 to 2011 and the proportion of funding to each state and territory

Table 5.3			
State or territory	2006–2008	2009–2011	2006 to 2011
New South Wales	\$102 M	\$117 M	\$219 M (48%)
	114	144	219
Queensland	\$18.6 M	\$27.8 M	\$46.4 M (10%)
	15	19	23
South Australia	\$0.24 M	\$9.2 M	\$9.4 M (2%)
	7	20	26
Tasmania	\$1.1 M	\$0.1 M	\$1.2 M (<1%)
	1	1	2
Victoria	\$73.6 M	\$89.7 M	\$163 M (36%)
	81	107	151
Western Australia	\$4.7 M	\$7.4 M	\$12.1 M (3%)
	7	13	15
Australian Capital Territory	\$0.90 M	\$1.0 M	\$1.9 M (1%)
	1	1	1
Northern Territory	None identified	None identified	None identified
	 Awards of funding		

Note: Many awards overlap trienniums, thus the total number of awards from 2006 to 2011 does not equal the sum of awards for 2006–2008 and 2009–2011.

Due to rounding, funding for 2006 to 2011 may not equal the sum of funding in 2006–2008 and 2009–2011 for each row.

5.4 Sources of funding for building cancer research capacity initiatives and infrastructure

In this section of the report, for analysis purposes, where a funding award for building cancer research capacity initiatives or infrastructure was co-funded, the total funding amount was allocated to the funding partner providing the majority of funds. For co-funded building cancer research capacity and infrastructure awards where the majority funder could not be identified, total funding was allocated to the funder who submitted the funding data to Cancer Australia.

Funding awards for building cancer research capacity initiatives and infrastructure were categorised by funding sector. Figure 5.2 shows the proportion of funding provided by different funding sectors for building cancer research capacity initiatives and infrastructure in Australia.

In the period 2006 to 2011, the major funders of building cancer research capacity initiatives and infrastructure, the total funding amounts provided, and the number of awards funded, were as follows:

- ▶ Other Australian Government sources^j (not including NHMRC) – \$157 million (35% of total funding), 48 awards;
- ▶ State and territory governments – \$119 million (26% of total funding), 214 awards;
- ▶ Cancer Foundations^k – \$63.6 million (14% of total funding), 54 awards
- ▶ NHMRC – \$41.9 million (9% of total funding), 27 awards;
- ▶ International sources – \$39.4 million (9% total funding), 16 awards;
- ▶ Cancer Councils – \$15.7 million (3% of total funding), 24 awards;
- ▶ Medical research institutes, hospitals and foundations^l – \$9.3 million (2% of total funding), 22 awards;
- ▶ Universities – \$4.3 million (1% of total funding), 20 awards; and
- ▶ Philanthropy – \$2.3 million (<1% total funding), 12 awards.

The Australian Government (NHMRC and other Australian Government sources) was the major funder of building cancer research capacity initiatives and infrastructure, providing 44% (\$199 million) of funding. State and territory governments provided the most awards – 214 (49% of all identified awards).

It should be noted that the level of funding provided by Medical research institutes, hospitals and foundations, Universities, and Philanthropy are likely to be an underestimate of the support provide by these sectors. Medical research institutes, hospitals and foundations, and Universities provide significant support to building research capacity and infrastructure for health and medical research which is not specifically identified as for cancer research. Similarly, Philanthropic sources which often support health and medical research, in a similar way, are also likely to be under-represented, with only four primary funders from Philanthropic sources identified.

^jOther Australian Government sources include many Australian Government departments and agencies. The major sources of funding were the Department of Industry (including the Australian Research Council), Cancer Australia and the Department of Health.

^kCancer foundations included foundations that provided funds specifically to cancer research, e.g. National Breast Cancer Foundation, Leukaemia Foundation, and the Prostate Cancer Foundation of Australia.

^lThis category includes Medical research institutes and hospitals, their associated foundations and foundations dedicated to medical research.

Figure 5.2 Proportion of funding to building cancer research capacity initiatives and infrastructure awards by funding source

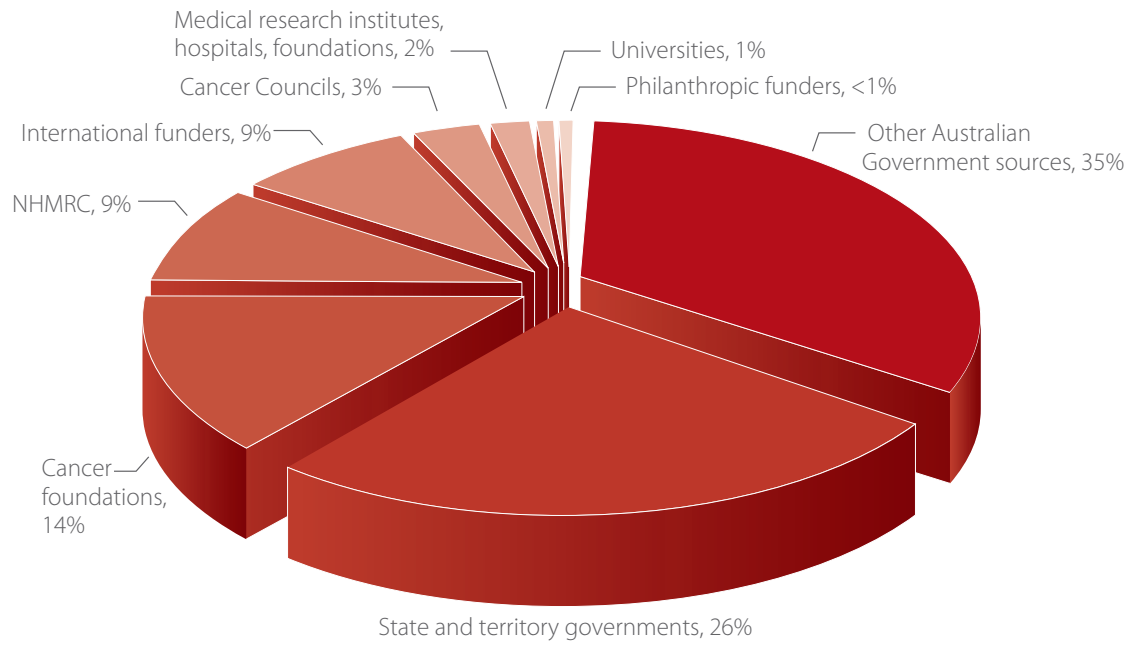
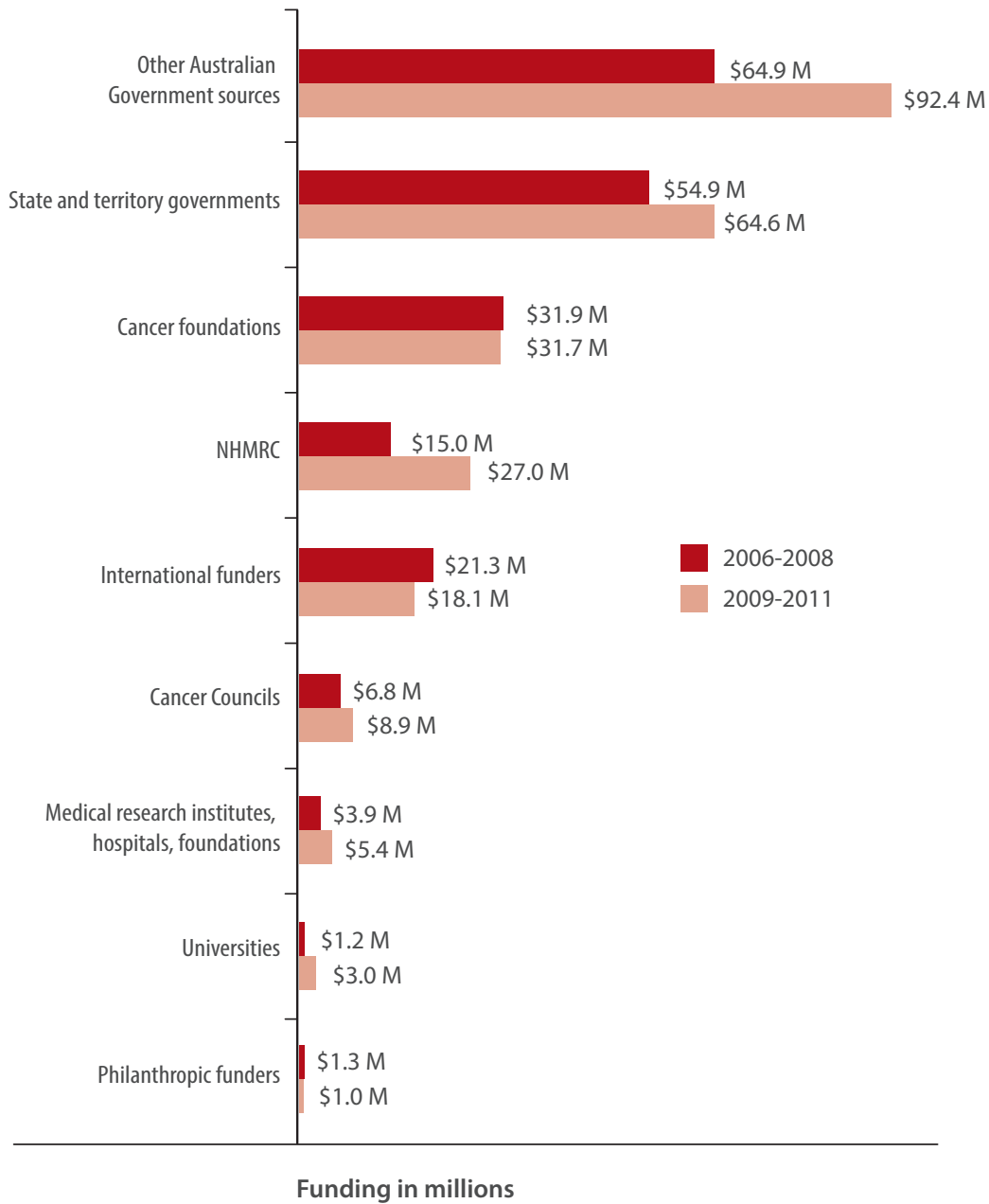


Figure 5.3 shows the level of funding provided in each triennium by each funding sector. From 2006–2008 to 2009–2011, all funding sources increased funding for building cancer research capacity initiatives and infrastructure, with the exception of Cancer foundations and Philanthropic funders, from whom funding remained fairly stable over the two trienniums.

Figure 5.3 Sources of funding and investment made in 2006–2008 and 2009–2011



5.5 Co-funding of awards for building cancer research capacity initiatives and infrastructure

In the period 2006 to 2011, 75% of funding for building cancer research capacity initiatives and infrastructure (387 individual awards) was provided by single funding sources. The remaining 25% of funding (50 individual awards) was co-funded by more than one funding source.

Of the 50 awards for building cancer research capacity initiatives and infrastructure which received funding from more than one source, 39 (78%) were funded by two sources and 11 (22%) were funded by three or more sources.

The major funding sources that were involved in co-funding of awards for building cancer research capacity initiatives and infrastructure were as follows:

- ▶ Cancer foundations co-funded 30 (60%) awards;
- ▶ The Australian Government (NHMRC and other Australian Government sources) co-funded 10 (20%) awards;
- ▶ Cancer Councils co-funded 5 (10%) awards; and
- ▶ State and territory governments co-funded 5 (10%) awards.

Co-funding of building cancer research capacity initiatives and infrastructure awards categories

Of the 50 identified co-funded awards, almost two thirds (62%, 31 awards) were for Equipment and Centres of research.

In the period 2006 to 2011, the number and proportion of awards which were co-funded within each building cancer research capacity initiatives and infrastructure category, were as follows:

- ▶ Of the 98 Equipment awards, 18 (18%) were co-funded;
- ▶ Of the 51 Centres of research awards, 13 (25%) were co-funded;
- ▶ Of the 25 Partnerships awards, 6 (24%) were co-funded;
- ▶ Of the 19 Data repositories awards, 4 (21%) were co-funded;
- ▶ Of the 35 Biobanks awards, 4 (11%) were co-funded;
- ▶ Of the 5 Strategic initiatives awards, 2 (40%) were co-funded; and
- ▶ Of the 95 Capacity building awards, 2 (2%) were co-funded.

No co-funded awards were identified for Clinical research networks, Laboratory research networks or Platform services/resources.



5.6 Pattern of funding to individual building cancer research capacity initiatives and infrastructure categories

The level of funding and number of awards to each individual building cancer research capacity initiatives and infrastructure category in the period 2006 to 2011 is shown in Figure 5.4, together with a breakdown of funding in each of the trienniums 2006–2008 and 2009–2011.

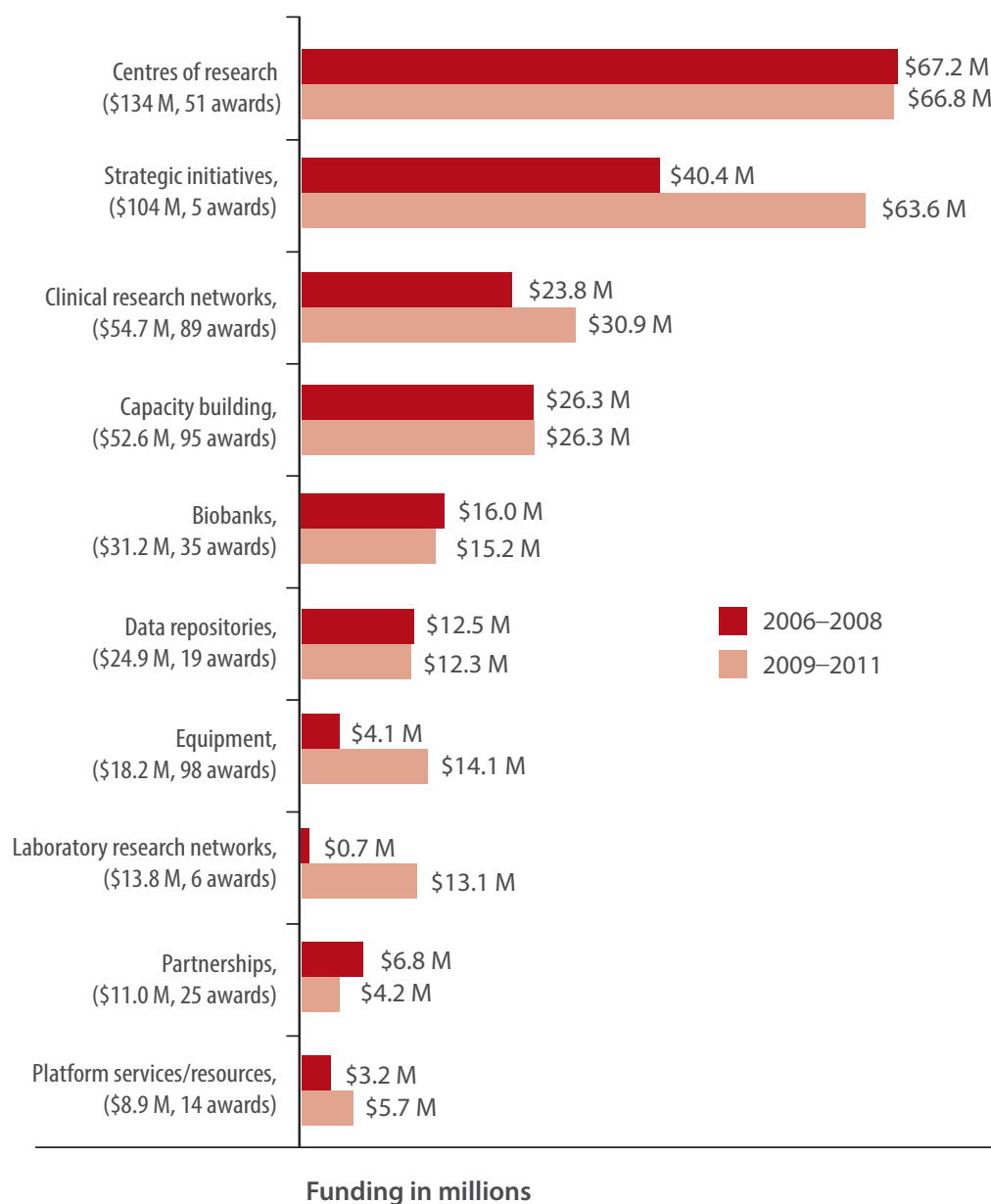
From 2006–2008 to 2009–2011, the level of funding increased for Strategic initiatives, Clinical research networks, Equipment, Laboratory research networks and Platform services/resources, and decreased or remained the same for Centres of research, Capacity building, Biobanks, Data repositories and Partnerships.

It should be noted that some large awards of funding to building cancer research capacity initiatives and infrastructure were reported as a 'bloc' of funding in a single year, even if the award was for multiple years of activity, whilst others were reported with funding apportioned in each year of the award. Where 'bloc' funding was awarded to a multiyear initiative, the amount of funding was apportioned equally to each year in which the initiative was reported as being active.

In summary, in the period 2006 to 2011:

- ▶ 30% (\$134 million) of funding was awarded to Centres of research;
- ▶ 23% (\$104 million) of funding was awarded to Strategic initiatives;
- ▶ 12% (\$54.7 million) of funding was awarded to Clinical research networks;
- ▶ 12% (\$52.6 million) of funding was awarded to Capacity building;
- ▶ 7% (\$31.2 million) of funding was awarded to Biobanks;
- ▶ 5% (\$24.9 million) of funding was awarded to Data repositories;
- ▶ 4% (\$18.2 million) of funding was awarded to Equipment;
- ▶ 3% (\$13.8 million) of funding was awarded to Laboratory research networks;
- ▶ 2% (\$11.0 million) of funding was awarded to Partnerships; and
- ▶ 2% (\$8.9 million) of funding was awarded to Platform services/resources.

Figure 5.4 Level of funding to building cancer research capacity and infrastructure categories in 2006–2008 and 2009–2011



Sources of funding for building cancer research capacity initiatives and infrastructure categories

Table 5.4 lists the funding to and number of awards to the different categories for building cancer research capacity initiatives and infrastructure, categorised by funding source. Figure 5.5 shows the proportional distribution of funding to the categories for building cancer research capacity initiatives and infrastructure in the period 2006 to 2011, categorised by the source of funding for the award.

In the period 2006 to 2011, the Australian Government (not including the NHMRC) was the largest funder of Strategic initiatives and Clinical research networks. When all Australian Government sources of funding are combined (i.e. including the NHMRC), they provided almost all (99.5%) funding towards Strategic initiatives, almost two-thirds (64%) of funding to Clinical research networks and more than half (53%) of all funding to Platform services/resources.

The second largest source of funding for building cancer research capacity initiatives and infrastructure, State and territory governments, provided most of the funding (90%) to Laboratory research networks and Equipment (86%), almost two-thirds (64%) of funding to Partnerships, more than half of funding (55%) towards Biobanks and a third (33%) of funding to Clinical research networks.

Six or more different funding sources provided funding for 323 awards to support Biobanks, Data repositories, Centres of research, Capacity building initiatives, Equipment and Partnerships awards.

In summary, for each building cancer research capacity initiatives and infrastructure category, the major funding sources, the level of funding provided and the number of awards funded, were as follows:

- ▶ Strategic initiatives were principally funded by other Australian Government sources^m (86%; \$89.1 million, 1 award) and NHMRC (14%; \$14.4 million, 3 awards);
- ▶ Centres of research were funded by 8 different sources; the major sources of funding were: International sources (29%; \$38.8 million, 14 awards), other Australian Government sources (27%; \$35.6 million, 3 awards) and Cancer foundations (24%; \$31.7 million, 12 awards);
- ▶ Clinical research networks were funded by 4 different sources; however, nearly 90% of funding was provided by other Australian Government sources (56%; \$30.6 million, 43 awards) and State and territory governments (33%; \$18.2 million, 40 awards);
- ▶ Capacity building was funded by 7 different sources, with 90% of funding provided by Cancer foundations (48%; \$25.1 million, 11 awards) and State and territory governments (42%; \$22.1 million, 69 awards);
- ▶ Biobanks were funded by 7 different sources; however, 88% of funding was provided by State and territory governments (55%; \$17.1 million, 11 awards) and NHMRC (33%; \$10.2 million, 8 awards);
- ▶ Data repositories were funded by 6 different sources; however, State and territory governments provided over half the funding (58%; \$14.4 million, 8 awards). Cancer Councils (16.9%; \$4.2 million, 3 awards), Cancer foundations (12.7%; \$3.2 million, 3 awards) and NHMRC (10.6%; \$2.6 million, 2 awards) also contributed to the funding of data repositories.
- ▶ Equipment was funded by 6 different sources; however most of the funding was provided by State and territory governments (86%; \$15.6 million, 57 awards);
- ▶ Laboratory research networks were funded by three different sources, however the principal funder was State and territory governments (90%; \$12.4 million, 4 awards);
- ▶ Partnerships were funded by 6 different sources. State and territory governments were the largest funder (64%; \$7.0 million, 12 awards), with Universities (15%; \$1.6 million, 1 award) and Cancer Councils (11%; \$1.2 million, 7 awards) also providing funding; and
- ▶ Platform services/resources were funded by 5 different sources. The NHMRC was the single largest funder (53%; \$4.7 million, 4 awards), with other Australian Government sources (22%; \$2.0 million, 1 award) and State and territory governments (19%; \$1.7 million, 7 awards) also providing funding.

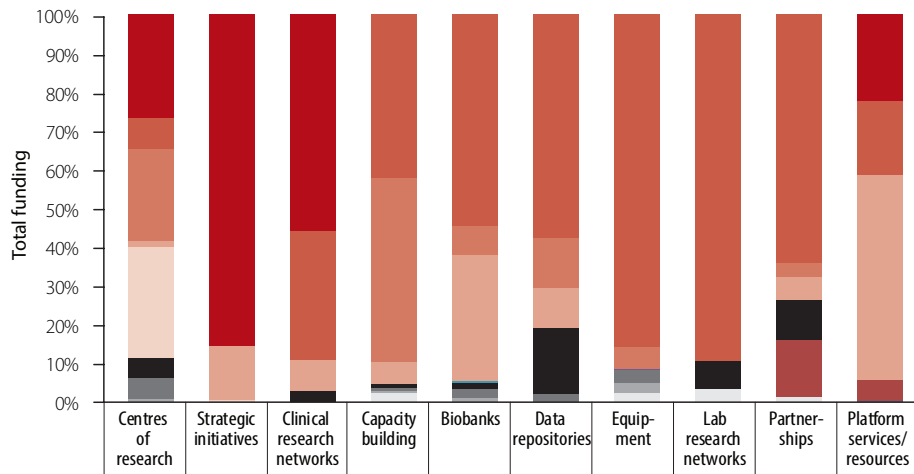
^m Other Australian Government sources include many Australian Government departments and agencies. The major sources of funding were the Department of Industry (including the Australian Research Council), Cancer Australia and the Department of Health.

Table 5.4

Major sources of funding – total funding to and number of awards funded for building cancer research capacity initiatives and infrastructure categories in the period 2006 to 2011

Source	Centres of research	Strategic initiatives	Clinical research networks	Capacity building	Biobanks	Data repositories	Equipment	Laboratory research networks	Partnerships	Platform service/resource	TOTAL
Other Australian Government sources	\$35.6 M 3	\$89.1 M 1	\$30.6 M 43	None identified	None identified	None identified	None identified	None identified	None identified	\$2.0 M 1	\$157 M 46
State and territory governments	\$11.0 M 6	None identified	\$18.2 M 40	\$22.1 M 69	\$17.1 M 11	\$14.4 M 8	\$15.6 M 57	\$12.4 M 4	\$7.0 M 12	\$1.7 M 7	\$119 M 214
Cancer foundations	\$31.7 M 12	None identified	None identified	\$25.1 M 11	\$2.3 M 8	\$3.2 M 3	\$0.99 M 18	None identified	\$0.41 M 2	None identified	\$63.6 M 54
NHMRC	\$1.8 M 2	\$14.4 M 3	\$4.4 M 3	\$3.1 M 3	\$10.2 M 8	\$2.6 M 2	None identified	None identified	\$0.65 M 2	\$4.7 M 4	\$41.9 M 27
International sources	\$38.8 M 14	\$0.55 M 1	None identified	None identified	\$0.10 M 1	None identified	None identified	None identified	None identified	None identified	\$39.4 M 16
Cancer Councils	\$7.0 M 1	None identified	\$1.5 M 3	\$0.35 M 4	\$0.44 M 3	\$4.2 M 3	\$0.05 M 1	\$0.99 M 1	\$1.2 M 7	None identified	\$15.7 M 24
Institutes, hospitals, foundations	\$7.0 M 10	None identified	None identified	\$0.38 M 4	\$0.80 M 2	\$0.47 M 2	\$0.65 M 4	None identified	None identified	None identified	\$9.3 M 22
Universities	\$1.1 M 3	None identified	None identified	\$0.36 M 1	\$0.30 M 1	None identified	\$0.42 M 13	None identified	\$1.6 M 1	\$0.47 M 1	\$4.3 M 20
Philanthropic funders	None identified	None identified	None identified	\$1.2 M 3	None identified	\$0.02 M 1	\$0.42 M 5	\$0.45 M 1	\$0.14 M 7	\$0.03 M 1	\$2.3 M 12
TOTAL	\$134 M 51	\$104 M 5	\$54.7 M 89	\$52.6 M 95	\$31.2 M 35	\$24.9 M 19	\$18.2 M 98	\$13.8 M 6	\$11.0 M 25	\$8.9 M 14	
	<div style="display: flex; align-items: center;"> <div style="width: 10px; height: 10px; background-color: #cccccc; margin-right: 5px;"></div> Awards of funding </div>										

Figure 5.5 The proportional distribution of funding to building cancer research capacity initiatives and infrastructure categories, by funding sources



	Centres of research	Strategic initiatives	Clinical research networks	Capacity building	Biobanks	Data repositories	Equipment	Lab research networks	Partnerships	Platform services/resources
■ Other Australian Government sources	27%	86%	56%	0%	0%	0%	0%	0%	0%	22%
■ State and territory governments	8%	0%	33%	42%	55%	58%	86%	90%	64%	19%
■ Cancer foundations	24%	0%	0%	48%	7%	13%	5%	0%	4%	0%
■ NHMRC	1%	14%	8%	6%	33%	11%	0%	0%	6%	53%
■ International funders	29%	1%	0%	0%	0%	0%	0%	0%	0%	0%
■ Cancer Councils	5%	0%	3%	1%	1%	17%	0%	7%	11%	0%
■ Institutes, hospitals, foundations	5%	0%	0%	1%	3%	2%	4%	0%	0%	0%
■ Universities	1%	0%	0%	1%	1%	0%	2%	0%	15%	5%
■ Philanthropic funders	0%	0%	0%	2%	0%	0%	2%	3%	1%	0%

5.7 Discussion

This audit of the period 2006 to 2011 has identified funding of \$453 million to 437 building cancer research capacity initiatives and infrastructure awards in the period 2006 to 2011. Whilst annual funding in 2011 was 48% higher than in 2006, a sustained year-on-year increase in funding from 2006 to 2011 was not observed. Nonetheless, the level of funding in the triennium 2009–2011 (\$252 million) was 25% higher than in 2006–2008 (\$201 million), and the number of funded awards increased by 36% from 2006–2008 to 2009–2011. However, caution is advised when interpreting the number of awards from one triennium to the next as many awards are funded in more than one triennium and can vary markedly in size – the average funding award was in excess of \$1.0 million whereas the median award size was \$290,000.

In the period 2006 to 2011, researchers in Victoria, New South Wales and Queensland together were awarded 94% of identified funding for building cancer research capacity initiatives and infrastructure. State and territory governments provided the greatest number of funding awards (49%; 214 awards) to building cancer research capacity initiatives and infrastructure. The geographical distribution of funding largely reflects the location of Australia's health and medical research workforce, and the number of awards provided by State and territory governments reflects the investment by jurisdictions in building local research capacity.

From 2006–2008 to 2009–2011, the total funding for building cancer research capacity initiatives and infrastructure increased in New South Wales, Queensland, South Australia, Victoria, Western Australia and the Australian Capital Territory. Funding to building cancer research capacity initiatives and infrastructure decreased in Tasmania from 2006–2008 to 2009–2011, due to the funding of a Centre of research only in 2006–2008. The funding to building cancer research capacity initiatives and infrastructure in South Australia increased markedly due to the funding of large capacity building and data repository awards in 2009–2011, by the Australian Cancer Research Foundation and the South Australian Government.

Sources of funding

In the period 2006 to 2011, the major funders of building cancer research capacity initiatives and infrastructure were the Australian Government (44%; \$157 million, including \$41.9 million from NHMRC), State and territory governments (26%; \$119 million), Cancer foundations (14%; \$63.6 million), International funders (9%; \$39.4 million) and the Cancer Councils (3%; \$15.6 million). The funding sectors of Medical research institutes, hospitals and foundations, Universities and Philanthropic sources together contributed 4% (\$15.9 million); however, this figure is likely to be an underestimate of the support for cancer research provided by these sectors. These sectors support health and medical research in general and such funding support may also benefit cancer research, but the specific contribution to cancer research could not be determined.

The dominance of the larger cancer research funders in providing support for building cancer research capacity initiatives and infrastructure suggests an opportunity for smaller funders to collaborate with the larger funders to co-fund awards. A co-funding approach with a single award to any one institution, would allow funders to continue to support grants in these areas, while reducing the administrative burden associated with grant management for both researchers and individual funders.

More than two-thirds (70%) of funding for building cancer research capacity initiatives and infrastructure was provided by the Australian Government (including NHMRC) and state and territory government sources. It should be noted that both the Australian Government and the state and territory governments also provide significant building research capacity and infrastructure support to health and medical research through other funding schemes, the cancer research component of which was not possible to determine. Such funding schemes include: the NHMRC's Equipment grants and the Independent Research Institutes Infrastructure Support

Scheme; the Australian Government's Research Infrastructure Block Grants funded through the Department of Education and Training, and funding provided for the support of independent medical research institutes provided by state and territory governments.

Funding to building cancer research capacity initiatives and infrastructure categories

Centres of research

Almost one-third (30%) of funding to building cancer research capacity initiatives and infrastructure was awarded to Centres of research, e.g. the Cancer Therapeutics CRC, the Australian Prostate Cancer Research Centres and the Ludwig Institute for Cancer Research. Centres of research were funded by 8 different funding sources. In total there were 51 awards of funding to Centres of research, 13 (25%) of which were co-funded awards.

Strategic initiatives

Almost a quarter (23%) of funding to building cancer research capacity initiatives and infrastructure was awarded to Strategic initiatives. The principal award funded in this category was CSIRO's Preventative Health National Research Flagship: Colorectal cancer and gut health initiative. Strategic initiatives were funded by three different funding sources. There were 5 identified awards of funding for Strategic initiatives, 2 (40%) of which were co-funded.

Clinical research networks

More than one-tenth (12%) of funding to building cancer research capacity initiatives and infrastructure was awarded to Clinical research networks, Australian Government sources (including the NHMRC) and state and territory governments together provided 97% of this funding to clinical research networks.

Funding for clinical research networks increased by 30% from 2006–2008 (\$23.8 million) to 2009–2011 (\$30.9 million), predominantly due to Australian Government funding to the National Cancer Cooperative Trials Groups, provided by Cancer Australia. Cancer Australia provides funding to these Groups to support the development of industry-independent cancer clinical trials protocols. This funding aims to:

- ▶ increase the participation in clinical trials by people affected by cancer;
- ▶ increase the number of cancer clinical trials conducted in Australia;
- ▶ increase the number of clinical sites actively participating in clinical trials; and
- ▶ increase the involvement of clinicians and researchers in clinical trials within Australia.

The intended outcome of this program is to guide scientific improvements in cancer prevention, treatment and care and, in doing so, build the evidence-base for best practice cancer care to improve health outcomes for Australians affected by cancer.

Clinical research networks were funded by 4 different sources. There were 89 separate funding awards identified to Clinical research networks, none of these were co-funded awards.

Capacity building

Capacity building initiatives also received more than one-tenth (12%) of funding awarded to building cancer research capacity initiatives and infrastructure. Capacity building initiatives were mostly funded by Cancer foundations (48%), and State and territory government sources (42%); the major State and territory government funders were the Cancer Institute NSW and the Victorian Cancer Agency. The Australian Cancer Research Foundation was the other major funder which invested in capacity building initiatives, as well as Centres of research, around Australia.

Capacity building initiatives were funded by 7 different sources. There were 94 awards of funding identified for Capacity building initiatives, 2 (2%) of which were co-funded.

Biobanks

Seven percent of funding for building cancer research capacity initiatives and infrastructure was awarded to Biobanks. Most of the funding was provided by State and territory governments (55%) and NHMRC (33%), and funding was provided as short-term grants. Sustainable funding models for the medium to long term are necessary, to ensure that biospecimens can be used for future research to help build our understanding of the molecular characteristics of cancer incidence, treatment and prognosis.

Biobanks were funded from 7 different sources. There were 35 awards of funding identified for Biobanks, 4 (11%) of which were co-funded.

Data repositories

Five percent of funding for building cancer research capacity initiatives and infrastructure was awarded to Data repositories. State and territory governments provided over half the funding (58%), and almost half of this (44%) was provided to the Australian Cancer Grid (BioGrid).

Data repositories were funded through 6 different sources. There were 19 awards of funding identified for Data repositories, 4 (21%) of which were co-funded.

Equipment

Four percent of funding for building cancer research capacity initiatives and infrastructure was awarded to Equipment. Equipment awards (which were for grants of \$10,000 or larger) were primarily funded by State and territory governments (86%), and the major funder was the Cancer Institute NSW which has a program to fund equipment for cancer research activities. It should be noted; however, that a lot of equipment support would also be provided through some of the other categories, especially Strategic initiatives, Centres of research, Capacity building and Platform services/resources. Funding for equipment increased almost 6-fold from 2006–2008 (\$4.1 million) to 2009–2011 (\$14.1 million), predominantly due to increased funding from the Cancer Institute NSW.

Equipment was funded by 6 different sources. There were 98 awards of funding identified for Equipment, 18 (18%) of which were co-funded.

Laboratory research networks

Three percent of funding for building cancer research capacity initiatives and infrastructure was awarded to Laboratory research networks. These research networks were primarily funded by State and territory governments (90%, and the major funder was the Victorian Cancer Agency). Funding for Laboratory research networks mostly occurred in 2009–2011 (\$13.1 million) with a smaller amount in 2006–2008 (\$0.75 million), predominantly due to increased Victorian Cancer Agency funding.

Laboratory research networks were funded by three different sources. There were 6 separate funding awards identified to Laboratory research networks, none of these were co-funded awards.

Partnerships

Two percent of funding for building cancer research capacity initiatives and infrastructure was awarded to Partnerships. State and territory governments were the largest funder (64%). Funding for Partnerships decreased from 2006–2008 (\$6.8 million) to 2009–2011 (\$4.2 million), primarily due to a large Cancer Institute NSW investment occurring in the first triennium.

Partnerships were funded by 6 different sources. There were 25 awards of funding identified for Partnerships, 6(24%) of which were co-funded.

Platform services/resources

Two percent of funding for building cancer research capacity initiatives and infrastructure was awarded to Platform services/resources. The NHMRC was the single largest funder (53%) with Medical research institutes, hospitals and foundations (22%), and State and territory governments (19%) also providing funding. Funding for Platform services/resources increased by 78% from 2006–2008 (\$3.2 million) to 2009–2011 (\$5.7 million), predominantly due to increased Australian Government commitment through the NHMRC and Department of Industry.

Platform services/resources were funded by 5 different sources.

Opportunities for co-funding

Given the large cost of some building cancer research capacity initiatives, there are inherent challenges in supporting these types of infrastructure solely for cancer research.

This audit identified that in the period 2006 to 2011, three quarters of funding (and over 380 different awards) for building cancer research capacity initiatives and infrastructure was provided by single funding sources.

Opportunities to co-fund grants in these areas may allow smaller funding organisations, new funders, or existing disease-specific funders to collectively support building research capacity initiatives and infrastructure. The opportunity for smaller or new funders to co-fund with existing funders or other disease-specific funders would increase the available funding for these types of grants and encourage sharing of infrastructure across research areas. The provision of Australia-wide co-funding opportunities could be achieved through the development of a new national collaborative funding scheme or through the expansion of an existing scheme.

Chapter 6 - Funding for building cancer research capacity initiatives and infrastructure - cancer research focus

KEY FINDINGS

In the period 2006 to 2011:

Common Scientific Outline

- ▶ More than half (56%) of the identified funding for building cancer research capacity initiatives and infrastructure was provided to the CSO categories of Biology and Treatment
- ▶ From 2006–2008 to 2009–2011, the level of funding increased to all CSO categories except Aetiology
- ▶ The CSO categories of Biology, Aetiology, Early Detection, Diagnosis and Prognosis, Treatment and Cancer Control, Survivorship and Outcomes Research were funded through seven or more different categories of building cancer research capacity initiatives and infrastructure. CSO Prevention was principally funded through a single Strategic initiative
- ▶ The major CSO foci for the different categories of building cancer research capacity initiatives and infrastructure were:
 - Centres of research – Biology and Treatment (87%, \$117 million)
 - Strategic initiatives – Prevention (86% of funding to the category, \$89.1 million)
 - Clinical research networks – Treatment (91%, \$49.5 million)
 - Capacity building – Biology and Treatment (80%, \$42.1 million)
 - Biobanks – Early Detection, Diagnosis and Prognosis (67%, \$20.8 million)
 - Data repositories – Early Detection, Diagnosis and Prognosis, Aetiology and Treatment (90%, \$18.4 million)
 - Equipment – Biology and Early Detection, Diagnosis and Prognosis (88%, \$15.8 million)
 - Laboratory research networks – Biology (87%, \$12.0 million)
 - Partnerships – Biology, Treatment and Cancer Control, Survivorship and Outcomes Research (94%, \$10.3 million)
 - Platform services/resources – Scientific Model Systems and Treatment (85%, \$7.6 million)

Tumour research focus

- ▶ 61% of funding (\$277 million) for building cancer research capacity initiatives and infrastructure was for tumour-specific research
- ▶ Funding increased from 2006–2008 to 2009–2011 for most tumour types (colon and rectum, prostate, kidney, breast, melanoma, leukaemia, ovary, sarcoma, pancreas and oesophagus) and remained level for brain
- ▶ Funding decreased to lung cancer (including pleural mesothelioma), neuroblastoma and cancers of the cervix and thyroid from their levels in 2006–2008

6.1 Classification of funding awards for building cancer research capacity initiatives and infrastructure by Common Scientific Outline

Each funding award for building cancer research capacity initiatives and infrastructure was classified by the Common Scientific Outline (CSO) category that best reflected the primary focus of the research to be supportedⁿ. As previously described in Chapter 2 (Methodology), the CSO categories used for this analysis were:

1. Biology;
2. Aetiology;
3. Prevention;
4. Early Detection, Diagnosis and Prognosis;
5. Treatment;
6. Cancer Control, Survivorship and Outcomes Research; and
7. Scientific Model Systems.

Figure 6.1 shows the proportional distribution to each CSO category of the funding provided to awards for building cancer research capacity initiatives and infrastructure in the period 2006 to 2011. More than half (56%) of the identified funding was provided to two CSO categories combined: Treatment (30%) and Biology (26%). Funding to Prevention (20%), Early Detection, Diagnosis and Prognosis (14%), Cancer Control, Survivorship and Outcomes Research (5%), Aetiology (3%) and Scientific Model Systems (2%) accounted for the balance of total funding.

It should be noted that the pattern of proportional funding to the CSO categories was strongly influenced by the funding provided to CSIRO's Preventative Health National Research Flagship: Colorectal cancer and gut health initiative. This initiative accounted for 20% (\$89.1 million) of the identified funding for building cancer research capacity initiatives and infrastructure in the period 2006 to 2011. Although the initiative encompassed activities across the cancer research continuum, including research into prevention, aetiology, early detection and diagnosis of colorectal cancer, the primary focus was Prevention, and this encompassed a range of biological research activities. This single one-off award accounted for 97% of funding to CSO Prevention in the period 2006 to 2011.

Across the two trienniums covered by this audit, 2006–2008 and 2009–2011, the level of funding to awards for building cancer research capacity initiatives and infrastructure increased for all CSO categories except Aetiology (see Figure 6.2). The largest increase in the level of funding occurred to CSO Early Detection, Diagnosis and Prognosis, which increased from \$23.2 million in 2006–2008 to \$39.8 million in 2009–2011.

ⁿ Each CSO category covers a broad range of research topics (see Appendix D). In some cases the research described for a particular research capacity and infrastructure award was relevant to multiple CSO categories. In such cases, the award was allocated to the CSO category which best represented the primary focus of the research undertaken.

Figure 6.1 The pattern of funding to building cancer research capacity initiatives and infrastructure: proportional distribution of funding, level of funding, and number of awards in each CSO category

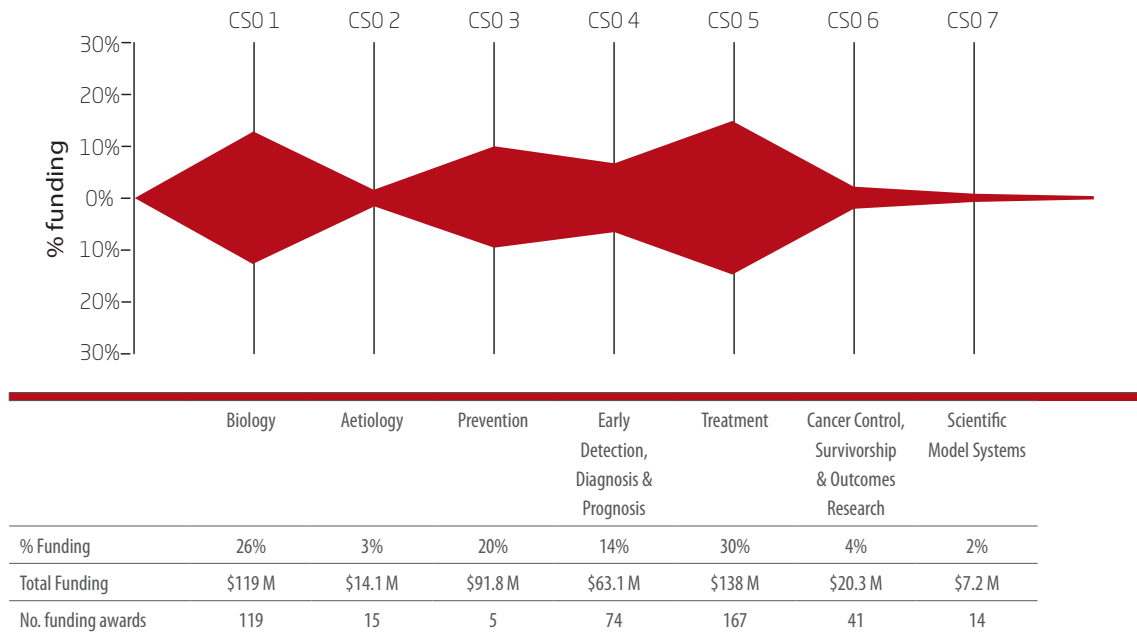
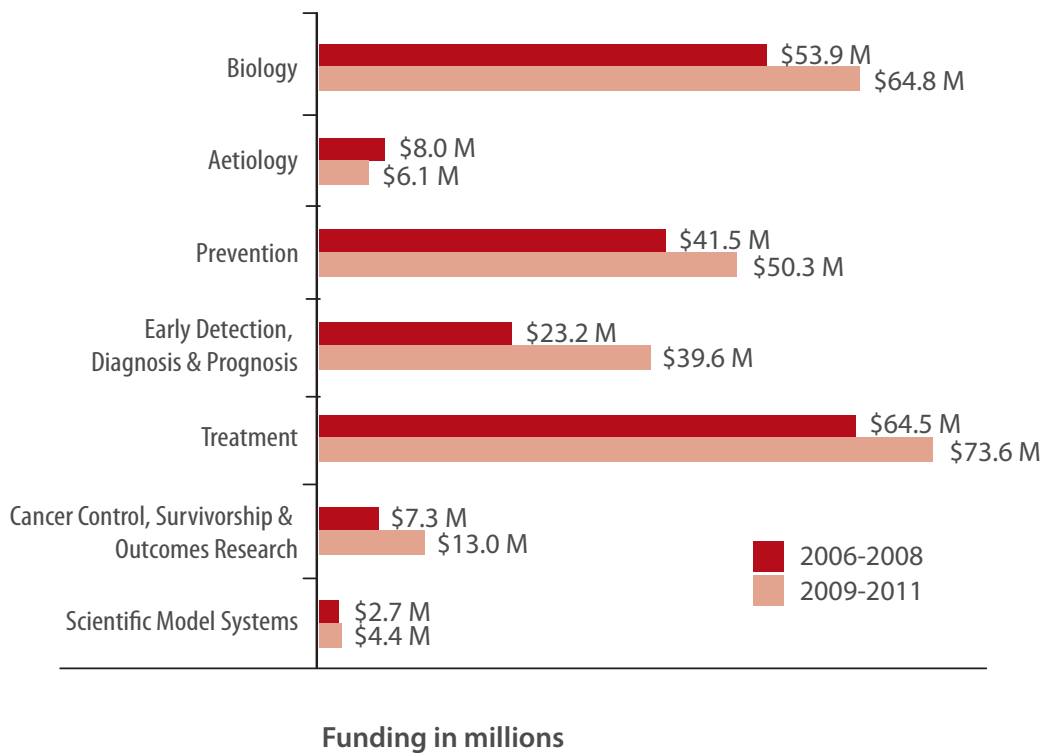


Figure 6.2 The level of funding to each CSO category for building cancer research capacity initiatives and infrastructure in 2006–2008 and 2009–2011



Funding to building cancer research capacity initiatives and infrastructure categories

Table 6.1 lists the funding, and number of awards, to each of the different categories of building cancer research capacity initiatives and infrastructure in the period 2006 to 2011. Within each CSO classification, the proportional distribution of funding to each building cancer research capacity initiatives and infrastructure category is also listed.

Figure 6.3 shows the proportional distribution of funding within each category of building cancer research capacity initiatives and infrastructure in the period 2006 to 2011, categorised by the CSO focus of the award.

In summary, for each building cancer research capacity initiatives and infrastructure category, the major CSO foci of awards were as follows:

- ▶ Awards of funding to Centres of research were predominantly for Biology (45%; \$59.9 million, 26 awards) and Treatment (42%; \$56.8 million, 17 awards);
- ▶ Awards of funding to Strategic initiatives were mostly for Prevention (86%; \$89.1 million, 1 award), followed by Early Detection, Diagnosis and Prognosis (13%; \$13.9 million, 2 awards);
- ▶ Awards of funding to Clinical research networks were predominantly for research in Treatment (91%; \$49.5 million, 71 awards);
- ▶ Awards of funding to Capacity building was mostly for research in Biology (48%; \$25.2 million, 26 awards) and Treatment (32%; \$16.9 million, 39 awards);
- ▶ Awards of funding to Biobanks were mostly for research in Early Detection, Diagnosis and Prognosis (67%; \$20.8 million, 8 awards), followed by Biology (15%; \$4.8 million, 4 awards);
- ▶ Awards of funding to Data repositories were mostly for research in Early Detection, Diagnosis and Prognosis (46%; \$11.3 million, 3 awards), Aetiology (26%; \$6.4 million, 3 awards), Treatment (18%; \$4.4 million, 10 awards) and Cancer Control, Survivorship and Outcomes Research (11%; \$2.7 million, 3 awards);
- ▶ Awards of funding to Equipment were mostly for research in Biology (63%; \$11.4 million, 53 awards), followed by Early Detection, Diagnosis and Prognosis (25%; \$4.4 million, 28 awards);
- ▶ Awards of funding to Laboratory research networks were predominantly for research in Biology (87%; \$12.0 million, 3 awards);
- ▶ Awards of funding to Partnerships were mostly for research in Biology (40%; \$4.4 million, 4 awards), followed by Treatment (29%; \$3.2 million, 8 awards) and Cancer Control, Survivorship and Outcomes Research (25%; \$2.7 million, 8 awards); and
- ▶ Awards of funding to Platform services/resources were predominantly for research in Scientific Model Systems (59%; \$5.3 million, 5 awards), followed by Treatment (26%, \$2.3 million, 3 awards).

The awards of funding to building cancer research capacity initiatives and infrastructure categories which supported each CSO category of research (i.e. the proportional funding to building cancer research capacity and infrastructure categories) was as follows:

- ▶ Biology – nine out of the 10 categories of building cancer research capacity initiatives and infrastructure supported research in the CSO category of Biology. The majority of funding (71%) to Biology was for Centres of research and Capacity building combined;
- ▶ Aetiology – seven out of the 10 categories of building cancer research capacity initiatives and infrastructure supported research in the CSO category of Aetiology. The majority of funding (66%) to Aetiology was for Biobanks and Data repositories;
- ▶ Prevention – four out of the 10 categories of building cancer research capacity initiatives and infrastructure supported research in the CSO category of Prevention. The majority of funding (97%) to Prevention was for a single Strategic initiative;
- ▶ Early Detection, Diagnosis and Prognosis – all categories of building cancer research capacity initiatives and infrastructure supported research in the CSO category of Early Detection, Diagnosis and Prognosis. The majority of funding (55%) to Early Detection, Diagnosis and Prognosis was for Biobanks and Strategic initiatives;
- ▶ Treatment – nine out of the 10 categories of building cancer research capacity initiatives and infrastructure supported research in the CSO category of Treatment. The majority of funding (77%) to Treatment was for Centres of research and Clinical research networks;
- ▶ Cancer Control, Survivorship and Outcomes Research – seven out of the 10 categories of building cancer research capacity initiatives and infrastructure supported research in the CSO category of Cancer Control, Survivorship and Outcomes Research. The majority of funding (72%) to Cancer Control, Survivorship and Outcomes Research was for Centres of research, Capacity building and Clinical research networks;
- ▶ Scientific Model Systems – three out of the 10 categories of building cancer research capacity initiatives and infrastructure supported research in the CSO category of Scientific Model Systems. The majority of funding (74%) to Scientific Model Systems was for Platform services/resources.

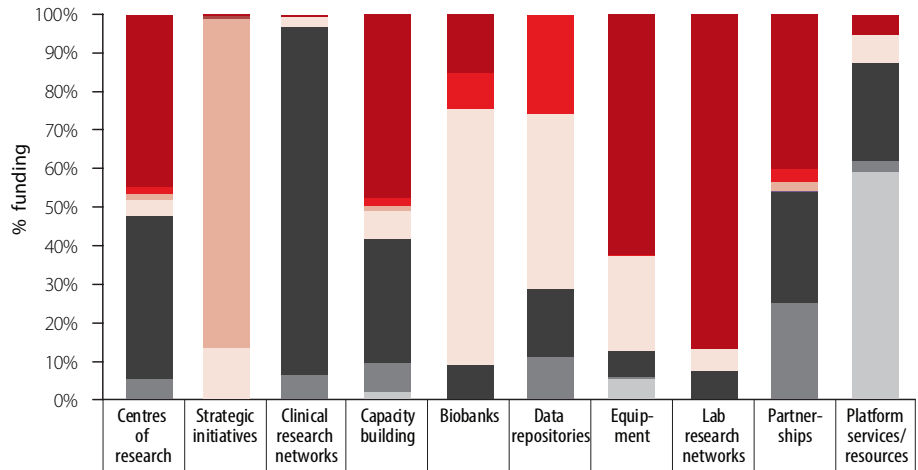


Table 6.1

Total funding to, proportional distribution and number of awards funded for building cancer research capacity initiatives and infrastructure categories in each CSO category in the period 2006 to 2011

CSO category	Centres of research	Strategic initiatives	Clinical research networks	Capacity building	Biobanks	Data repositories	Equipment	Laboratory research networks	Partnerships	Platform services/resources
Biology	\$59.9 M (50%) 26	\$0.4 M (<1%) 1	\$0.28 M (<1%) 1	\$25.2 M (21%) 1	\$4.8 M (4%) 4	None identified	\$11.4 M (10%) 53	\$12.0 M (10%) 3	\$4.4 M (4%) 4	\$0.47 M (<1%) 1
Aetiology	\$2.7 M (19%) 3	\$0.6 M (4%) 1	None identified	\$1.1 M (8%) 1	\$2.9 M (21%) 4	\$6.4 M (45%) 3	\$0.05 M (<1%) 1	None identified	\$0.38 M (3%) 2	None identified
Prevention	\$1.8 M (2%) 1	\$89.1 M (97%) 1	None identified	\$0.64 M 1	None identified	None identified	None identified	None identified	\$0.23 M (<1%) 2	None identified
Early Detection, Diagnosis & Prognosis	\$5.7 M (9%) 3	\$13.9 M (22%) 2	\$1.5 M (2%) 6	\$3.9 M (6%) 8	\$20.8 M (33%) 18	\$11.3 M (18%) 3	\$4.4 M (7%) 28	\$0.8 M (1%) 2	\$0.04 M (<1%) 1	\$0.66 M (1%) 3
Treatment	\$56.8 M (41%) 17	None identified	\$49.5 M (36%) 71	\$16.9 M (12%) 39	\$2.8 M (2%) 9	\$4.4 M (3%) 10	\$1.2 M (1%) 9	\$0.99 M (1%) 1	\$3.2 M (2%) 8	\$2.3 M (2%) 3
Cancer Control, Survivorship & Outcomes	\$7.0 M (35%) 1	None identified	\$3.4 M (17%) 9	\$4.0 M (20%) 16	None identified	\$2.7 M (14%) 3	\$0.44 M (<1%) 2	None identified	\$2.7 M (13%) 8	\$0.24 M (1%) 2
Scientific Model Systems	None identified	None identified	None identified	\$0.92 M (13%) 4	None identified	None identified	\$0.94 M (13%) 5	None identified	None identified	\$5.3 M (74%) 5
TOTAL	\$134 M 51	\$104 M 5	\$54.7 M 65	\$52.6 M 95	\$31.2 M 35	\$24.9 M 19	\$18.2 M 98	\$13.8 M 6	\$11.0 M 25	\$8.9 M 14
	■ Awards of funding									

Figure 6.3 The proportional distribution of funding within each building cancer research capacity initiatives and infrastructure category, by CSO focus of funding awards



	Centres of research	Strategic initiatives	Clinical research networks	Capacity building	Biobanks	Data repositories	Equipment	Lab research networks	Partnerships	Platform services/resources
■ Biology	45%	0%	1%	48%	15%	0%	63%	87%	40%	5%
■ Aetiology	2%	1%	0%	2%	9%	26%	0%	0%	3%	0%
■ Prevention	1%	86%	0%	1%	0%	0%	0%	0%	2%	0%
■ Early Detection, Diagnosis & Prognosis	4%	13%	3%	7%	67%	46%	25%	6%	0%	7%
■ Treatment	42%	0%	91%	32%	9%	18%	7%	7%	29%	26%
■ Cancer Control, Survivorship & Outcomes	5%	0%	6%	8%	0%	11%	1%	0%	25%	3%
■ Scientific Model Systems	0%	0%	0%	2%	0%	0%	5%	0%	0%	59%

6.2 Tumour research focus of building cancer research capacity initiatives and infrastructure awards

Each individual award of funding for building cancer research capacity initiatives and infrastructure was categorised by whether the research to be undertaken was:

- ▶ Tumour specific, i.e.:
 - specific to a single tumour type; or
 - related to different tumour types within a single tumour stream; or
 - related to different tumour types across multiple tumour streams; or
- ▶ Not tumour-specific.

A 'tumour stream' comprises a collective group of tumour types that are common to an anatomical area or function of the body. The tumour streams and tumour types used in this audit are listed in Appendix E. Not tumour-specific research refers to cancer research which did not have a focus on any particular tumour type or stream, but rather was relevant to a broad range of tumour types.

Figure 6.4 shows the level of funding to tumour-specific, and not tumour-specific, building cancer research capacity initiatives and infrastructure in the trienniums 2006–2008 and 2009–2011. The total funding for the period 2006 to 2011 for each tumour research category is also shown.

In summary, the change in the level of funding to building cancer research capacity initiatives and infrastructure across the trienniums was as follows:

- ▶ The level of funding to tumour-specific building cancer research capacity initiatives and infrastructure increased by \$42.5 million (36%), from \$117 million in 2006–2008 to \$160 million in 2009–2011; and
- ▶ The level of funding to not tumour-specific building cancer research capacity initiatives and infrastructure increased by \$8.5 million (10%), from \$83.7 million in 2006–2008 to \$92.2 million in 2009–2011.

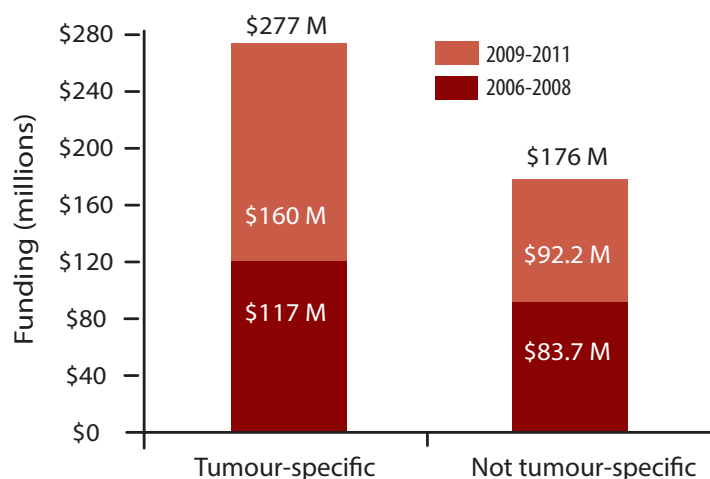
In total, in the period 2006 to 2011, 61% of funding (\$277 million) was for tumour-specific research and 39% (\$176 million) was for research which was not tumour-specific.

Increase in funding to tumour-specific research

From 2006–2008 to 2009–2011, funding to building cancer research capacity initiatives increased by \$51.0 million, and \$42.5 million (83%) of this was for tumour-specific research.

Of this \$42.5 million, \$28.0 million (66%) was due to increased funding by the Australian Government (including the NHMRC) to Strategic initiatives and Centres of research, and \$10.5 million was provided by State and territory governments to Laboratory research networks.

Figure 6.4 Level of funding to tumour-specific and not tumour-specific building cancer research capacity initiatives and infrastructure, in 2006–2008 and 2009–2011



Funding to individual categories of building cancer research capacity initiatives and infrastructure

Table 6.2 lists the funding to, and number of awards for, each of the different categories of building cancer research capacity initiatives and infrastructure in the period 2006 to 2011, categorised by tumour research focus of the award. Figure 6.5 shows the proportional distribution of funding within each building cancer research capacity initiatives and infrastructure category in the period 2006 to 2011, categorised by the tumour research focus of the award.

In summary, for each building cancer research capacity initiatives and infrastructure category, the major tumour research foci of awards were as follows:

- ▶ The proportional distribution of funding to Centres of research was:
 - 52% to tumour-specific research (\$70.2 million, 33 awards); and
 - 48% to not tumour-specific research (\$63.7 million, 20 awards);
- ▶ The proportional distribution of funding to Strategic initiatives was:
 - 100% to tumour-specific research (\$104 million, 5 awards);
- ▶ The proportional distribution of funding to Clinical research networks was:
 - 61% to tumour-specific research (\$33.1 million, 45 awards); and
 - 39% to not tumour-specific research (\$21.5 million, 42 awards);
- ▶ The proportional distribution of funding to Capacity building was:
 - 42% to tumour-specific research (\$21.1 million, 20 awards); and
 - 58% to not tumour-specific research (\$30.5 million, 75 awards);
- ▶ The proportional distribution of funding to Biobanks was:
 - 43% to tumour-specific research (\$13.4 million, 25 awards); and
 - 57% to not tumour-specific research (\$17.8 million, 10 awards);

- ▶ The proportional distribution of funding to Data repositories was:
 - 28% to tumour-specific research (\$6.9 million, 11 awards); and
 - 72% to not tumour-specific research (\$18.0 million, 8 awards);
- ▶ The proportional distribution of funding to Equipment was:
 - 11% to tumour-specific research (\$2.1 million, 25 awards); and
 - 89% to not tumour-specific research (\$16.1 million, 73 awards); and
- ▶ The proportional distribution of funding to Laboratory research networks was:
 - 100% to tumour-specific research (\$13.8 million, 6 awards)
- ▶ The proportional distribution of funding to Partnerships was:
 - 64% to tumour-specific research (\$7.1 million, 11 awards); and
 - 36% to not tumour-specific research (\$3.9 million, 14 awards);
 - The proportional distribution of funding to Platform services/resources was:
 - ▶ 13% to tumour-specific research (\$1.1 million, 5 awards); and
 - ▶ 87% to not tumour-specific research (\$7.8 million, 9 awards).

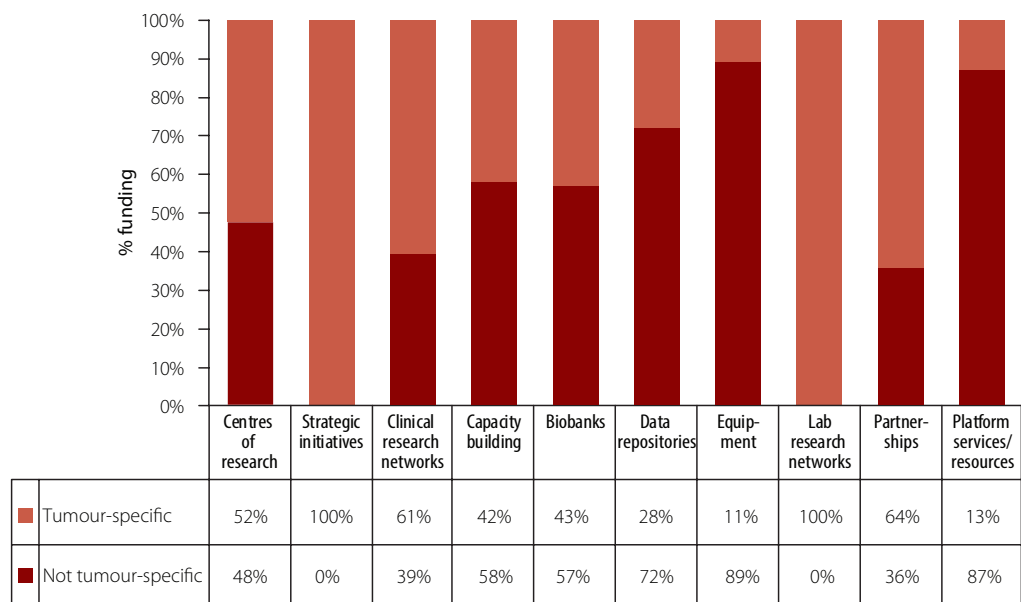
Table 6.2 Total funding and number of awards to tumour-specific, and not tumour specific, building cancer research capacity and infrastructure categories in the period 2006 to 2011

Table 6.2 a.					
Tumour research focus	Centres of research	Strategic initiatives	Clinical research networks	Capacity building	Biobanks
Tumour-specific	\$70.2 M	\$104 M	\$33.1 M	\$21.1 M	\$13.4 M
	33	5	45	20	25
Not tumour-specific	\$63.7 M	None identified	\$21.5 M	\$30.5 M	\$17.8 M
	20		42	75	10
<div style="display: flex; align-items: center;"> Awards of funding </div>					

Table 6.2 b.					
Tumour research focus	Data repositories	Equipment	Laboratory research networks	Partnerships	Platform services/ resources
Tumour-specific	\$6.9 M	\$2.1 M	\$13.8 M	\$7.1 M	\$1.1 M
	11	25	6	11	5
Not tumour-specific	\$18.0 M	\$16.1 M	None identified	\$3.9 M	\$7.8 M
	8	73		14	9
<div style="display: flex; align-items: center;"> Awards of funding </div>					



Figure 6.5 The proportional distribution of funding to tumour-specific, and not tumour specific, building cancer research capacity and infrastructure categories in the period 2006 to 2011



6.3 Funding for tumour-specific research

The funding provided to building cancer research capacity initiatives and infrastructure for research into individual tumour types is listed in Table 6.3. Tumour types are grouped into their parent tumour stream. Also provided in the table is the funding provided to research into more than one tumour type in each of the tumour streams, and funding provided to research into more than one tumour type across multiple tumour streams.

Funding to tumour types

In the period 2006 to 2011, of the \$277 million identified for tumour-specific building cancer research capacity initiatives and infrastructure, \$202 million was provided in awards to 15 individual tumour types and \$16.5 million was provided in awards of funding to research which focused on more than one tumour type within a particular tumour stream. A further \$58.6 million was provided for research into more than one tumour type across multiple tumour streams (Table 6.3).

Total funding increased from 2006–2008 to 2009–2011 for cancers of the colon and rectum, prostate, kidney, breast, melanoma, leukaemia, ovary, sarcoma, pancreas and oesophagus. By contrast, funding to lung cancer (including pleural mesothelioma), neuroblastoma and cancers of the cervix and thyroid decreased from 2006–2008 to 2009–2011. Funding to brain cancer remained the same over this period.

Multiple tumour streams research

Funding to tumour-specific building cancer research capacity initiatives and infrastructure awards which focused on tumour types across multiple streams accounted for 21% (\$58.6 million) of funding for tumour-specific research in the period 2006 to 2011. From 2006–2008 to 2009–2011, funding increased by 74% (from \$21.4 million to \$37.3 million).

In the period 2006 to 2011, there were 38 awards for multiple tumour streams research, with one single award for research into gynaecological and upper gastrointestinal cancers accounting for almost one-quarter (23%) of funding for multiple tumour streams research in that period. Almost half (15) of the awards involved a combination of breast, genitourinary and/or gynaecological cancers.



Table 6.3 Total funding to and number of awards to single and multiple tumour types, in each tumour stream, and across multiple tumour streams for building cancer research capacity and infrastructure awards in 2006–2008 and 2009–2011, and for the period 2006 to 2011

Table 6.3					
Tumour stream	Tumour type	2006–2008	2009–2011	2006 to 2011	No. awards
Colorectal cancer	Colon and rectum	\$50.5 M	\$57.6 M	\$108 M	10
Genitourinary cancers	Prostate	\$8.3 M	\$17.3 M	\$25.6 M	41
	Kidney	\$1.6 M	\$2.4 M	\$4.0 M	3
	<i>More than one type</i>	\$3.0 M	\$1.7 M	\$4.6 M	2
Breast cancer	Breast	\$5.6 M	\$17.0 M	\$22.6 M	23
Lung cancers	Lung and pleural mesothelioma	\$10.6 M	\$5.3 M	\$15.9 M	14
Skin cancers	Melanoma	\$3.6 M	\$8.9 M	\$12.6 M	4
	<i>More than one type</i>	\$0.87 M	\$1.9 M	\$2.8 M	4
Haematological cancers	Leukaemia	None identified	\$0.20 M	\$0.20 M	1
	<i>More than one type</i>	\$3.2 M	\$3.5 M	\$6.7 M	13
Central nervous system cancers	Brain	\$1.7 M	\$1.7 M	\$3.4 M	8
	Neuroblastoma	\$3.1 M	None identified	\$3.1 M	1
	<i>More than one type</i>	\$0.15 M	None identified	\$0.15 M	1
Gynaecological cancers	Ovary	\$0.66 M	\$1.5 M	\$2.1 M	4
	Cervix	\$0.10 M	\$0.04 M	\$0.14 M	2
	<i>More than one type</i>	\$1.0 M	\$1.2 M	\$2.2 M	4
Musculoskeletal cancers	Sarcoma	\$0.92 M	\$1.5 M	\$2.4 M	4
	<i>More than one type</i>	\$0.05 M	\$0.03 M	\$0.08 M	1
Upper gastrointestinal cancers	Pancreas	\$0.75 M	\$0.80 M	\$1.5 M	2
	Oesophagus	None identified	\$0.15 M	\$0.15 M	1
Head and neck cancers	Thyroid	\$0.15 M	\$0.01 M	\$0.16 M	2
Multiple tumour streams	<i>More than one type</i>	\$21.4 M	\$37.3 M	\$58.6 M	38

Distribution of tumour stream funding to individual categories of building cancer research capacity initiatives and infrastructure

Table 6.4 details the total funding to each building cancer research capacity initiatives and infrastructure award category in each single tumour stream, and for multiple tumour streams, and provides the number of awards that were funded in the period 2006 to 2011.

Figure 6.6 shows the proportional distribution in each tumour stream of funding to building cancer research capacity initiatives and infrastructure categories.

In the period 2006 to 2011, for funding provided through awards for building cancer research capacity initiatives and infrastructure:

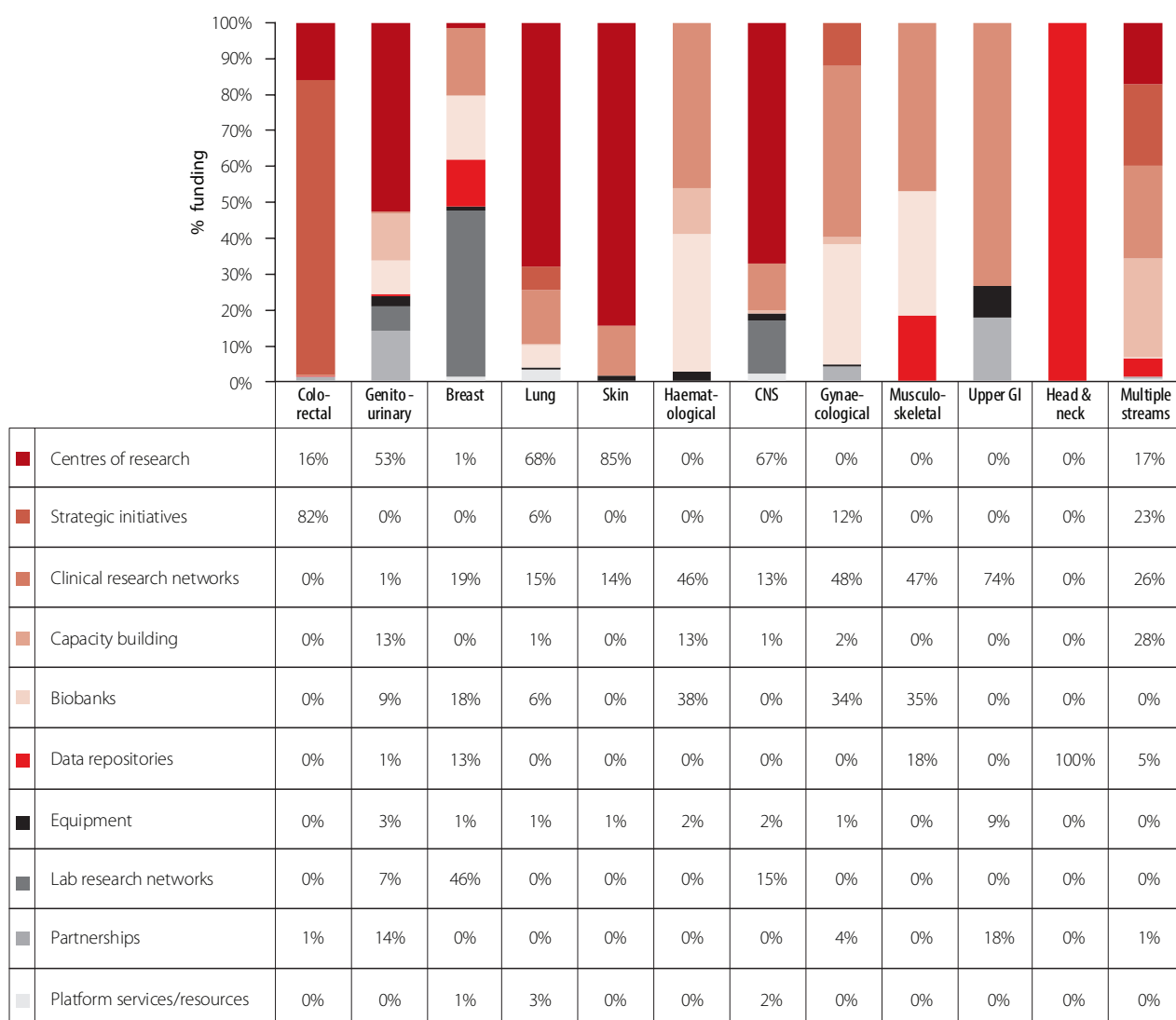
- ▶ Research in colorectal cancer was principally funded through a single Strategic initiative (82%; \$89.1 million, 1 award), followed by Centres of research (16%; \$17.1 million, 5 awards);
- ▶ Research in genitourinary cancers was principally funded through Centres of research (53%; \$18.0 million, 8 awards), followed by Partnerships (14%; \$4.8 million, 5 awards), Capacity building (13%; \$4.5 million, 2 awards) and Biobanks (9%; \$3.2 million, 6 awards);
- ▶ Research in breast cancer was principally funded through Laboratory research networks (46%; \$10.5 million, 1 award), followed by Clinical research networks (19%; \$4.3 million, 6 awards), Biobanks (18%; \$4.0 million, 9 awards); and Data repositories (13%; \$3.0 million, 2 awards);
- ▶ Research in lung cancers was principally funded through Centres of research (68%; \$10.8 million, 4 awards), followed by Clinical research networks (15%; \$2.4 million, 4 awards);
- ▶ Research in skin cancers was principally funded through Centres of research (85%; \$13.0 million, 4 awards), followed by Clinical research networks (14%; \$2.1 million, 3 awards);
- ▶ Research in haematological cancers was principally funded through Clinical research networks (46%; \$3.2 million, 7 awards) and Biobanks (38%; \$2.6 million, 3 awards,) followed by Capacity building awards (13%; \$0.89 million, 5 awards);
- ▶ Research in central nervous system cancers was principally funded through Centres of research (67%; \$4.5 million, 4 awards), followed by Laboratory research networks (15%; \$0.99 million, 1 award) and Clinical research networks (13%; \$0.06 million, 1 award);
- ▶ Research in gynaecological cancers was principally funded through Clinical research networks (48%; \$2.2 million, 3 awards) and Biobanks (34%; \$1.5 million, 3 awards), followed by Strategic initiatives (12%; \$0.55 million, 1 award);
- ▶ Research in musculoskeletal cancers was principally funded through Clinical research networks (47%; \$1.2 million, 2 awards) and Biobanks (35%; \$0.88 million, 2 awards) followed by Data repositories (18%; \$0.46 million, 1 award);
- ▶ Research in upper gastrointestinal cancers was principally funded through Clinical research networks (74%; \$1.2 million, 2 awards), followed by Partnerships (18%; \$0.30 million, 1 award);
- ▶ Research in head and neck cancers was funded through Data repositories (100%; \$0.16 million, 2 awards); and
- ▶ Research in multiple tumour streams was principally funded through Capacity building (28%; \$16.2 million, 8 awards), Clinical research networks (26%; \$15.3 million, 17 awards), a Strategic initiative (23%; \$13.3 million, 1 award) and Centres of research (17%; \$10.0 million, 6 awards).

Table 6.4

Total funding and number of awards to building cancer research capacity and infrastructure categories, by tumour stream focus research in the period 2006 to 2011

Tumour stream	Centres of research	Strategic initiatives	Clinical research networks	Capacity building	Biobanks	Data repositories	Equipment	Laboratory research networks	Partnerships	Platform services/resources
Colorectal	\$17.1 M 5	\$89.1 M 1	\$0.15 M 1	\$0.30 M 1	None identified	\$0.02 M 1	None identified	None identified	\$1.4 M 1	None identified
Genitourinary	\$18.0 M 8	None identified	\$0.22 M 1	\$4.5 M 2	\$3.2 M 6	\$0.23 M 2	\$0.99 M 18	\$2.3 M 4	\$4.8 M 5	None identified
Breast	\$0.30 M 1	None identified	\$4.3 M 6	\$0.02 M 1	\$4.0 M 9	\$3.0 M 2	\$0.31 M 1	\$10.5 M 1	None identified	\$0.24 M 2
Lung	\$10.8 M 4	\$1.0 M 2	\$2.4 M 4	\$0.08 M 1	\$1.0 M 1	None identified	\$0.09 M 1	None identified	None identified	\$0.48 M 1
Skin	\$13.0 M 4	None identified	\$2.1 M 3	None identified	None identified	None identified	\$0.22 M 1	None identified	None identified	None identified
Haematological	None identified	None identified	\$3.2 M 7	\$0.89 M 5	\$2.6 M 3	None identified	\$0.17 M 1	None identified	None identified	None identified
Central nervous system	\$4.5 M 4	None identified	\$0.9 M 2	\$0.06 M 1	None identified	None identified	\$0.12 M 1	\$0.99 M 1	None identified	\$0.14 M 1
Gynaecological	None identified	\$0.55 M 1	\$2.2 M 3	\$0.01 M 1	\$1.5 M 3	None identified	\$0.03 M 1	None identified	\$0.18 M 3	None identified
Musculo-skeletal	None identified	None identified	\$1.2 M 2	None identified	\$0.88 M 2	\$0.46 M 1	None identified	None identified	None identified	None identified
Upper gastro-intestinal	None identified	None identified	\$1.2 M 2	None identified	None identified	None identified	\$0.15 M 1	None identified	\$0.30 M 1	None identified
Head & neck	None identified	None identified	None identified	None identified	None identified	\$0.16 M 2	None identified	None identified	None identified	None identified
Multiple streams	\$10.0 M 6	\$13.3 M 1	\$15.3 M 17	\$16.2 M 8	\$0.12 M 1	\$3.1 M 3	None identified	None identified	\$0.36 M 1	\$0.27 M 1
	■ Awards of funding									

Figure 6.6 Proportional funding to building cancer research capacity initiatives and infrastructure categories, for tumour streams in the period 2006 to 2011



6.4 Discussion

Analysis of the cancer research focus of building cancer research capacity initiatives and infrastructure in the period 2006 to 2011 identified the pattern of funding to CSO categories and tumour-specific research. Differences between the pattern of funding for building cancer research capacity initiatives and infrastructure, and the previously reported pattern for cancer research projects and research programs, are discussed below.

Funding to CSO categories

For building cancer research capacity initiatives and infrastructure, the CSO categories of Biology and Treatment together accounted for more than half (56%) of funding to building cancer research capacity initiatives and infrastructure. This figure is similar to the 63% of direct funding to these two CSO categories observed for cancer research projects and research programs in the period 2006 to 2011.⁶ The level of funding to these two CSO categories reflects the predominant areas of cancer research focus.

The proportional funding to the CSO categories of Aetiology (3%) and Cancer Control, Survivorship and Outcomes Research (4%) in building cancer research capacity initiatives and infrastructure was one-third and one-half, respectively, of the proportional funding observed to these CSO categories for cancer research projects and research programs in the period 2006 to 2011.⁶ Research in these areas may not require the same level of capacity building and infrastructure support as other areas of research. These types of research are likely to receive the majority of their funding support through project and program grants.

The proportional funding to CSO Prevention (20%) was ten-fold higher in building cancer research capacity and infrastructure than was previously observed for the funding to cancer research projects and research programs over the same period.⁶ This difference is due to the impact of the funding for CSIRO's Preventative Health National Research Flagship: Colorectal cancer and gut health initiative. This initiative accounted for 20% (\$89.1 million) of the identified funding for building cancer research capacity initiatives and infrastructure in the period 2006 to 2011. Although this initiative encompassed activities across the cancer research continuum, including prevention, aetiology, early detection and diagnosis of colorectal cancer, the primary focus was prevention, and the initiative accounted for 97% of funding to CSO Prevention in the period 2006 to 2011. In the absence of this single initiative, the level of funding to Prevention research would be low. Prevention research can build the evidence base to reduce the risk of cancer. Strategies which continue to support Prevention research should be explored to reduce the morbidity and mortality associated with this disease.

From 2006–2008 to 2009–2011, funding increased to each CSO category except for Aetiology. However, caution is advised when interpreting the change in funding and numbers of awards from one triennium to the next, as sometimes funding to support initiatives over a number of years were allocated in a single year. The reduction in funding to CSO Aetiology was primarily due to two awards of funding, for a Centre of research and a Data repository, each receiving funding in a single year in the triennium 2006–2008. The largest increase in funding from 2006–2008 to 2009–2011 was to CSO Early Detection, Diagnosis and Prognosis, which was largely due to the commencement of NHMRC funding of the Medical Bioinformatics, Genomics & Proteomics Program in 2009.

Building cancer research capacity initiatives and infrastructure categories

Almost half of the funding to Centres of research (45%) and Capacity building (48%) was for research in Biology, and these two building cancer research capacity initiatives and infrastructure categories accounted for almost three-quarters (71%) of funding in Biology. These categories, together with funding for Laboratory research networks (87% of which was in Biology) and Equipment (63%) represent significant areas of investment for the support of new and ongoing laboratories, and teams of laboratory researchers.

Funding to Strategic initiatives was principally provided for Prevention research (86%), through the single award to CSIRO's Preventative Health National Research Flagship: Colorectal cancer and gut health initiative. The goal of this initiative is to reduce the burden of colorectal cancer and improve the success rate of existing and emerging therapies, by coupling nutritional and lifestyle disease prevention strategies with related research into early disease diagnosis.¹⁷

Centres of research and Clinical research networks accounted for more than three-quarters (77%) of the funding for Treatment, reflecting that the funding of centres for the discovery of new treatments and Clinical research networks, like clinical trials groups which undertake industry-independent clinical trials, have been important mechanisms of support for Treatment research. The provision of targeted funding to Centres of research and Capacity building initiatives in the areas of Cancer Control, Survivorship and Outcomes Research would accelerate research in these fields furthering the effectiveness of our cancer control strategies, and improving the care, quality of life, and outcomes of people diagnosed with cancer.

The majority of funding provided to Biobanks was principally for the purposes of Early Detection, Diagnosis and Prognosis. Given the increasing focus on the mutational status of tumours and the capacity of individual tumour genotypes to influence treatment response, targeted funding could be provided to researchers to access existing Biobank samples for the purpose of research into treatment response and improved clinical management.

Less than 10% of funding to Centres of research and Capacity building initiatives was provided to the area of Cancer Control, Survivorship and Outcomes Research.

Over 90% of funding to Partnerships went to the CSO categories of Biology, Treatment and Cancer Control, Survivorship and Outcomes Research, and 2% of funding to Partnership awards supported research in Prevention.

Many preventable risk factors for cancer are common to other chronic diseases such as cardiovascular disease and diabetes. Partnership awards which would bring together researchers from different chronic disease areas would accelerate the conduct of Prevention research, increase our knowledge of effective prevention approaches, and could improve outcomes and reduce the burden of disease across a range of chronic disease areas including cancer.

Tumour research focus

Proportional funding to tumour-specific building cancer research capacity initiatives and infrastructure (61%) was the same as was previously observed for the funding to cancer research projects and research programs in the period 2006 to 2011,⁶ and a similar increase in proportional funding was observed from 2006–2008 to 2009–2011.

From 2006–2008 to 2009–2011, 83% of the increase in funding for building cancer research capacity initiatives and infrastructure was for tumour-specific research. The impact that the Australian Government and State and territory governments had in driving the increase in funding for tumour-specific building cancer research capacity initiatives and infrastructure, and thus support to this area of support as a whole, highlights opportunities for funders to collaborate with government when prioritising tumour-specific cancer research support.



Tumour stream and tumour type research

Colorectal cancer research received the most funding, due to the CSIRO's Preventative Health National Research Flagship: Colorectal cancer and gut health initiative, which accounted for 82% of funding to cancer of the colon and rectum. Funding for genitourinary cancers was predominantly through Centres of research, specifically the Australian Prostate Cancer Research Centres which received support mostly from the Australian Government but also from Universities and Cancer foundations.

Almost half (46%) of the support for Breast cancer research was provided to Laboratory research networks. Breast cancer research also received support through Clinical research networks, Biobanks and Data repositories. The diversity of breast cancer research support from basic biology through to Clinical research networks reflects the well-established nature of funding to this tumour type.

Lung cancer, skin cancers and central nervous system cancers were supported mostly through Centres of research, due to Australian Government, State and territory governments, and Cancer foundation support. Haematological cancers, gynaecological cancers and musculoskeletal cancers received similar levels of proportional support through Clinical research networks and Biobanks, reflecting that the focus of much of the research in these tumour streams is through the patient-centred research activities of Early Detection and Diagnosis, and Treatment.

Upper gastrointestinal cancers research was predominantly supported through Clinical research networks, mostly due to Cancer Councils support; and head and neck cancers received all funding support through Data repositories, via state and territory governments support.

Funding increased from 2006–2008 to 2009–2011 for most tumour types (colon and rectum, prostate, kidney, breast, melanoma, leukaemia, ovary, sarcoma, pancreas and oesophagus) and remained level for brain.

Multiple tumour streams research

Building cancer research capacity initiatives and infrastructure awards which were for research across multiple tumour streams accounted for more than one-fifth (21%) of funding for tumour-specific research. Funding increased by 74% from 2006–2008 to 2009–2011, and this was largely due to NHMRC funding of the Medical Bioinformatics, Genomics & Proteomics Program.

The level of funding (\$58.6 million) in the period 2006 to 2011, the number of funding awards (38) and the fact that multiple tumour streams research was supported with significant funding through Capacity building awards, Clinical research networks, a Strategic initiative and Centres of research, reflects an increasing research focus on genetic and epigenetic factors which are common across different tumour types and streams. The support of research in areas which extend across tumour types is becoming an increasing focus. Almost half (15) of the awards involved a combination of breast, genitourinary and/or gynaecological cancers, which are cancers that can be caused by common gene mutations.

Chapter 7 - Patterns of funding to cancer research: the combined national picture, and international comparisons

KEY FINDINGS

In the period 2006 to 2011:

- ▶ \$1.77 billion was provided to 4,924 cancer research grants and awards in Australia, consisting of:
 - \$304 million provided to 1,381 people support scheme awards
 - \$453 million provided to 437 building cancer research capacity initiatives and infrastructure awards
 - \$1.01 billion provided to 3,106 cancer research projects and research programs
- ▶ The Australian Government (including the NHMRC) provided \$1.03 billion (58% of funding) for cancer research
- ▶ Of the 4,924 grants and awards identified for cancer research, 441 (9%) were co-funded by two or more funding sources
- ▶ The pattern of funding to CSO categories in Australia was broadly similar to international patterns of funding
- ▶ 62% of cancer research funding was provided to the CSO categories of Biology and Treatment
- ▶ Funding to cancer research *per capita*, and as a percentage of GDP, was similar for Australia, Canada and the UK
- ▶ Breast cancer, colorectal cancer, haematological cancers and genitourinary cancers received the highest levels of funding in Australia, and were also the four highest proportionally funded tumour streams in Canada and the UK
- ▶ Colorectal cancer and skin cancers received higher levels of proportional funding in Australia than Canada and the UK
- ▶ Proportional funding to research in many cancers was low compared to incidence, mortality and burden of disease on the Australian population. These cancers included lung, lymphoma, pancreas, oesophagus, kidney, stomach, bladder, myeloma and cancer of unknown primary

From 2006–2008 to 2009–2011:

- ▶ The level of funding increased to each CSO category in Australia
- ▶ The level of funding increased for each individual tumour stream in Australia



7.1 Funding to cancer research identified in the National Audits of 2006 to 2011

For the period 2006 to 2011, this National Audit identified funding of \$304 million to 1,381 people support scheme awards (in the form of Scholarships, Fellowships and Academic Cancer Research Chairs) and \$453 million in funding for 437 awards to building cancer research capacity initiatives and infrastructure. By comparison, Cancer Australia's National Audit of funding to cancer research projects and research programs identified \$1.01 billion in direct funding through 3,106 grants in the period 2006 to 2011.⁶

Taken together, Cancer Australia's two National Audits have identified \$1.77 billion in funding to cancer research in Australia, through 4,924 grants and awards, for the period 2006 to 2011.

Sources of funding

In the period 2006 to 2011, the major funders of cancer research projects and research programs, people support scheme awards, building cancer research capacity initiatives and infrastructure awards, the proportion of funding provided by each source (see Figure 7.1) and the total funding amounts provided, and the number of Scholarships funded, were as follows:

- ▶ NHMRC – \$767 million (43% of funding);
- ▶ State and territory governments – \$280 million (16% of funding);
- ▶ Other Australian Government sources^o – \$266 million (15% of funding);
- ▶ Cancer foundations^p – \$157 million (9% of funding);
- ▶ Cancer Councils – \$133 million (8% of funding);
- ▶ International sources – \$84.6 million (5% of funding);
- ▶ Medical research institutes, hospitals and foundations – \$32.0 million (2% of funding);
- ▶ Other sources^q – \$29.1 million (2% of funding);
- ▶ Universities – \$11.6 million (1% of funding); and
- ▶ Philanthropic funders – \$5.2 million (<1% of funding).

The Australian Government (including the NHMRC) was the major funder of cancer research projects and research programs, people support scheme awards, and building cancer research capacity initiatives and infrastructure awards, providing 58% (\$1.03 billion) of funding.

The support provided by Government and other funders to Cooperative Research Centres was captured in this audit of funding to building cancer research capacity initiatives and infrastructure. It should be noted that funds were also provided via the Co-operative Research Centres to cancer research projects and research programs. As such, up to \$17 million (approximately 1%) of funding to cancer research may be counted in both cancer research projects and research programs, and building cancer research capacity initiatives and infrastructure.

It should also be noted that the level of funding provided by Medical research institutes, hospitals and foundations, Universities, and Philanthropic funders is likely to be an underestimate of

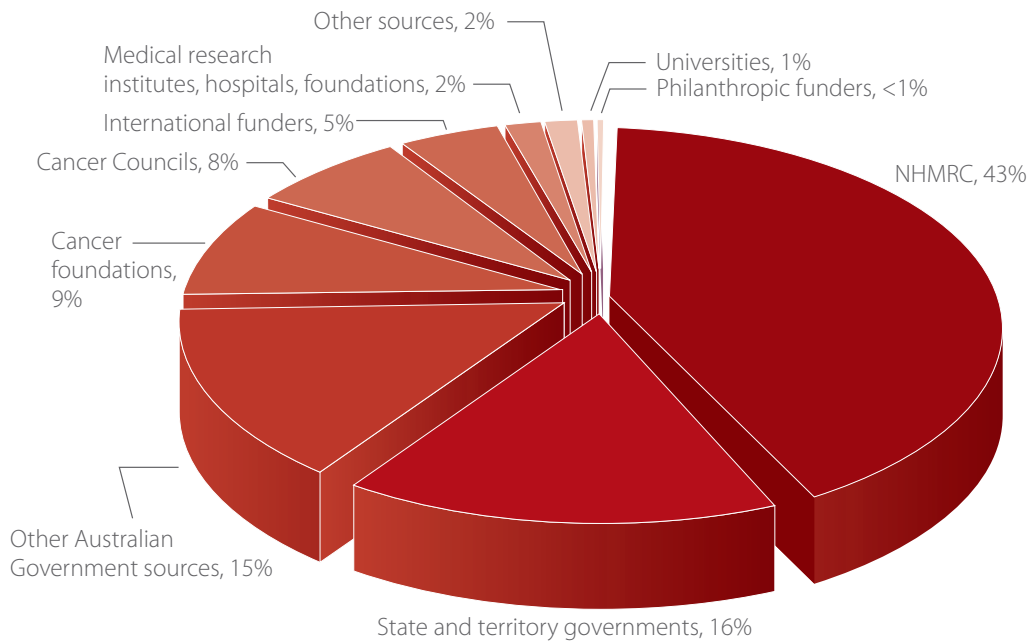
^oOther Australian Government sources include many Australian Government departments and agencies. The major sources of funding were the Department of Industry (including the Australian Research Council), Cancer Australia and the Department of Health.

^pCancer foundations include foundations that provide funds specifically to cancer research, e.g. National Breast Cancer Foundation, Leukaemia Foundation and the Prostate Cancer Foundation of Australia.

^qOther sources of funding were the Cancer Therapeutics CRC, CRC for Biomarker Translation and the Oral Health CRC.

the support provide by these sectors. Medical research institutes, hospitals and foundations, Universities and Philanthropic funders provide significant support to building research capacity and infrastructure for health and medical research which is not specifically identified as for cancer research.

Figure 7.1 Proportion of funding by funding source to cancer research projects and research programs, building cancer research capacity initiatives, and infrastructure awards



Co-funding

In the period 2006 to 2011, there were 4,924 grants and awards identified for cancer research projects and research programs, people support scheme awards, building cancer research capacity initiatives and infrastructure.

Of these grants and awards, 441 (9%) were co-funded by two or more funding sources.

7.2 Combined pattern of funding to CSO categories in Australia

Figure 7.2 shows the patterns of CSO funding to people support scheme awards, and building cancer research capacity initiatives and infrastructure identified in this audit, to cancer research projects and research programs identified in the previous audit, and the combined pattern of funding for cancer research in Australia in the period 2006 to 2011.

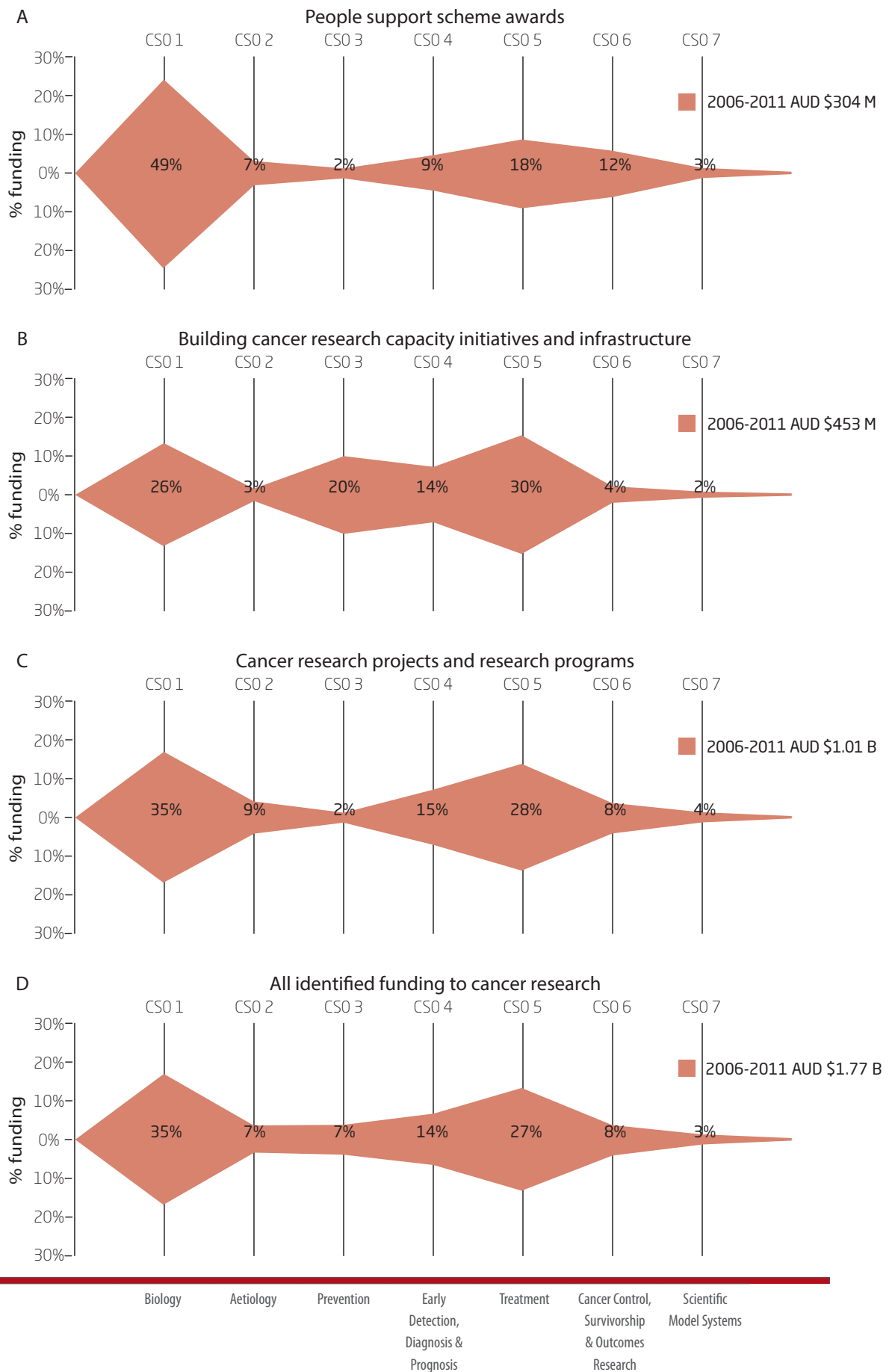
In the period 2006 to 2011, for people support scheme awards (Figure 7.2A), almost half of identified funding was provided to Biology (49%). Funding to Treatment (18%), Cancer Control, Survivorship and Outcomes Research (12%), Early Detection, Diagnosis and Prognosis (9%), Aetiology (7%), Scientific Model Systems (3%), and Prevention (2%), accounted for the balance of total funding.

For building cancer research capacity initiatives and infrastructure awards (Figure 7.2B), more than half of identified funding (56%) was provided to two CSO categories combined: Treatment (30%), and Biology (26%). Funding to Prevention was also notable (20%), and Early Detection, Diagnosis and Prognosis (14%), Cancer Control, Survivorship and Outcomes Research (4%), Aetiology (3%) and Scientific Model Systems (2%) accounted for the balance of total funding.

Similar features of the patterns of funding to CSO categories for people support scheme awards, building cancer research capacity initiatives and infrastructure, and cancer research projects and research programs (Figure 7.2C), were higher proportional levels of funding to Biology and the more patient-centred CSO categories of Treatment, and Early Detection, Diagnosis and Prognosis. The proportional funding to Prevention was much higher for building cancer research capacity initiatives and infrastructure, due to the impact of a single Strategic initiative.

When the data from Cancer Australia's National Audits of funding to cancer research projects and research programs, and funding to people support, building cancer research capacity initiatives and infrastructure funding were combined (Figure 7.2D), almost two-thirds of identified funding (62%) was provided to two CSO categories combined: Biology (35%) and Treatment (27%). Funding to Early Detection, Diagnosis and Prognosis (14%), Cancer Control, Survivorship and Outcomes Research (8%), Prevention (7%), Aetiology (7%) and Scientific Model Systems (3%) accounted for the balance of total funding.

Figure 7.2 The pattern of funding to cancer research in Australia in the period 2006 to 2011



Change in funding to CSO categories from 2006–2008 to 2009–2011

Table 7.1 shows the funding provided to cancer research in Australia in each CSO category in the trienniums 2006–2008 and 2009–2011, the increase in funding across the trienniums and the percentage increase, and the total for the period 2006 to 2011. The data represents the combined funding to CSO categories identified in this audit of funding to people support schemes, building cancer research capacity initiatives and infrastructure, and in the previous audit of funding to cancer research projects and research programs.

For all CSO categories, the level of funding increased from 2006–2008 to 2009–2011. The most notable increases in funding, taking into consideration both the total and proportional changes from 2006–2008 to 2009–2011, were to the more patient-centred CSO research categories of Early Detection, Diagnosis and Prognosis, Treatment and Cancer Control, Survivorship and Outcomes Research.

Table 7.1 Combined funding identified by Cancer Australia’s National Audits of cancer research in 2006–2008 and 2009–2011, and the total for the period 2006 to 2011

Table 7.1				
CSO category	2006–2008	2009–2011	Increase (%)	2006 to 2011
Biology	\$272 M	\$345 M	\$73.0 M (27%)	\$618 M
Aetiology	\$55.7 M	\$67.4 M	\$11.7 M (21%)	\$123 M
Prevention	\$53.2 M	\$68.3 M	\$15.1 M (28%)	\$122 M
Early Detection, Diagnosis and Prognosis	\$88.2 M	\$151 M	\$62.8 M (71%)	\$239 M
Treatment	\$195 M	\$276 M	\$81.0 M (42%)	\$471 M
Cancer Control, Survivorship and Outcomes Research	\$50.7 M	\$90.2 M	\$39.5 M (78%)	\$141 M
Scientific Model Systems	\$18.4 M	\$33.7 M	\$15.3 M (83%)	\$52.1 M

Note: Due to rounding, funding for 2006 to 2011 may not equal the sum of funding in 2006–2008 and 2009–2011 for each row.

7.3 Comparison between the national pattern of funding to cancer research in Australia with international patterns of funding

Analysis of the pattern of funding in Australia and abroad

Recent international surveys by the Canadian Cancer Research Alliance (CCRA)¹⁸, the National Cancer Research Institute (NCRI)¹⁹ and the International Cancer Research Partnership (ICRP)²⁰, have identified the following funding to cancer research:

- ▶ CAD\$2.92 billion from 2006 to 2011 in Canada, by more than 40 organisations tracked by the CCRA;
- ▶ GBP£2.81 billion from 2006 to 2011 in the UK, by 22 members of the NCRI; and
- ▶ USD\$19.0 billion from 2005 to 2008 internationally, by 53 members of the ICRP.

These surveys captured a mix of government and non-government funders, and those members of the CCRA and NCRI that were members of the ICRP are included in the ICRP survey. Each of these surveys classified the funded research by CSO codes, and a comparison between the patterns of funding derived from the Canadian (CCRA) and UK (NCRI) surveys with the pattern of funding identified by Cancer Australia's National Audits of cancer research funding (2006 to 2011) is shown in Figure 7.3.

The ICRP survey included data for cancer research funding provided by the US-based NIH. As the NIH funding comprised 71% of the ICRP funding from 2005 to 2008, these NIH data were disaggregated from the total ICRP data so that patterns of funding could be compared. The pattern of funding for research funded by the NIH and other ICRP members in 2008 is shown in Figure 7.4.

Some important caveats must be considered when comparing data from the combined Australian National Audits with the cited international surveys. Firstly, the methods of apportioning research expenditure to CSO codes differed between the surveys. The CCRA, NCRI and ICRP surveys apportioned budgets to more than one CSO code when a project was deemed to be of multi-CSO focus, whereas Cancer Australia allocated the research funds to the major CSO of focus. Also, the CCRA and NCRI surveys apportioned budgets to projects based on the percentage by which each project was judged as being dedicated to cancer research, whereas Cancer Australia's National Audits only included funding to research where the main research focus was on cancer.

Nonetheless, the patterns of funding for Australia, Canada (CCRA) and the UK (NCRI), were broadly similar, with the majority of proportional funding going to the CSO categories of Biology and Treatment, which when combined, accounted for 62%, 63% and 66% of the funding to cancer research in Australia, Canada and the UK, respectively. The CSO categories of Early Detection, Diagnosis and Prognosis, Aetiology and Cancer Control, Survivorship and Outcomes Research received similar relative levels of proportional funding in the three countries, and the lowest levels of proportional funding went to Prevention and Scientific Model Systems.

The pattern of funding for the ICRP was more evenly distributed across the CSO categories and it is apparent that this effect was largely due to research funded by the NIH. When the ICRP data was analysed after removal of NIH funding data, it was observed that the pattern of funding was broadly similar to Australia, Canada (CCRA) and the UK (NCRI), although the proportional funding to Prevention in Australia more closely resembled the pattern of funding for the whole ICRP.



Figure 7.3 Comparison of the pattern of funding to cancer research in Australia, Canada and the UK in the period 2006 to 2011

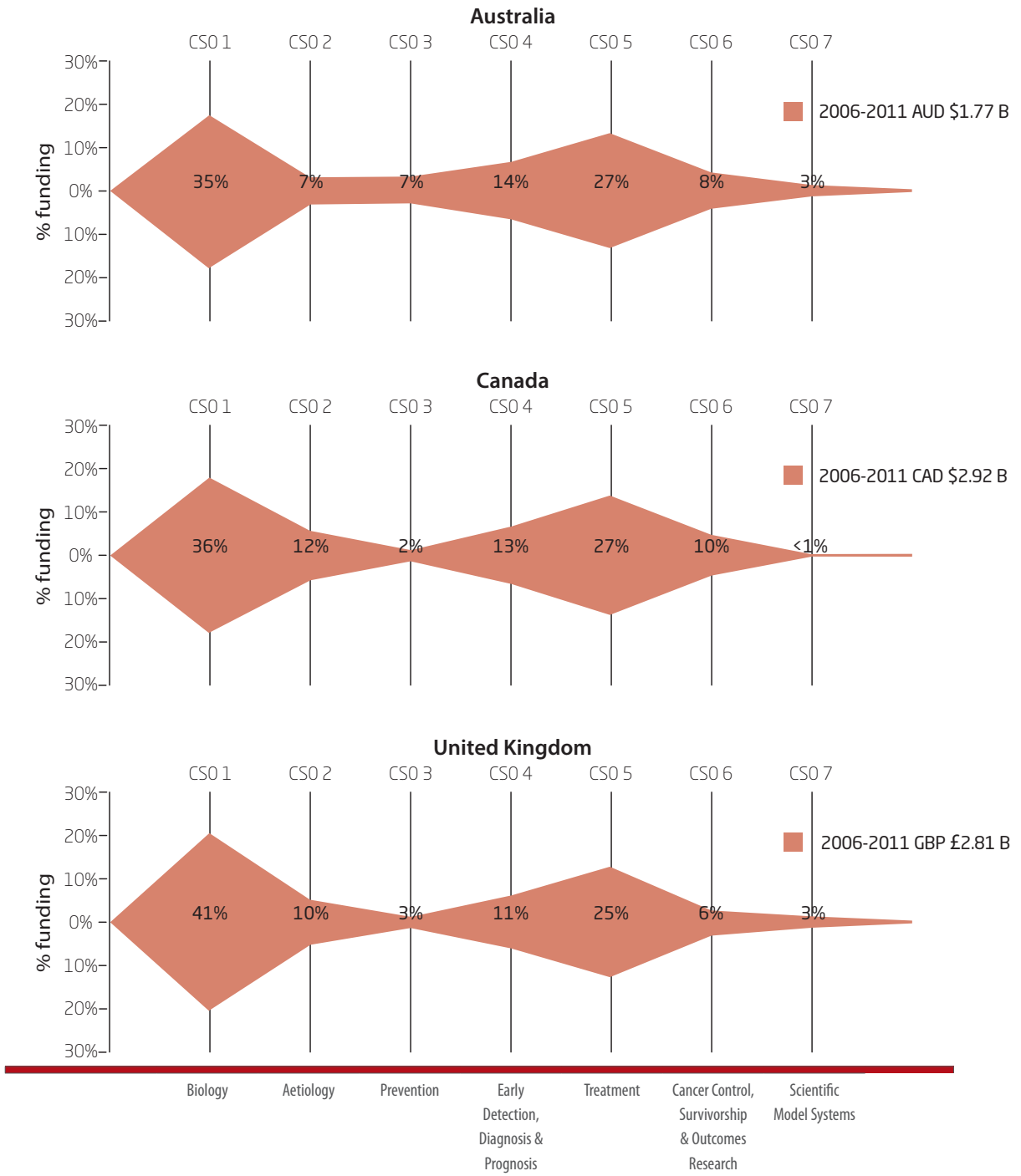
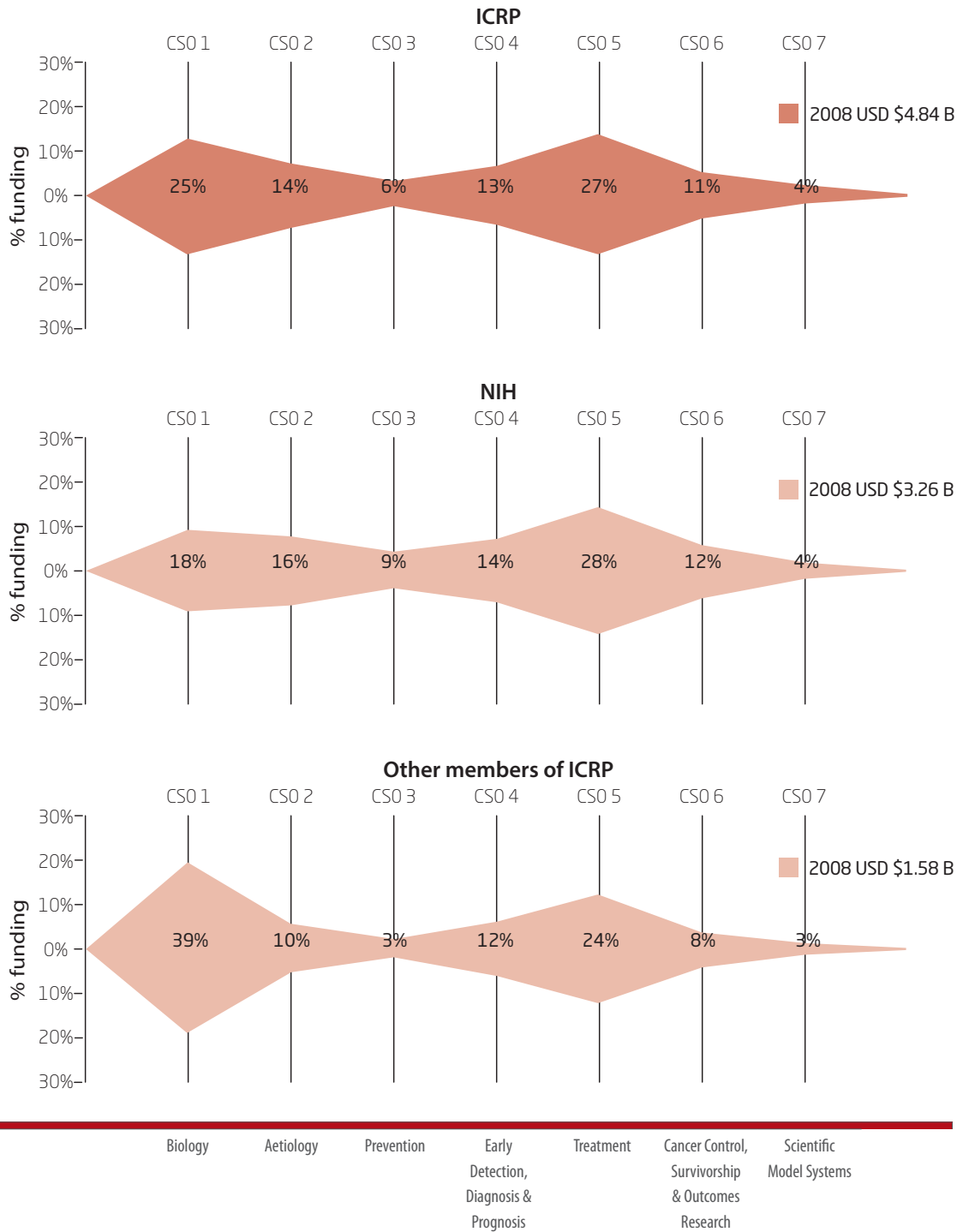


Figure 7.4 Pattern of funding to cancer research from the International Cancer Research Partnership (2008)



Note: As proportional funding to CSO categories was only available for the years 2005 and 2008 for ICRP data, only the 2008 data is shown here.

Analysis of the changes in the pattern of funding over time in Australia and abroad

This section compares changes in the pattern of funding over time for different international funders. Figure 7.5 compares the changes in pattern of cancer research funding:

- ▶ In Australia, Canada and the UK across the trienniums 2006–2008 and 2009–2011 (Figure 7.5A);
- ▶ The ICRP from 2005 to 2008 (Figure 7.5B); and
- ▶ From 2005 to 2008 for the disaggregated ICRP data: NIH and the rest of the ICRP membership (Figure 7.5B).

The pattern of funding for the ICRP is presented for the first and last years of the available data and is consistent with the presentation of its data in its report.

In summary:

- ▶ The total funding to Australian cancer research increased from \$0.73 billion (2006–2008) to \$1.03 billion (2009–2011), although the pattern of funding was similar in each triennium. Proportional funding to Biology decreased from 37% (2006–2008) to 34% (2009–2011) and Early Detection, Diagnosis and Prognosis increased from 12% (2006–2008) to 14% (2009–2011);
- ▶ The total funding to cancer research in the UK increased from £1.30 billion (2006–2008) to £1.52 billion (2009–2011). The patterns of funding to CSO categories for the UK remained relatively constant across the trienniums. Proportional funding to Aetiology decreased from 12% (2006–2008) to 9% (2009–2011) and Early Detection, Diagnosis and Prognosis, increased from 10% (2006–2008) to 12% (2009–2011);
- ▶ The total funding to cancer research in Canada increased from CAD\$1.29 billion (2006–2008) to CAD\$1.63 billion in (2009–2011). The changes in the pattern of funding to CSO categories in Canada were similar to, but more pronounced than, Australia and the UK, with the largest proportional changes in funding to Biology, which decreased from 43% (2006–2008) to 31% (2009–2011) and Treatment, which increased from 24% (2006–2008) to 29% (2009–2011);
- ▶ The total funding to cancer research by members of the ICRP increased from USD\$4.76 billion in 2005 to USD\$4.84 billion in 2008. In 2005 and 2008, the patterns of funding were more evenly distributed across the CSO categories, and the largest changes in proportional funding were to Aetiology, which decreased from 18% to 14%, and to Biology which increased from 22% to 25%. The NIH provided almost three-quarters of the ICRP funding in the period 2005 to 2008:
 - The total funding to cancer research by the NIH was USD\$3.57 billion in 2005 and USD\$3.26 billion in 2008. The patterns of funding in 2005 and 2008 for the NIH were more equally distributed across the CSO categories and remained relatively constant, with the largest change in proportional funding to Aetiology, which decreased from 20% to 16%; and
 - The total funding to cancer research by other members of the ICRP was USD\$1.19 billion in 2005 and USD\$1.58 billion in 2008. The patterns of funding in 2005 and 2008 were relatively constant, with the largest change in proportional funding to Aetiology, which decreased from 13% to 10%.

Figure 7.5 International comparisons of the changes in the patterns of funding to cancer research

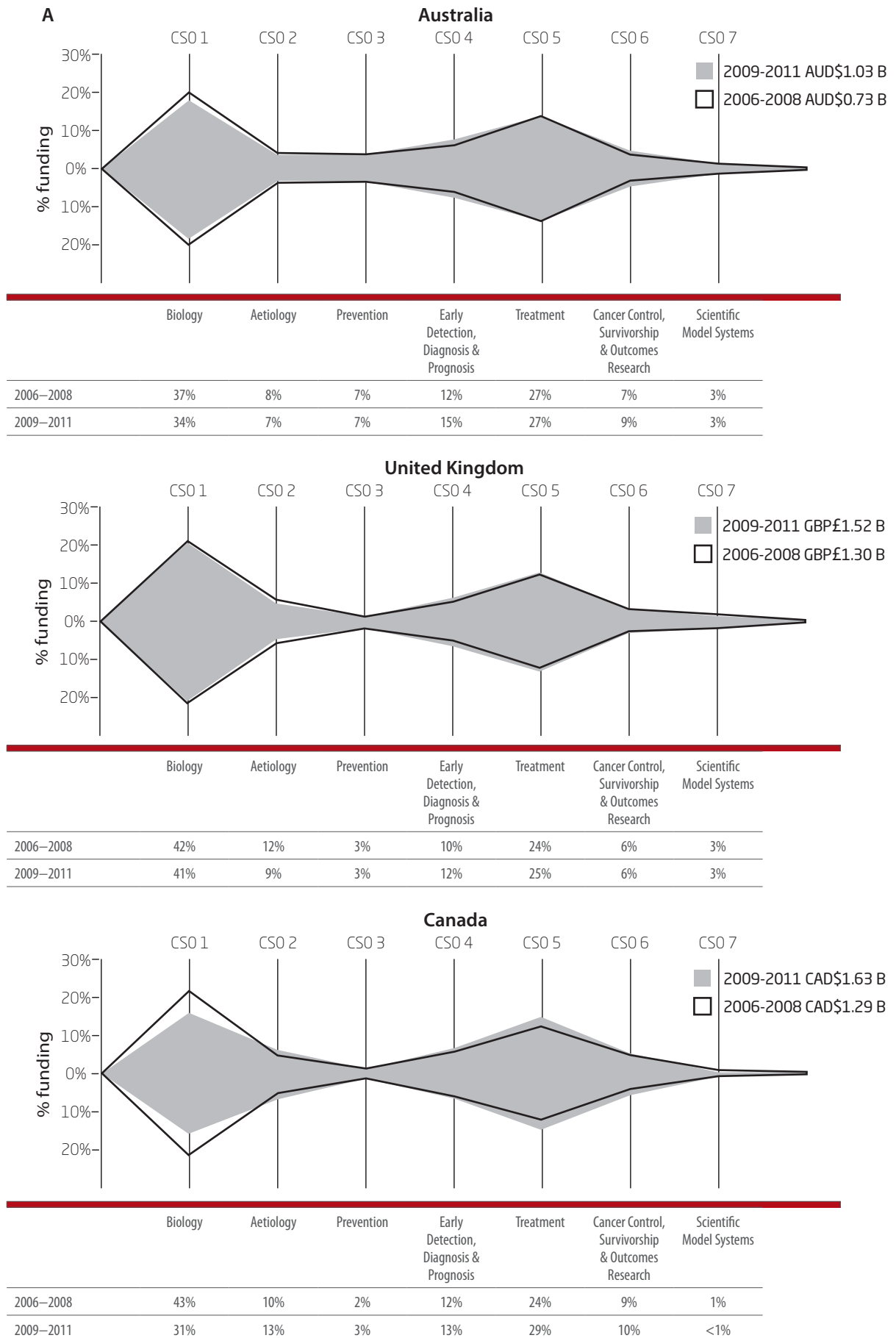
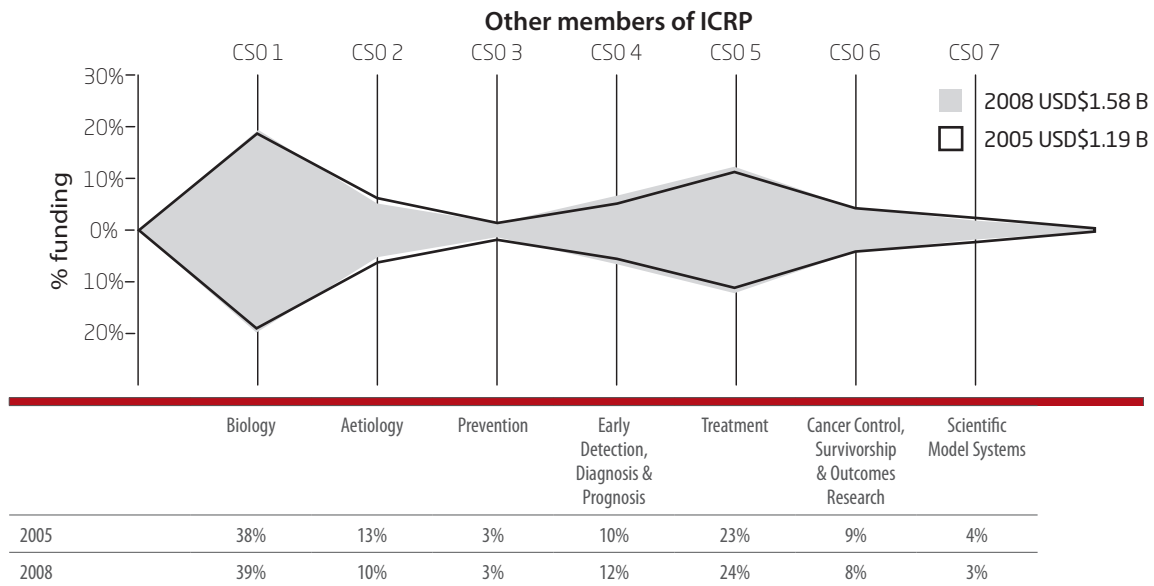
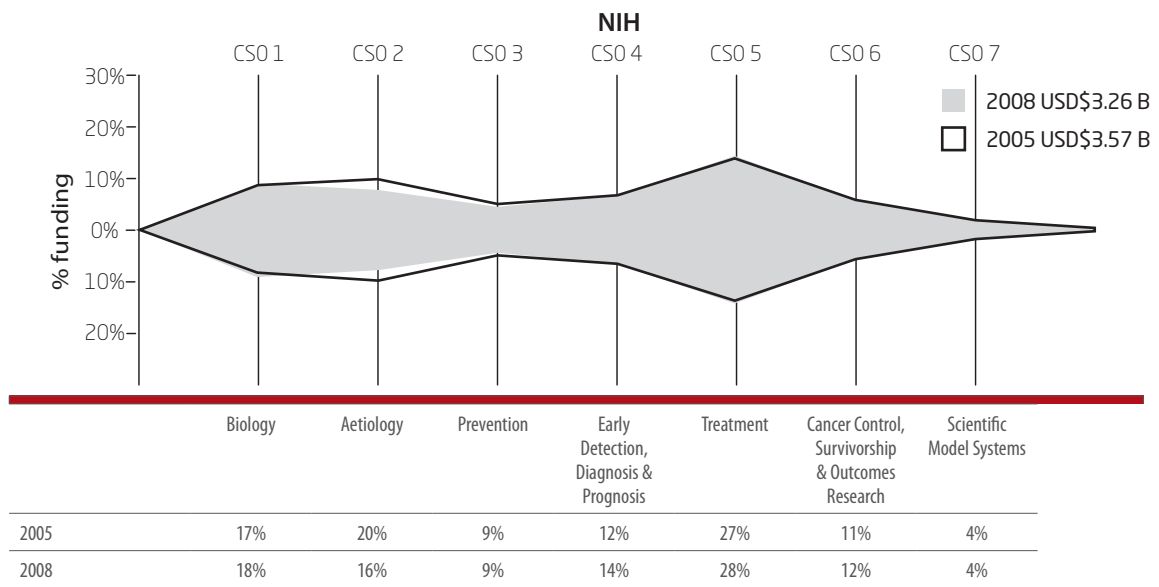
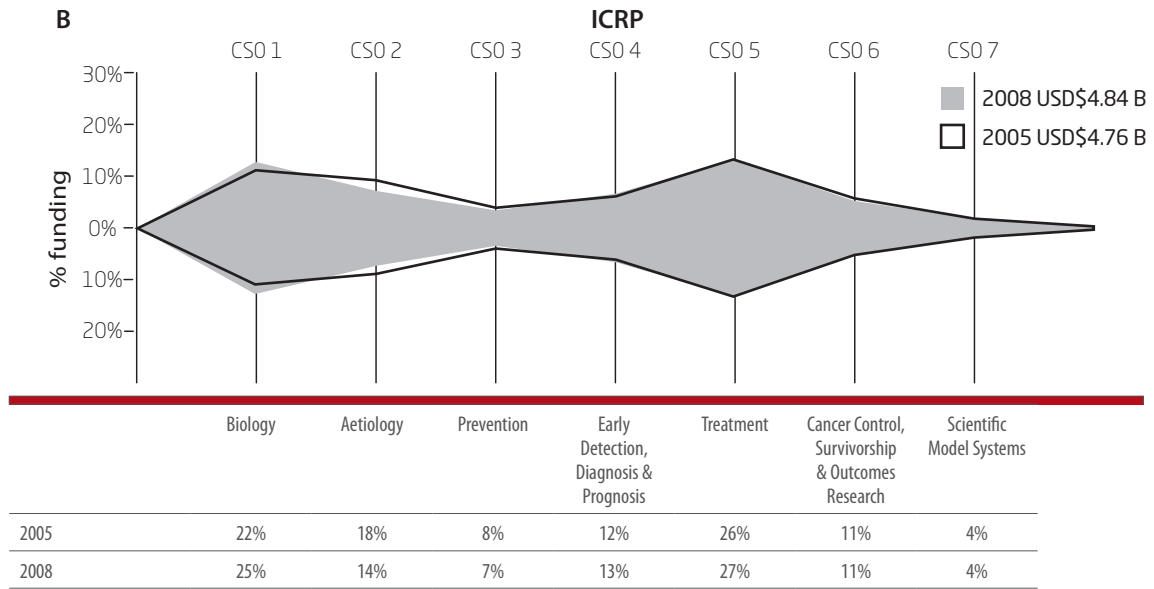


Figure 7.5 (contd)



Analysis of cancer research funding by Gross Domestic Product and *per capita*

The level of funding to cancer research in Australia, Canada and the UK in the period 2006 to 2011 was calculated as a percentage of each country's Gross Domestic Product (GDP, USD\$) for the same time period, and as a level of funding *per capita* (Table 7.2).

Funding to cancer research as a percentage of GDP was similar in Australia, Canada and the UK. The slightly lower percentage of GDP for cancer research funding in Australia may relate, in part, to the difference in funding included in each country's audit of cancer research support. In the two audits conducted by Cancer Australia, funding to cancer research projects and research programs, people support scheme awards and building cancer research capacity initiatives and infrastructure awards which were not principally related to cancer research were not counted. However the Canadian (CCRA) and UK (NCRI) audits apportioned budgets to projects based on the percentage by which each project was judged as being dedicated to cancer research.

Funding to cancer research *per capita* was similar in Australia, Canada and the UK.

Table 7.2 Level of cancer research funding in Australia, Canada in the UK 2006 to 2011, funding as a percentage of GDP and per capita funding

Country	Funding	Funding as % of GDP	Per capita funding
Australia	USD\$1.55 billion	0.025%	USD\$72 per person
Canada	USD\$2.74 billion	0.030%	USD\$82 per person
UK	USD\$4.85 billion	0.031%	USD\$77 per person

Notes:

1. The annual funding to cancer research in period 2006 to 2011 for each country was converted to USD using the average annual currency exchange rate.²¹
2. Funding as a percentage of GDP was calculated using the GDP for each country for the period 2006 to 2011, as measured in US dollars.²²
3. Funding per capita was calculated using the population of each country as measured in each nation's 2011 census.^{23, 24, 25}

7.4 Funding to tumour streams research

In the period 2006 to 2011, Cancer Australia's National Audits of cancer research projects and research programs, and people support, building cancer research capacity initiatives and infrastructure, identified combined funding of \$926 million for research conducted in single tumour streams. Funding of \$116 million to research which focused on multiple tumour streams and \$724 million to research which was not specific to any tumour streams was also identified.

Table 7.3 shows the funding identified to research in each tumour stream in Australia in 2006–2008 and 2009–2011, the increase in funding and the percentage increase, and the total for the period 2006 to 2011. From 2006–2008 to 2009–2011, funding increased to each tumour stream, with the largest increase in funding going to breast cancer research.

In summary, from 2006–2008 to 2009–2011:

- ▶ Funding to breast cancer research increased by \$42.7 million (54%), from \$79.3 million to \$122 million;
- ▶ Funding to colorectal cancer research increased by \$31.7 million (39%), from \$81.3 million to \$113 million;
- ▶ Funding to haematological cancers research increased by \$34.2 million (72%), from \$47.2 million to \$81.4 million;
- ▶ Funding to genitourinary cancers research increased by \$24.9 million (53%), from \$46.6 million to \$71.5 million;
- ▶ Funding to skin cancers research increased by \$17.2 million (48%), from \$35.8 million to \$53.0 million;
- ▶ Funding to upper gastro-intestinal cancers research increased by \$14.0 million (84%), from \$16.6 million to \$30.6 million;
- ▶ Funding to gynaecological cancers research increased by \$8.8 million (47%), from \$18.8 million to \$27.6 million;
- ▶ Funding to lung cancers research increased by \$5.6 million (29%), from \$19.5 million to \$25.1 million;
- ▶ Funding to central nervous system cancers research increased by \$6.6 million (42%), from \$15.6 million to \$22.2 million;
- ▶ Funding to musculoskeletal cancers research increased by \$4.8 million (178%), from \$2.7 million to \$7.5 million; and
- ▶ Funding to head and neck cancers research increased by \$1.6 million (48%), from \$3.3 million to \$4.9 million.

Table 7.3 Total identified funding to single tumour stream research in Australia in 2006–2008 and 2009–2011, and for the period 2006 to 2011

Table 7.3				
Tumour stream	2006–2008	2009–2011	Increase (%)	2006 to 2011
Breast cancer	\$79.3 M	\$122 M	\$42.7 M (54%)	\$201 M
Colorectal cancer	\$81.3 M	\$113 M	\$31.7 M (39%)	\$195 M
Haematological cancers	\$47.2 M	\$81.4 M	\$34.2 M (72%)	\$129 M
Genitourinary cancers	\$46.6 M	\$71.5 M	\$24.9 M (53%)	\$118 M
Skin cancers	\$35.8 M	\$53.0 M	\$17.2 M (48%)	\$88.7 M
Upper gastrointestinal cancers	\$16.6 M	\$30.6 M	\$14.0 M (84%)	\$47.2 M
Gynaecological cancers	\$18.8 M	\$27.6 M	\$8.8 M (47%)	\$46.4 M
Lung cancers	\$19.5 M	\$25.1 M	\$5.6 M (29%)	\$44.6 M
Central nervous system cancers	\$15.6 M	\$22.2 M	\$6.6 M (42%)	\$37.8 M
Musculoskeletal cancers	\$2.7 M	\$7.5 M	\$4.8 M (178%)	\$10.2 M
Head and neck cancers	\$3.3 M	\$4.9 M	\$1.6 M (48%)	\$8.2 M

Note: Due to rounding, funding for 2006 to 2011 may not equal the sum of funding in 2006–2008 and 2009–2011 for each row.

International comparisons of proportional funding to tumour streams research

The proportional funding to research conducted in single tumour streams in the period 2006 to 2011 was calculated from the combined data from Cancer Australia’s National Audits of cancer research projects and research programs, and people support, building cancer research capacity initiatives and infrastructure, and compared to the data for cancer research funding for Canada and the UK. Figure 7.6 shows the proportion of tumour-specific funding which went to each individual tumour stream in the period 2006 to 2011, for Australia, Canada and the UK.

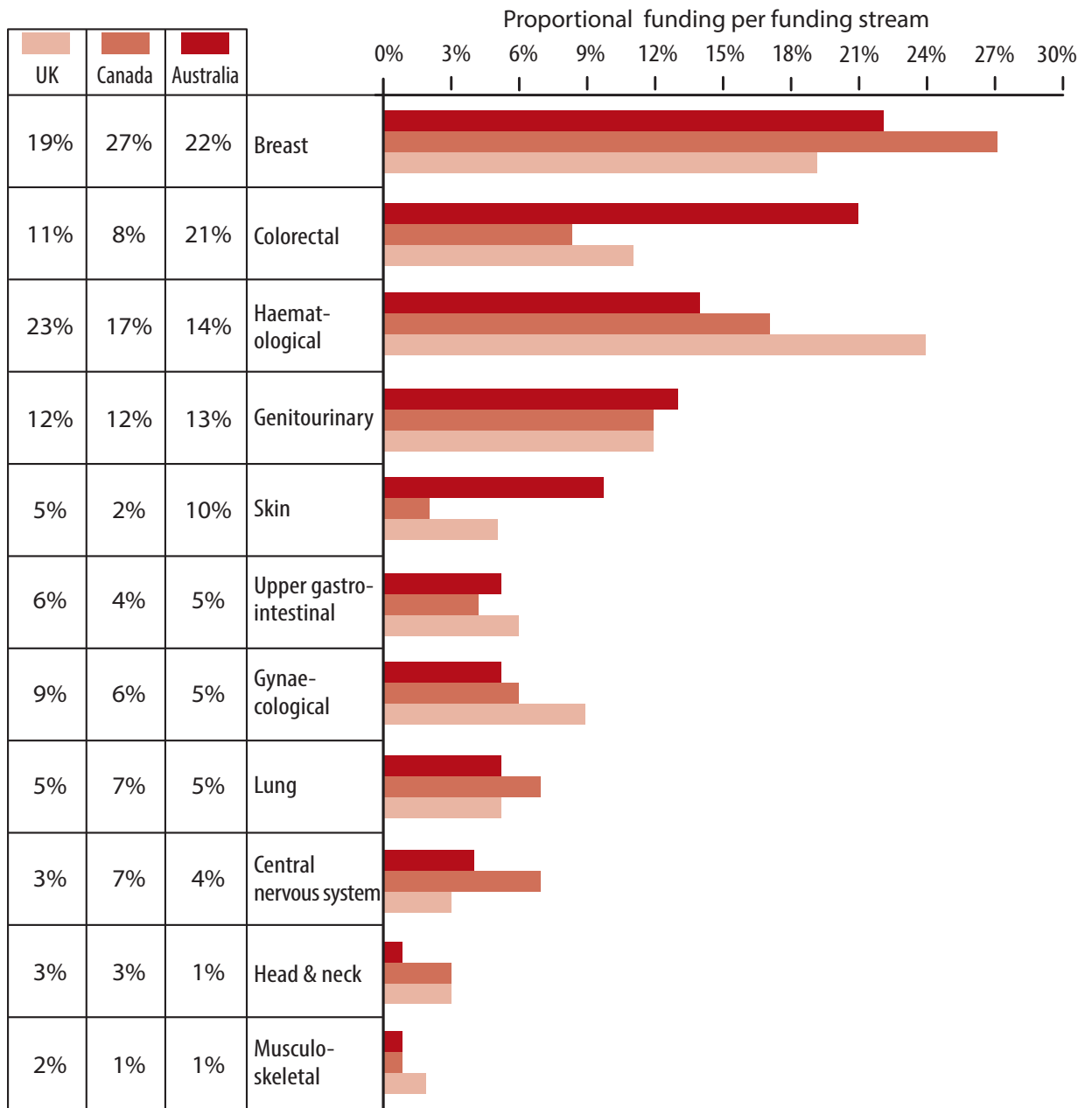
In the period 2006 to 2011, breast cancer, colorectal cancer, haematological cancers and genitourinary cancers were the four largest funded tumour streams in each of Australia, Canada and the UK.

In summary, for each tumour stream:

- ▶ Breast cancer:
 - in Australia and Canada was the highest funded tumour stream at 22% and 27%, respectively; and
 - in the UK was the second highest funded tumour stream at 19%.

- ▶ Colorectal cancer:
 - in Australia was the second highest funded tumour stream at 21%; and
 - in Canada and the UK was the fourth highest funded tumour stream at 8% and 11% respectively.
- ▶ Haematological cancers:
 - in the UK was the highest funded tumour stream at 23%;
 - in Canada was the second highest funded tumour stream at 17%; and
 - in Australia was the third highest funded tumour stream at 14%.
- ▶ Genitourinary cancers:
 - in Canada and the UK was the third highest funded tumour stream at 12%; and
 - in Australia was the fourth highest funded tumour stream at 13%.
- ▶ Skin cancers:
 - in Australia was the fifth highest funded tumour stream at 10%;
 - in the UK was the equal seventh highest funded tumour stream at 5%; and
 - in Canada was the ninth highest funded tumour stream at 2%.
- ▶ Upper gastrointestinal cancers:
 - in Australia and the UK, was the equal sixth and sixth highest funded tumour streams at 5% and 6% respectively; and
 - in Canada was the seventh highest funded tumour stream at 4%.
- ▶ Gynaecological cancers:
 - in the UK was the fifth highest funded tumour stream at 9%; and
 - in Australia and Canada was the equal sixth and sixth highest funded tumour stream at 5% and 6%, respectively.
- ▶ Lung cancers:
 - in Canada was the fifth highest funded tumour stream at 7%;
 - in Australia was the sixth highest funded tumour stream at 5%; and
 - in the UK was the seventh highest funded tumour stream at 5%.
- ▶ Central nervous system cancers:
 - in Canada was the fifth highest funded tumour stream at 7%;
 - in Australia was the seventh highest funded tumour stream at 4%; and
 - in the UK was the equal eighth highest funded tumour stream at 3%.
- ▶ Head and neck cancers:
 - In Australia, Canada and the UK was eighth or equal eighth highest funded tumour stream at 1%, 3% and 3%, respectively.
- ▶ Musculoskeletal cancers:
 - in Australia was the equal eighth highest funded tumour stream at 1%;
 - in the UK was the ninth highest funded tumour stream at 2%; and
 - in Canada was the tenth highest funded tumour stream at 1%.

Figure 7.6 Proportional funding to research for single tumour streams in Australia, Canada and the UK in the period 2006 to 2011



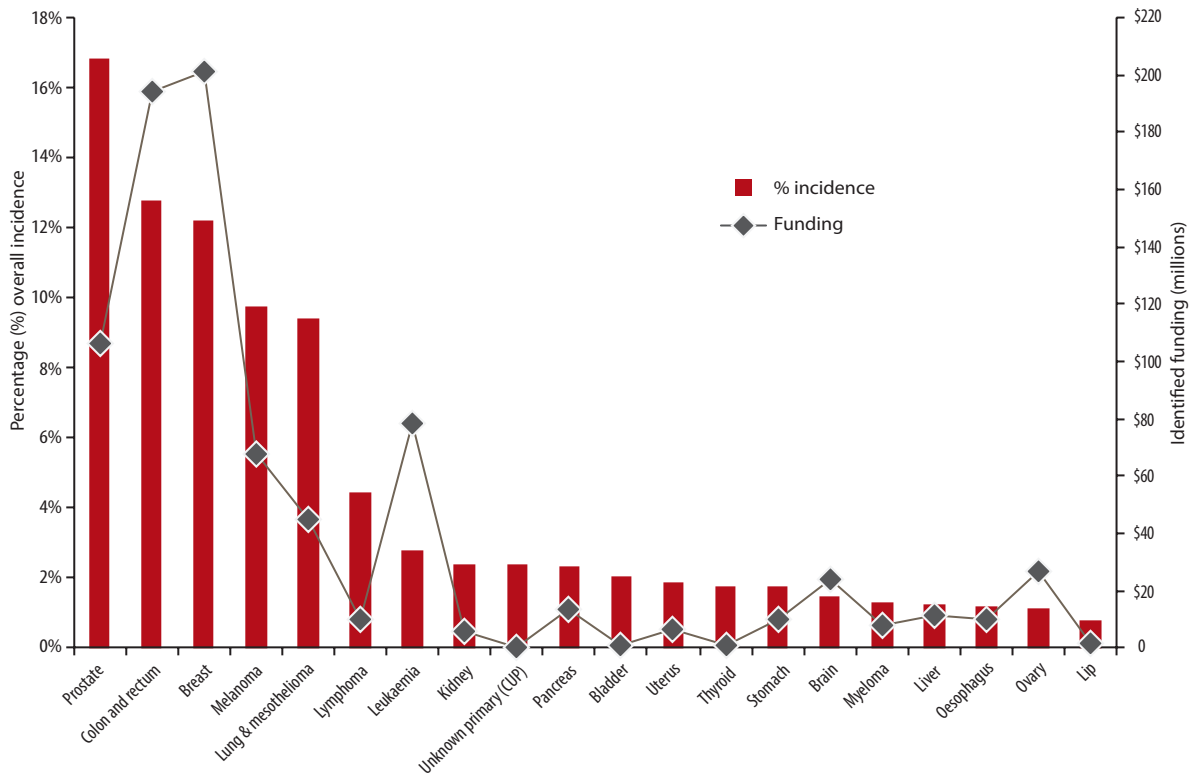
7.5 Funding to tumour type research compared to measures of disease impact and burden in Australia

The funding provided to tumour-specific cancer research projects and research programs, people support scheme awards and building cancer research capacity initiatives and infrastructure awards, which focused on a single tumour type, was compared to different measures of disease impact and burden of disease for these tumour types. These measures included incidence, mortality, and disability-adjusted life years (DALYs).

Incidence

Figure 7.7 shows the funding to single tumour types (2006 to 2011) for the top 20 cancers by incidence in 2011.¹ Relative to incidence, there were proportionally lower levels of funding to prostate cancer, lung cancer and mesothelioma, lymphoma, kidney, cancer of unknown primary (CUP), pancreas, bladder, uterus, thyroid, stomach and lip cancers.

Figure 7.7 Funding to tumour type-specific cancer research in Australia 2006 to 2011, compared with the top 20 cancers by incidence in Australia, 2011



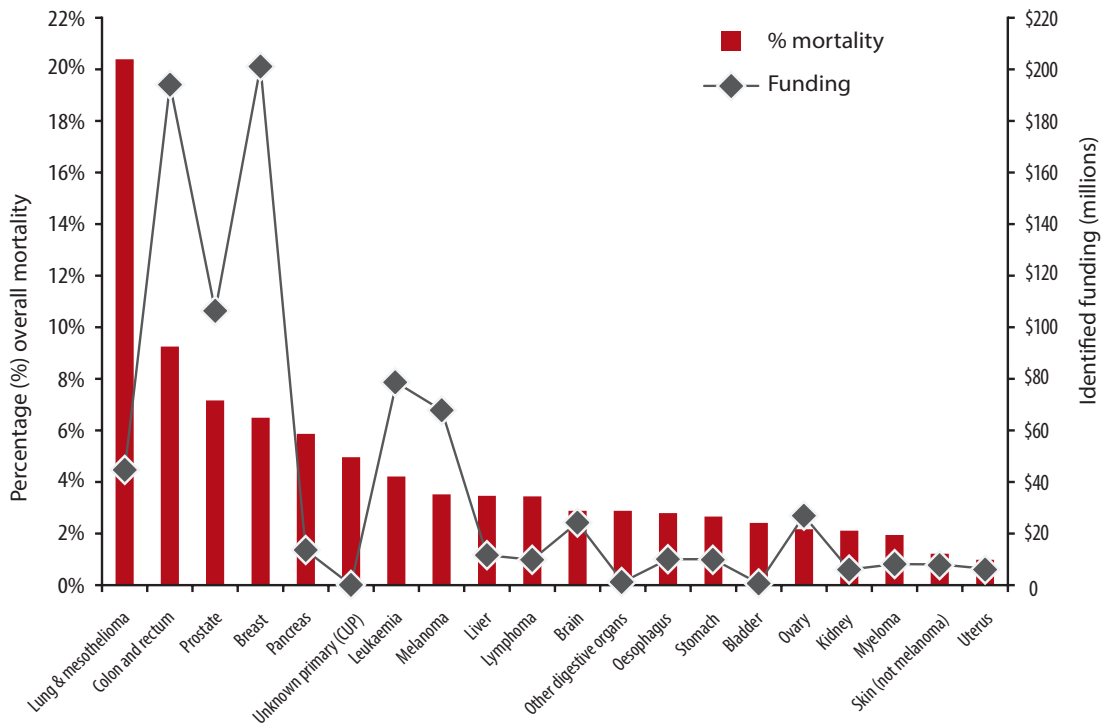
Notes:

1. The AIHW lung and mesothelioma data for incidence has been summed to allow comparison with our collection of total funding to lung cancer and mesothelioma.
2. Leukaemia incidence data has been obtained by summing AIHW data for cancer types C91-C95.
3. Lymphoma incidence has been obtained by summing AIHW data for cancer sites C81-C85 & C96.
4. Total funding to lymphoma represents the summed total funding to the tumour types Hodgkin's disease and non-Hodgkin's lymphoma.
5. Total funding to endometrial cancer is allocated to cancer of the uterus for consistency with AIHW data.

Mortality

Figure 7.8 shows the Funding to single tumour types (2006 to 2011) for the top 20 cancers by mortality in 2012.¹ Relative to mortality, there were proportionally lower levels of funding to lung cancer and mesothelioma, cancer of the pancreas, cancer of unknown primary (CUP), liver, lymphoma, other digestive organs, oesophagus, stomach, bladder, kidney and myeloma.

Figure 7.8 Funding to tumour type-specific cancer research in Australia 2006 to 2011, compared with the top 20 cancers by mortality in Australia, 2012



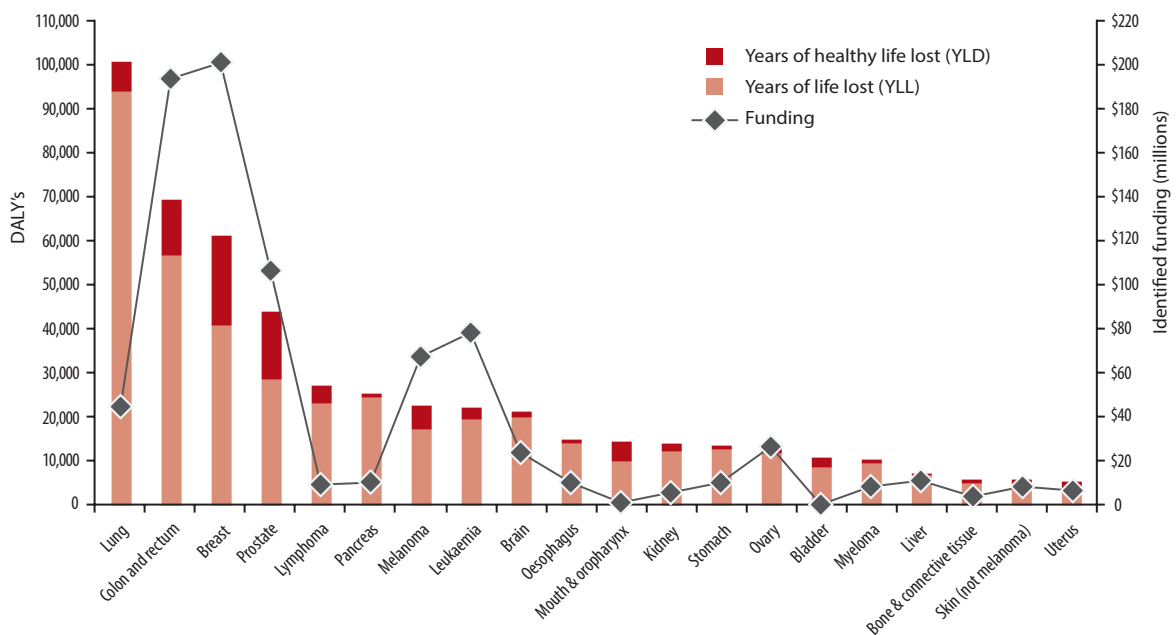
Notes:

1. The AIHW lung and mesothelioma data for mortality has been summed to allow comparison with our collection of total funding to lung cancer and mesothelioma.
2. Leukaemia mortality data has been obtained by summing AIHW data for cancer types C91-C95.
3. Lymphoma mortality data has been obtained by summing AIHW data for cancer sites C81-C85 & C96.
4. Total funding to lymphoma represents the summed total funding to the tumour types Hodgkin's disease and non-Hodgkin's lymphoma.
5. Total funding to endometrial cancer is allocated to cancer of the uterus for consistency with AIHW data.

Disability-adjusted life years

Figure 7.9 shows the funding to single tumour types (2006 to 2011) for the top 20 cancers by Disability-adjusted life years lost (DALYs).¹ DALYs represent the summed estimated years of life lost due to premature death (YLL) and years of healthy life lost to disability (YLD). When total funding was compared to each tumour type's burden of disease, funding for lung cancer, lymphoma and cancers of the pancreas, oesophagus, mouth and oropharynx, kidney, stomach, bladder, myeloma, and bone and connective tissue was proportionally lower relative to the burden of disease caused by these cancers.

Figure 7.9 Funding to tumour type-specific cancer research in Australia 2006 to 2011, compared with the top 20 cancers by DALYs in Australia, 2012



Notes:

1. AIHW mesothelioma data is not available for DALYs. As such DALYs are only presented for lung cancer.
2. In Cancer Australia's audit, mouth and oropharynx tumour site funding is obtained by summing the total spend for oral cavity and lip and pharyngeal tumour types.
3. Statistics on the burden of disease for persons diagnosed with cancer of unknown primary (CUP) in Australia are not available.
4. Total funding to lymphoma represents the summed total funding to the tumour types Hodgkin's disease and non-Hodgkin's lymphoma.
5. Total funding to endometrial cancer is allocated to cancer of the uterus for consistency with AIHW data.

7.6 Discussion

In the period 2006 to 2011, a total of \$1.77 billion in funding was provided in Australia to 4,924 grants and awards for cancer research.

The major funder of cancer research in Australia in the period 2006 to 2011 was the Australian Government, which provided \$665 million to cancer research projects and research programs⁶, \$170 million to people support scheme awards, and \$199 million in funding to building cancer research capacity initiatives and infrastructure. In total, the Australian Government provided \$1.03 billion, or 58%, of the combined funding to cancer research identified by Cancer Australia's two National Audits of the period 2006 to 2011.

The majority of grants and awards identified in the National Audits were funded from a single source. Across the National Audits, 316 cancer research projects and research programs⁶, 75 people support scheme awards, and 50 awards for building cancer research capacity initiatives and infrastructure, were co-funded by two or more funding sources; overall, 441 of 4,924 (9%) of identified awards and grants were co-funded.

Pattern of funding to cancer research areas in Australia and abroad – CSO focus

From 2006–2008 to 2009–2011, the level of funding increased to each CSO category in Australia and the pattern of funding to CSO categories reflected the dominant areas of cancer research in Australia. In the period 2006 to 2011, the CSO categories of Biology and Treatment together accounted for nearly two-thirds (62%) of the identified funding to cancer research.

An analysis of the patterns of funding to CSO categories for people support scheme awards, building cancer research capacity initiatives and infrastructure awards, and cancer research projects and research programs, showed that common features were the higher proportional levels of funding to Biology and the more patient-centred CSO categories of Treatment, and Early Detection, Diagnosis and Prognosis.

A comparison between the national patterns of funding to CSO categories in Australia with international surveys of cancer research, revealed both similarities and differences. A similar pattern of proportional funding to CSO categories in Australia, the UK and Canada was apparent, with the highest proportional funding going to Biology, Treatment and Early Detection, Diagnosis and Prognosis, and similarly lower proportional funding to Cancer Control, Survivorship and Outcomes Research and Scientific Model Systems. The proportional funding Prevention in Australia was higher than for Canada and the UK, and the proportional funding to Aetiology was lower than for those two countries. The impact of the CSIRO's Preventative Health National Research Flagship: Colorectal cancer and gut health initiative had the effect of both increasing Australia's proportional share of Prevention research and reducing the proportional funding to other CSO categories. It should be noted that the CSIRO initiative included research relevant to a number of CSO categories, including Aetiology, but for coding purposes was attributed to Prevention research.

The pattern of funding by ICRP members (excluding NIH) to CSO categories was most similar to the pattern of funding in Australia. The pattern of funding for the NIH in 2008 was more evenly spread across the CSO categories than was observed for Australia, Canada, UK and the other members of the ICRP. The National Cancer Institute (NCI) is the NIH's principal funder of cancer research and supports research across the cancer continuum. The NCI assigns more than one CSO code to cancer grants which address multiple research themes; as such the pattern of CSO funding appears more evenly distributed.

From 2006–2008 to 2009–2011, the observed change in the pattern of funding over time for Australia was noted to be similar to that of the UK and Canada. The similar pattern of funding observed for Australia, the UK and Canada, provides the opportunity to collaboratively fund research in areas of common research endeavour and need.

Funding to cancer research as a percentage of GDP and *per capita* was similar for Australia, Canada and the UK.

Pattern of funding to cancer research areas in Australia and abroad – tumour focus

From 2006–2008 to 2009–2011, the level of funding increased to each individual tumour stream in Australia. That the lowest proportional increase in funding to tumour streams was 29% (for lung cancer and pleural mesothelioma research), and the median proportional increase to individual tumour streams was 48%, demonstrating the increasing focus on tumour-specific research in Australia.

In the period 2006 to 2011, breast cancer, colorectal cancer, haematological cancers and genitourinary cancers received the highest levels of funding in Australia, and these were also the four highest proportionally funded tumour streams in Canada and the UK. There were some notable differences in the pattern of proportional funding to the tumour streams in Australia, Canada and the UK, and these differences may relate, in part, to the level of funding provided by government and non-government funders of tumour-specific research. The higher level of proportional funding to colorectal cancer and skin cancers in Australia compared with Canada and the UK, speaks to the research focus and relative impact of these cancers on the Australian population.

The proportional funding to research in many cancers was low compared to incidence, mortality and burden of disease on the Australian population. These cancers included lung and mesothelioma, lymphoma, pancreas, oesophagus, kidney, stomach, bladder, myeloma and cancer of unknown primary. Research funding investment in Australia could be prioritised for cancers which have a high impact (incidence and mortality) and burden of disease – disability-adjusted life years (DALYs).

The similar cancer research funding pattern across the CSO continuum and also across tumour streams in different countries identifies areas of common and strong research support. The lower proportional funding identified in common areas provides the opportunity for national funders to direct, co-operate and co-fund collaborative international research endeavours.



Appendix A – Appendix A – Organisations invited to provide details of their funding to support cancer research in Australia, 2006 to 2011

ACT Health Research Office
American Association for Cancer Research
American Cancer Society
American Institute for Cancer Research
AMP Foundation
ANZ Trustees
ANZAC Research Institute
Arrow Bone Marrow Transplant Foundation
Asbestos Diseases Research Institute
Association for International Cancer Research
auDA Foundation
Austin Medical Research Foundation
Australasian Gastro-Intestinal Trials Group
Australasian Leukaemia and Lymphoma Group
Australasian Sarcoma Study Group
Australia and New Zealand Breast Cancer Trials Group Ltd
Australia and New Zealand Children’s Haematology and Oncology Group
Australia and New Zealand Gynaecological Oncology Group
Australia and New Zealand Melanoma Trials Group
Australia and New Zealand Urogenital and Prostate (ANZUP) Cancer Trials Group
Australian Breast Cancer Research
Australian Cancer Research Foundation
Australian National University
Australian Nuclear Science and Technology Organisation
Australian Research Council
Australian Rotary Health
Australian Synchrotron
Avon Foundation for Women
Bowel Cancer Australia
Brain Foundation
BUPA Foundation
Burnet Institute
Cabrini Institute



Canadian Institute for Health Research
Cancer Institute NSW
Cancer Nurses Society of Australia
Cancer Research Institute
CanTeen
CASS Foundation
Centenary Institute of Cancer Medicine and Cell Biology
Children's Cancer Institute Australia
Children's Leukaemia and Cancer Research Foundation
Children's Medical Research Institute
Children's Health Foundation Queensland
Clinical Oncological Society of Australia
Colonial Foundation
Commonwealth Department of Health
Commonwealth Department of Industry
Commonwealth Scientific and Industrial Research Organisation
Conquer Cancer Foundation of the American Society of Clinical Oncology
Cooperative Research Centre for Aboriginal and Torres Strait Islander Health
Cooperative Research Centre for Biomarker Translation
Cooperative Research Centre for Cancer Therapeutics
Cooperative Trials Group for Neuro-Oncology
Cure Cancer Australia Foundation
Cure Brain Cancer Foundation
Deakin University
Epworth Research Institute
European Organisation for Research and Treatment of Cancer
Fight Cancer Foundation
Flinders University
Garvan Research Foundation
Griffith University
Helen MacPherson Smith Trust
Human Frontier Science Program
Ian Potter Foundation
International Myeloma Foundation
James S. McDonnell Foundation
Kidney Health Australia
Kolling Institute of Medical Research

Latrobe University
Leukaemia Foundation
Leukemia and Lymphoma Society
Leukemia Research Foundation
Lions Medical Research Foundation
Ludwig Institute for Cancer Research
Macquarie Group Foundation
Macquarie University
Medical Oncology Group of Australia
Melanoma Institute Australia
Menzies Research Institute
Menzies School of Health
Monash Institute of Medical Research
Monash University
Multiple Myeloma Research Foundation
Murdoch Childrens Research Institute
Myeloma Foundation of Australia
National Breast Cancer Foundation
National Health and Medical Research Council
National Institutes of Health
New South Wales Office for Health and Medical Research
Oral Health CRC
Ovarian Cancer Australia
Perpetual Trustees
Peter MacCallum Cancer Foundation
Primary Care Collaborative Cancer Clinical Trials Group
Prince Henry's Institute of Medical Research
Princess Alexandra Hospital Research Foundation
Princess Margaret Hospital Foundation
Prostate Cancer Foundation of Australia
Psycho-oncology Co-operative Trials Group
Queensland Children's Medical Research Institute
QIMR Berghofer Institute of Medical Research
Queensland Office of Health and Medical Research
Queensland University of Technology
Raine Medical Research Foundation
Royal Adelaide Hospital Research Fund (incl Hanson Institute)



Royal Australian and New Zealand College of Radiologists
Royal Australian College of Surgeons
Royal Brisbane and Women's Hospital Foundation
Royal Children's Hospital Foundation
Royal Hobart Hospital Foundation
Royal Melbourne Hospital Foundation
Royal North Shore Hospital Foundation
Royal Perth Hospital Foundation
Royal Women's Hospital Foundation
Sir Charles Gairdner Research Foundation
Sir Edward Dunlop Medical Research Foundation
Skin & Cancer Foundation Australia
Skin & Cancer Foundation Inc
South Australia Department of Health and Ageing
South Australian Health and Medical Research Institute
St Vincent's Health, Melbourne
St Vincent's Institute of Medical Research
Susan G. Komen for the Cure
Sydney Cancer Centre
Sydney Children's Hospital Foundation
Sydney Medical School Foundation
Telethon Institute for Child Health Research
Telstra Foundation
Terry Fox Foundation
The Alfred Foundation
The Atlantic Philanthropies
The Australian Lung Foundation
The Cancer Council Australia
The Cancer Council Australian Capital Territory
The Cancer Council NSW
The Cancer Council Northern Territory
The Cancer Council Queensland
The Cancer Council South Australia
The Cancer Council Tasmania
The Cancer Council Victoria
The Cancer Council Western Australia
The Children's Hospital at Westmead incl. Kids Research Institute

The Hospital Research Foundation
The John Curtin Medical Research Foundation
The Kids' Cancer Project (previously Oncology Children's Foundation)
The Kinghorn Cancer Centre
The Myer Foundation and Sydney Myer Fund
The West Australia Institute for Medical Research
Therapeutic Innovation Australia
Trans-Tasman Radiation Oncology Group
United States of America Department of Defense, Congressionally Directed Medical Research Programs
University of Adelaide
University of Melbourne
University of New South Wales
University of Newcastle incl. Hunter Medical Research Institute
University of Queensland
University of South Australia
University of Sydney
University of Tasmania
University of Western Australia
Val Lishman Health Research Foundation
Victorian Breast Cancer Research Consortium
Victorian Cancer Agency
Victorian Department of Business and Innovation
Victorian Prostate Cancer Research Consortium
Walter and Eliza Hall Institute of Medical Research
Wellcome Trust
Western Australia Department of Health
Western Australian Institute of Medical Research
Westmead Institute for Cancer Research
World Cancer Research Fund



Appendix B – Email Introduction to the Audit

Dear

Cancer Australia invites your participation in identifying funding to areas of cancer research support in Australia.

The attached letter from Professor Helen Zorbas, CEO of Cancer Australia, is an invitation for your organisation to contribute to this audit, and requests assistance from you in providing details of cancer research support activities funded by your organisation in the calendar years 2006-2011.

To facilitate incorporation of this information into our database, we request that these details be provided in a spread sheet format (preferably using Microsoft Excel). We understand however, that this may not always be possible, in which case, information supplied in a Microsoft Word file format would be an acceptable alternative.

Your information can be provided as an attachment to an email addressed to:

Alan.Woods@canceraustralia.gov.au

If your data files are too large to be attached to electronic mail, we would be happy to accept the data on a CD or DVD. This can be mailed to:

Dr Alan Woods
Cancer Australia
GPO Box 4530
Melbourne 3001
Victoria, Australia

We would appreciate receiving this information by C.O.B. February 15, 2013. If your organisation did not fund cancer research support activities between 2006 and 2011, please let us know so that we can update our records.

If you would like any further information, please do not hesitate to contact me using the details below.

We look forward to your contribution to informing cancer research priorities.

Kind regards,

Alan
Dr Alan Woods
Senior Project Officer
Research Audits
Cancer Australia
www.canceraustralia.gov.au



Appendix C – Invitation from CEO of Cancer Australia to cancer research funding organisation

Dear

National audit of areas of cancer research support in Australia, 2006–2011

Cancer Australia invites your participation in identifying funding to areas of cancer research support in Australia. Cancer Australia is the Australian Government's national cancer agency established to reduce the impact of cancer and improve the wellbeing of people affected by cancer in Australia. Our mission is to strengthen and provide advice on the Australian Government's strategic focus on cancer control and care.

In 2012, Cancer Australia conducted an audit of direct funding to cancer research projects and research programs from 2006 to 2011. This audit helped to identify the pattern of funding provided to cancer research projects and research programs in Australia. The findings from this audit have informed Cancer Australia's priorities for its Priority-driven Collaborative Cancer Research Scheme (PdCCRS); an innovative research funding scheme, which brings together government and other funders of cancer research across Australia to collaboratively fund research in identified priority areas. The audit's findings will be released in 2013.

In 2013, Cancer Australia will be undertaking a new national audit of direct funding to areas of cancer research support. This audit will measure direct funding provided to the following areas:

1. **People support – including PhD scholarships, fellowships and other researcher support schemes;**
2. **Research capacity building – including grants for centres of research and networks, partnership grants and strategic or priority-driven awards; and**
3. **Infrastructure support and enabling funding – including biobanks, repositories and equipment used in cancer research.**

This new audit will complement the audit of cancer research projects and research programs conducted in 2012 and further enable Cancer Australia and research funders to identify new opportunities for supporting cancer research.

Cancer Australia invites (name of organisation) to provide details of **direct** funding awarded to the different areas of cancer research support in each of the calendar years from 2006 through to 2011 (inclusive). Please refer to Attachment A for the details that we require.

We would appreciate receiving this information by C.O.B. Friday 15 February, 2013. If you would like clarification of the details required, or would like to discuss any aspect of this audit further, please contact:

Dr Alan Woods, Senior Project Officer – Research Audits, Cancer Australia, by email at: Alan.Woods@canceraustralia.gov.au or by telephone on (03) 8866 0401.

Cancer Australia looks forward to your organisation's contribution to this audit and thanks you for your support in helping to inform cancer research efforts which improve outcomes for people affected by cancer.

Yours sincerely,



Professor Helen Zorbas
Chief Executive Officer



Appendix D – Common Scientific Outline (CSO) classification of cancer research

Biology

1.1 Normal Functioning

Examples of science that would fit:

- ▶ Developmental biology (from conception to adulthood) and the biology of aging
- ▶ Normal functioning of genes, including their identification and expression, and the normal function of gene products, such as hormones and growth factors
- ▶ Normal formation of the extracellular matrix
- ▶ Normal cell-to-cell interactions
- ▶ Normal functioning of apoptotic pathways

1.2 Cancer Initiation: Alterations in Chromosomes

Examples of science that would fit:

- ▶ Abnormal chromosome number
- ▶ Aberration in chromosomes and genes (e.g., in chronic myelogenous leukaemia)
- ▶ Damage to chromosomes and mutation in genes
- ▶ Failures in DNA repair
- ▶ Aberrant gene expression
- ▶ Epigenetics
- ▶ Genes and proteins involved in aberrant cell cycles

1.3 Cancer Initiation: Oncogenes and Tumour Suppressor Genes

Examples of science that would fit:

- ▶ Genes and signals involved in growth stimulation or repression, including oncogenes (Ras, etc.), and tumour suppressor genes (p53, etc.)
- ▶ Effects of hormones and growth factors and their receptors such as oestrogens, androgens, TGF-beta, GM-CSF, etc.

1.4 Cancer Progression and Metastasis

Examples of science that would fit:

- ▶ Latency, promotion, and regression
- ▶ Expansion of malignant cells
- ▶ Interaction of malignant cells with the immune system or extracellular matrix
- ▶ Cell mobility, including detachment, motility, and migration in the circulation
- ▶ Invasion



- ▶ Malignant cells in the circulation, including penetration of the vascular system and extravasation
- ▶ Systemic and cellular effects of malignancy
- ▶ Tumour angiogenesis and growth of metastases
- ▶ Role of hormone or growth factor dependence/independence in cancer progression

1.5 Resources and Infrastructure

Examples of science that would fit:

- ▶ Informatics and informatics networks
- ▶ Specimen resources
- ▶ Epidemiological resources pertaining to biology
- ▶ Reagents, chemical standards
- ▶ Education and training of investigators at all levels (including clinicians), such as participation in training workshops, advanced research technique courses, and Master's course attendance. This does not include longer-term research-based training, such as Ph.D. or post-doctoral fellowships

Aetiology

2.1 Exogenous Factors in the Origin and Cause of Cancer

Examples of science that would fit:

- ▶ Lifestyle factors such as smoking, chewing tobacco, alcohol consumption, parity, diet, sunbathing, and exercise
- ▶ Environmental and occupational exposures such as radiation, second-hand smoke, radon, asbestos, organic vapours, pesticides, and other chemical or physical agents
- ▶ Infectious agents associated with cancer aetiology, including viruses (Human Papilloma Virus-HPV, etc.) and bacteria (*helicobacter pylori*, etc.)
- ▶ Viral oncogenes and viral regulatory genes associated with cancer causation

2.2 Endogenous Factors in the Origin and Cause of Cancer

Examples of science that would fit:

- ▶ Free radicals such as superoxide and hydroxide radicals
- ▶ Genes known to be involved or suspected of being mechanistically involved in familial cancer syndromes; for example, BRCA1, Ataxia Telangiectasia, and APC
- ▶ Genes suspected or known to be involved in "sporadic" cancer events; for example, polymorphisms and/or mutations that may affect carcinogen metabolism (e.g., CYP, NAT, glutathione transferase, etc.)

2.3 Interactions of Genes and/or Genetic Polymorphisms with Exogenous and/or Endogenous Factors

Examples of science that would fit:

- ▶ Gene-environment interactions

- ▶ Interactions of genes with lifestyle factors, environmental, and/or occupational exposures such as variations in carcinogen metabolism associated with genetic polymorphisms
- ▶ Interactions of genes and endogenous factors such as DNA repair deficiencies and endogenous DNA damaging agents such as oxygen radicals or exogenous radiation exposure

2.4 Resources and Infrastructure Related to Aetiology

Examples of science that would fit:

- ▶ Informatics and informatics networks; for example, patient databanks
- ▶ Specimen resources (serum, tissue, etc.)
- ▶ Reagents and chemical standards
- ▶ Epidemiological resources pertaining to aetiology
- ▶ Statistical methodology or biostatistical methods
- ▶ Centres, consortia, and/or networks
- ▶ Education and training of investigators at all levels (including clinicians), such as participation in training workshops, advanced research technique courses, and Master's course attendance. This does not include longer term research based training, such as Ph.D. or post-doctoral fellowships

Prevention

3.1 Interventions to Prevent Cancer: Personal Behaviours That Affect Cancer Risk

Examples of science that would fit:

- ▶ Research on determinants of personal behaviours, such as diet, physical activity, sun exposure, and tobacco use, that affect cancer risk
- ▶ Interventions to change personal behaviours that affect cancer risk

3.2 Nutritional Science in Cancer Prevention

Examples of science that would fit:

- ▶ Quantification of nutrients and micronutrients
- ▶ Studies on the effect(s) of nutrients or nutritional status on cancer incidence
- ▶ Dietary assessment efforts, including dietary questionnaires and surveys
- ▶ Development, characterization, and validation of dietary/nutritional assessment instruments

3.3 Chemoprevention

Examples of science that would fit:

- ▶ Chemopreventive agents and their discovery, mechanism of action, development, testing in model systems, and clinical testing

3.4 Vaccines

Examples of science that would fit:

- ▶ Vaccines for prevention, their discovery, mechanism of action, development, testing in model systems, and clinical testing



3.5 Complementary and Alternative Prevention Approaches

Examples of science that would fit:

- ▶ Discovery, development, and testing of complementary/alternative prevention approaches such as diet, herbs, supplements, or other interventions that are not widely used in conventional medicine or are being applied in different ways as compared to conventional medical uses
- ▶ Hypnotherapy, relaxation, transcendental meditation, imagery, spiritual healing, massage, biofeedback, etc., used as a preventive measure

3.6 Resources and Infrastructure Related to Prevention

Examples of science that would fit:

- ▶ Informatics and informatics networks; for example, patient databanks
- ▶ Specimen resources (serum, tissue, etc.)
- ▶ Epidemiological resources pertaining to prevention
- ▶ Clinical trials infrastructure
- ▶ Statistical methodology or biostatistical methods
- ▶ Centres, consortia, and/or networks
- ▶ Education and training of investigators at all levels (including clinicians), such as participation in training workshops, advanced research technique courses, and Master's course attendance. This does not include longer term research based training, such as Ph.D. or post-doctoral fellowships

Early Detection, Diagnosis, and Prognosis

4.1 Technology Development and/or Marker Discovery

Examples of science that would fit:

- ▶ Discovery of markers (e.g., proteins, genes), and/or technologies (such as fluorescence, nanotechnology, etc.) that are potential candidates for use in cancer detection, staging, diagnosis, and/or prognosis
- ▶ Use of proteomics, genomics, expression assays, or other technologies in the discovery of markers

4.2 Technology and/or Marker Evaluation With Respect to Fundamental Parameters of Method

Examples of science that would fit:

- ▶ Development, refinement, and preliminary evaluation (e.g., animal trials and Phase I human trials)
- ▶ Preliminary evaluation with respect to laboratory sensitivity, laboratory specificity, reproducibility, and accuracy
- ▶ Research into mechanisms assessing tumour response to therapy at a molecular or cellular level

4.3 Technology and/or Marker Testing in a Clinical Setting

Examples of science that would fit:

- ▶ Evaluation of clinical sensitivity, clinical specificity, and predictive value (Phase II or III clinical trials)
- ▶ Quality assurance and quality control
- ▶ Inter- and intra-laboratory reproducibility
- ▶ Testing of the method with respect to effects on morbidity and/or mortality
- ▶ Study of screening methods, including compliance, acceptability to potential screenees, and receiver-operator characteristics
- ▶ Research into improvements in techniques to assess clinical response to therapy

4.4 Resources and Infrastructure Related to Detection, Diagnosis, or Prognosis

Examples of science that would fit:

- ▶ Informatics and informatics networks; for example, patient databanks
- ▶ Specimen resources (serum, tissue, images, etc.)
- ▶ Clinical trials infrastructure
- ▶ Epidemiological resources pertaining to risk assessment, detection, diagnosis, or prognosis
- ▶ Statistical methodology or biostatistical methods
- ▶ Centres, consortia, and/or networks
- ▶ Education and training of investigators at all levels (including clinicians), such as participation in training workshops, advanced research technique courses, and Master's course attendance. This does not include longer term research based training, such as Ph.D. or post-doctoral fellowships

Treatment

5.1 Localized Therapies - Discovery and Development

Examples of science that would fit:

- ▶ Discovery and development of treatments administered locally that target the organ and/or neighbouring tissue directly, including but not limited to surgical interventions and radiotherapy
- ▶ Therapies with a component administered systemically but that act locally (e.g., photodynamic therapy, radioimmunotherapy and radiosensitizers)
- ▶ Development of methods of drug delivery
- ▶ Research into the development of localized therapies to prevent recurrence

5.2 Localized Therapies - Clinical Applications

Examples of science that would fit:

- ▶ Clinical testing and application of treatments administered locally that target the organ and/or neighbouring tissue directly, including but not limited to surgical interventions and radiotherapy



- ▶ Clinical testing and application of therapies with a component administered systemically but that act locally (e.g., photodynamic therapy and radiosensitizers)
- ▶ Phase I, II, or III clinical trials of promising therapies that are administered locally
- ▶ Side effects, toxicity, and pharmacodynamics
- ▶ Clinical testing of localized therapies to prevent recurrence

5.3 Systemic Therapies - Discovery and Development

Examples of science that would fit:

- ▶ Discovery and development of treatments administered systemically such as cytotoxic or hormonal agents, novel systemic therapies such as immunologically directed therapies (vaccines, antibodies), gene therapy, angiogenesis inhibitors, apoptosis inhibitors, and differentiating agents
- ▶ Defining molecular signatures of cancer cells
- ▶ Identifying molecular targets for drug discovery. Includes mechanistic studies of cellular metabolism, combinatorial chemical synthesis, drug screening, development of high-throughput assays, and testing in model systems
- ▶ Investigating the molecular mechanisms of drug resistance and pre-clinical evaluation of therapies to circumvent resistance
- ▶ Development of methods of drug delivery
- ▶ Research into the development of systemic therapies to prevent recurrence

5.4 Systemic Therapies - Clinical Applications

Examples of science that would fit:

- ▶ Clinical testing and application of treatments administered systemically such as cytotoxic or hormonal agents, novel systemic therapies such as immunologically directed therapies (vaccines, antibodies), gene therapy, angiogenesis inhibitors, apoptosis inhibitors, and differentiating agents
- ▶ Phase I, II, or III clinical trials of promising therapies administered systemically
- ▶ Side effects, toxicity, and pharmacodynamics
- ▶ Clinical testing of systemic therapies to prevent recurrence

5.5 Combinations of Localized and Systemic Therapies

Examples of science that would fit:

- ▶ Development and testing of combined approaches to treatment
- ▶ Clinical application of combined approaches to treatment such as systemic cytotoxic therapy and radiation therapy
- ▶ Development and clinical application of combined localized and systemic therapies to prevent recurrence

5.6 Complementary and Alternative Treatment Approaches

Examples of science that would fit:

- ▶ Discovery, development, and clinical application of complementary/alternative treatment approaches such as diet, herbs, supplements, natural substances, or other interventions

that are not widely used in conventional medicine or are being applied in different ways as compared to conventional medical uses

- ▶ Complementary/alternative approaches to the prevention of recurrence (please note that primary prevention using complementary or alternative approaches should be coded under 3.5)

5.7 Resources and Infrastructure Related to Treatment and the prevention of recurrence

Examples of science that would fit:

- ▶ Informatics and informatics networks; for example, clinical trials networks and databanks
- ▶ Mathematical and computer simulations
- ▶ Specimen resources (serum, tissue, etc.)
- ▶ Clinical trial groups
- ▶ Epidemiological resources pertaining to treatment
- ▶ Statistical methodology or biostatistical methods
- ▶ Drugs and reagents for distribution and drug screening infrastructures
- ▶ Centres, consortia, and/or networks
- ▶ Education and training of investigators at all levels (including clinicians), such as participation in training workshops, advanced research technique courses, and Master's course attendance. This does not include longer-term research-based training, such as Ph.D. or post-doctoral fellowships

Cancer Control, Survivorship, and Outcomes Research

6.1 Patient Care and Survivorship Issues

Examples of science that would fit:

- ▶ Quality of life
- ▶ Pain management
- ▶ Psychological impacts of cancer survivorship
- ▶ Rehabilitation
- ▶ Reproductive issues
- ▶ Long-term morbidity
- ▶ Symptom management, including nausea, vomiting, lymphedema, neuropathies, etc.
- ▶ Prevention of treatment-related toxicities and sequelae, including symptom management, prevention of mucosities, prevention of cardiotoxicities, etc.

6.2 Surveillance

Examples of science that would fit:

- ▶ Epidemiology and end results reporting (e.g., SEER)
- ▶ Surveillance of cancer risk factors such as diet, body weight, physical activity, sun exposure, and tobacco use
- ▶ Analysis of variations in risk factor exposure by demographic or other factors
- ▶ Registries that track incidence, morbidity, and/or mortality related to cancer



- ▶ Trends in use of interventional strategies
- ▶ Method development for risk factor surveillance

6.3 Behaviour

Examples of science that would fit:

- ▶ Behavioural medicine research and interventions
- ▶ Influence of social factors such as community, policy, education, and legislation, on behaviours related to cancer control
- ▶ Attitudes and belief systems and their influence on psychological health and on behaviours related to cancer control. For example, how beliefs can alter attempts to seek screening, detection, and treatment
- ▶ Interventions to change attitudes and beliefs that affect behaviour related to cancer control and cancer outcomes
- ▶ Influences of attitudes and beliefs on compliance with treatment and prevention protocols
- ▶ Psychological or educational interventions to promote behaviours that lessen treatment-related morbidity and promote psychological adjustment to the diagnosis of cancer and to treatment effects
- ▶ Burdens of cancer on family members/caregivers and psychological/behaviour issues

6.4 Cost Analyses and Health Care Delivery

Examples of science that would fit:

- ▶ Analyses of the cost effectiveness of methods used in cancer prevention, detection, diagnosis, prognosis, treatment, and survivor care/support
- ▶ Development and testing of health service delivery methods
- ▶ Interventions to increase the quality of health care delivery
- ▶ Impact of organisational, social, and cultural factors on access and quality of care
- ▶ Studies of providers such as geographical or care-setting variations in outcomes
- ▶ Effect of reimbursement and/or insurance on cancer control, outcomes, and survivorship support
- ▶ Access to care issues
- ▶ Health services research, including health policy and practice
- ▶ Analysis of health service provision, including the interaction of primary and secondary care; cost-effectiveness of treatments

6.5 Education and Communication

Examples of science that would fit:

- ▶ Development of communication tools and methods
- ▶ Education of patients, health care providers, at-risk populations, and the general population about cancer
- ▶ Communication to patients regarding therapeutic options
- ▶ Educational interventions to promote self-care and symptom management

- ▶ Communicating cancer risk to underserved populations, at-risk populations, and the general public
- ▶ Alternative teaching methods to communicate therapeutic options and risk-reduction behaviour to patients and the general public
- ▶ Communication of lifestyle models that reduce cancer risk, such as communication of nutritional interventions
- ▶ Communicating smoking and tobacco cessation interventions
- ▶ Special approaches and considerations for underserved and at-risk populations
- ▶ Education, information, and prevention/screening/assessment systems for the general public, primary care professionals, or policy makers
- ▶ Training, predictive cancer models, pain management, and surveillance systems for primary care professionals, telehealth/telemedicine applications
- ▶ Communication regarding cancer genetics, managed oncology care, and communicating with survivors
- ▶ Barriers to successful health communication

6.6 End-of-Life Care

Examples of science that would fit:

- ▶ End-of-life care issues, including palliative care, psychological interventions with families at end of life, hospice care, and pain management for terminally ill patients

6.7 Ethics and Confidentiality in Cancer Research

Examples of science that would fit:

- ▶ Informed consent modeling and development
- ▶ Quality of Institutional Review Boards (IRBs)
- ▶ Protecting patient confidentiality and privacy
- ▶ Research ethics

6.8 Complementary and Alternative Approaches for Supportive Care of Patients and Survivors

Examples of science that would fit:

- ▶ Hypnotherapy, relaxation, transcendental meditation, imagery, spiritual healing, massage, biofeedback, etc., as used for the supportive care of patients and survivors
- ▶ Discovery, development, and testing of complementary/alternative approaches such as diet, herbs, supplements, or other interventions that are not widely used in conventional medicine or are being applied in different ways as compared to conventional medical uses

6.9 Resources and Infrastructure Related to Cancer Control, Survivorship, and Outcomes Research

Examples of science that would fit:

- ▶ Informatics and informatics networks
- ▶ Clinical trial groups related to cancer control, survivorship, and outcomes research
- ▶ Epidemiological resources pertaining to cancer control, survivorship, and outcomes research



- ▶ Statistical methodology or biostatistical methods
- ▶ Surveillance infrastructures
- ▶ Centres, consortia, and/or networks
- ▶ Psychosocial, economic, political and health services research frameworks and models
- ▶ Education and training of investigators at all levels (including clinicians), such as participation in training workshops, advanced research technique courses, and Master's course attendance. This does not include longer-term research-based training, such as Ph.D. or post-doctoral fellowships

Scientific Model Systems

7.1 Development and Characterisation of Model Systems

Examples of science that would fit:

- ▶ Development and characterisation of model systems, including but not limited to:
- ▶ Computer-simulation model systems and computer software development
- ▶ In vitro models systems
- ▶ Cell culture model systems
- ▶ Organ and tissue model systems
- ▶ Animal model systems such as drosophila and c. elegans, zebra fish, mouse, etc.

7.2 Application of Model Systems

Examples of science that would fit:

- ▶ Research into new ways of applying model systems, including but not limited to:
- ▶ Computer simulation model systems and computer software development
- ▶ In vitro models systems
- ▶ Cell culture model systems
- ▶ Organ and tissue model systems
- ▶ Animal model systems such as drosophila and c. elegans, zebra fish, mouse, etc.

7.3 Resources and Infrastructure Related to Scientific Model Systems

Examples of science that would fit:

- ▶ Models made available for distribution to the scientific community
- ▶ Centres, consortia, and/or networks
- ▶ Education and training of investigators at all levels (including clinicians), such as participation in training workshops, advanced research technique courses, and Master's course attendance. This does not include longer-term research-based training, such as Ph.D. or post-doctoral fellowships.

Appendix E – Tumour streams and tumour types

Tumour streams

Breast cancer

Central nervous system tumours

Colorectal cancer

Genitourinary cancers (includes cancers of the bladder, kidney, prostate and testis)

Gynaecological cancers

Head and neck cancers

Haematological cancers (includes leukaemia, lymphomas and myeloma)

Lung cancers

Musculoskeletal cancers

Skin cancers including melanoma

Upper gastro-intestinal cancers (includes cancers of the hepato-biliary system, oesophagus, pancreas and stomach)

Tumour types

Specific tumour types used for coding cancer research projects and research programs

Adrenocortical cancer

Anal cancer

Bladder cancer

Blood cancer (other than Hodgkin's Disease, Leukaemia, Myeloma, Non-Hodgkin's Lymphoma)

Bone cancer (including malignant fibrous histiocytoma and osteosarcoma)

Brain tumour (including Chordoma)

Breast cancer

Cancer of unknown primary (CUP)

Cervical cancer

Colon and rectal cancer

Ear cancer

Endometrial cancer

Eye cancer (not including retinoblastoma)

Gallbladder cancer

Gastrointestinal tract cancer (not including colon and rectal, gallbladder, liver, oesophageal, pancreatic, small intestine and stomach)

Genital System, Female (not including cervical, endometrial, ovarian, vaginal and vulva)

Genital System, Male (not including penile, prostate and testicular)

Head and neck cancer (not including laryngeal, nasal cavity and paranasal sinus, oral cavity and lip, parathyroid, pharyngeal, salivary gland and thyroid)

Heart cancer



Hodgkin's disease
Kaposi's sarcoma
Kidney cancer (including Wilm's tumour)
Laryngeal cancer
Leukaemia (including acute lymphoblastic leukaemia, acute myeloid leukaemia, chronic lymphocytic leukaemia, chronic myelogenous leukaemia, hairy cell leukaemia)
Liver cancer (including bile duct and hepatocellular)
Lung cancer (including pleural mesothelioma)
Melanoma
Myeloma (including Multiple Myeloma)
Nasal cavity and paranasal sinus cancer
Neuroblastoma
Non-Hodgkin's lymphoma
Oesophageal
Oral cavity and lip cancer
Ovarian cancer
Pancreatic cancer
Penile cancer
Pharyngeal cancer
Pituitary tumour
Prostate cancer
Retinoblastoma
Respiratory system cancer (not including lung, nasal cavity and paranasal sinus)
Salivary gland cancer
Sarcoma (including chondrosarcoma, Ewing's sarcoma, fibrosarcoma, osteosarcoma, rhabdomyosarcoma, soft tissue sarcoma and uterine sarcoma)
Skin cancer (not melanoma)
Small intestine cancer
Stomach cancer
Testicular cancer
Thymoma (malignant)
Thyroid cancer
Urinary system (not including bladder, kidney and Wilm's)
Vaginal cancer
Vulva cancer

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