DEVELOPMENT
POLICY CENTRE

Australian funding of global medical research:
how to scale up?

Camilla Burkot and Stephen Howes

25 August 2017

Contents

Note
Figures cited are in Australian dollars unless otherwise noted.

Executive Summary

The starting point for this paper is that there is a strong case for scaling up Australian support for global medical research: research leading to the development of new medical products, such as drugs, vaccines and diagnostic tests, to address health problems predominantly affecting people in the developing world.

This case to scale up Australian support for global medical research rests on four points. First, the future of aid will increasingly be about the financing of global public goods, whether to combat climate change, to develop new and improved crop varieties, or to discover new medicines and vaccines. Second, global medical research seems to yield high social returns. Third, Australia has a strong medical research community. Fourth, there has been growing interest within the Australian government on the subject of medical research. Two recent official reviews (the Hollway Review of aid of 2011 and the McKeon Review of medical research of 2013) have both recommended greater action by Australia in this area. The current Liberal-National Coalition government also seems to show a growing interest, the most recent example being the June 2016 announcement of a health security fund, with a heavy emphasis on research.

While it is impossible to come up with a definitive target for the volume of Australian funding for global medical research, it is obvious in our view that such funding should be significantly increased. Doubling it would bring it into line with our spending on global agricultural research. **The aim of this paper is to examine how a significant scaling up of aid for global medical research, such as a doubling, should be managed.**

The paper argues for a two-pronged approach. First, the current access of global medical researchers to the National Health and Medical Research Council (NHMRC) is valuable and should be expanded. One of the recommendations of the McKeon Review was that the NHMRC should "more fully embrace grant assistance for global health" by opening up grants to international researchers (either alone or in partnership with Australian researchers and institutions) and establishing co-funded grants with global philanthropic organisations. Similar access to the Medical Research Future Fund (MRFF) should also be obtained. All of this funding should be counted as Official Development Assistance (ODA).

Second, additional funding for global medical research should be provided by the Australian aid program. This should not be via additional aid funding for the NHMRC. Such funding is largely investigator-driven and needs to be complemented by a more strategic and results-oriented approach. After examining a number of alternative models, the paper argues for one that has a strong Australian focus, that supports global engagement, and that is external to DFAT. There are a variety of reasons why research management is not an appropriate task for a government department. **The best option would be the establishment of a global medical research centre**. In 2010, the Canadian government established Global Challenges Canada as a federally incorporated organisation with the specific mandate of supporting innovative global health research projects and proposals. In the Australian context, the options are either to create a new Australian Centre for International Medical Research, or to expand the mandate of the Australian Centre for International Agricultural Research (ACIAR) to cover medical research, so that it would become ACIR: the

Australian Centre for International Research. Under this scenario, ACIR would finance Australian researchers, often in collaboration with developing country counterparts. It would also be responsible for Australian funding of medical research internationally; for example, Product Development Partnerships (PDPs) of particular strategic interest to Australia.

While we argue that a global medical research centre in Australia is the best way in which to scale up Australia's contribution to global medical research, we also note that the government is taking a somewhat different route. As per its June 2016 election announcement and as confirmed in the 2017-18 Federal Budget, it is moving to introduce a 'regional health security partnership fund'. This overlaps with the recommendation of this paper in that it clearly will have an emphasis on research, but differs from it in two regards. First, this new initiative will have an operational as well as a research focus. Second, there is no indication that the government is looking to any entity other than DFAT to oversee this initiative.

The merits of a health security operational initiative can be debated, but even if accepted do not undermine the case for greater spending on global medical research, implemented by a body external to DFAT.

As global medical research becomes more important for Australia, better data is required. Though the data from the G-FINDER survey (an annual global survey of public, private, and philanthropic investment in neglected disease research and development conducted by Policy Cures Research) drawn upon throughout this paper provides a broad indication of the quantity of funding currently being granted, it is limited to product-related R&D for a specific subset of diseases. If those grants issued by the NHMRC and other public bodies which are directed to global medical research were more closely tracked and easily identifiable, this would help to support improved strategic investment decision-making by clarifying what kinds of research is being funded, and identifying existing gaps or opportunities for developing promising initial findings. Better tracking would also facilitate counting these funds as Australian ODA, and might assist in attracting further funding for Australian medical research from multilateral, philanthropic and even private industry sources.

Scaling up Australia's contribution to global medical research is long overdue. Our approach to supporting global agricultural research has worked well; we should take a similar approach with regard to global medical research.

1. Introduction

For several decades, Australia has been a leader in global agricultural research, both through the Australian Centre for International Agricultural Research (ACIAR), and through broader support for the CGIAR, an international network of agricultural research institutions. ACIAR has an annual budget of $140 million, including the funds that it disburses overseas. There has never been the same support from Australian aid for global medical research, the total Australian public funding for which is estimated at about $38 million per year.[1] Australia's aid funding for agricultural research for the benefit of developing countries makes up six per cent of the global total, a significant amount given that our aid is under two per cent of the global total. By contrast, our aid funding for medical research is less than three per cent of the global total (all figures based on 2015 OECD DAC statistics). This seems anomalous, given Australia's strengths in both areas.

The starting point for this paper is that there is a strong case for scaling up Australian support for global medical research. By global medical research, we mean research leading to the development of new medical products, such as drugs, vaccines and diagnostic tests, intended to address health problems predominantly affecting people in the developing world.

This case rests on four points. First, the future of aid will increasingly be about the financing of global public goods, whether to combat climate change, to develop new and improved crop varieties, or to discover new medicines and vaccines. Second, Australia has a strong medical research community, with significant expertise that can be applied to research targeting health problems predominant in the developing world. Third, global medical research seems to be an area of high return. An analysis by Gray et al 2006 estimates a cost-effectiveness ratio for new drugs of more than five times the benchmark for the roll-out of existing programs. Fourth, there has been growing interest within the Australian government in medical research, as reflected in various recent reviews and policy commitments. Two recent official reviews (the Hollway Review of aid of 2011 and the McKeon Review of medical research of 2013) have both recommended greater action by Australia in this area. The current Liberal-National Coalition government also seems to show a growing interest, the most recent example being the June 2016 announcement of a health security fund, with a heavy emphasis on research.

While it is impossible to come up with a definitive target for Australian funding for global medical research, it is obvious in our view that such funding should be significantly increased. The aim of this paper is to examine how a significant scaling up of aid for global medical research, such as a doubling, should be managed.[2]

There is an ongoing debate as to the desirable balance between research into the delivery of health services and utilisation of existing medical technologies (what might be called 'health research'), and research leading to the development of new medical technologies (what we refer to as 'medical

---

[1] As discussed in Section 3.1, reported as US$30 million, converted here to Australian dollars ($) using an exchange rate of 0.8US$/$.

[2] The March 2014 Aid Inquiry report of the Senate Foreign Affairs, Defence and Trade References Committee endorsed a commitment to global medical research and recommended annual funding of about $50 million a year, which is roughly a doubling of current spending (Recommendation 9).

research').[3] While our focus is on the latter, this should not be taken to imply that it is the more important of the two. However, worldwide, about US$30 billion of aid flows into health, and nearly of all this goes, in one way or another, to support the delivery of health services using available technologies. Clearly, there should be a focus within this large spend on health research. But it may not require a separate initiative, since it already closely relates to the core business of aid agencies. Global medical research, by contrast, clearly requires a separate approach since it cannot be attached effectively to regular operational health aid funding streams.

The paper is structured as follows. Section 2 gives an overview of worldwide medical research funding trends and patterns. Section 3 then examines the volume of Australian public and philanthropic funding for global medical research, particularly that related to new product research and development. It puts this funding in a global context, and outlines the roles that the various major Australian public funders of such research play, and who the recipients of that funding are. Section 4 discusses the main constraints on the effectiveness of current Australian efforts. Section 5 turns to possible strategies for the future, first by reflecting on past efforts to develop a strategy, and then by identifying key characteristics of an effective Australian aid-funded model for global medical research. Section 6 examines a range of alternative funding models and considers their strengths and weaknesses. Section 7 concludes.

2. Global medical research: an overview

Over the last fifteen years, global health has grown to become a major development spending area. Overall official development assistance for health (DAH; not limited to research) is estimated to have tripled from US$10.9 billion in 2000 to US$30.6 billion in 2011 (Schäferhoff et al 2015, p. 16), driven in part by the launching of the Millennium Development Goals and the establishment of initiatives and funds such as the US President's Emergency Plan for AIDS Relief, the Global Fund to Fight AIDS, Tuberculosis and Malaria, and GAVI. According to the Institute for Health Metrics and Evaluation (2016), global DAH peaked in 2013 at US$38 billion, and in 2016 was estimated at US$37.6 billion.

Increased interest in health research for development accompanied the increase in global health aid. A series of summits on research for health, including in Mexico in 2004 and Bamako in 2008, drew out the connections between research and improved health outcomes. The Bamako Call to Action reiterated earlier recommendations that international development agencies "invest at least 5% of development assistance funds earmarked for the health sector in research". More recently, Sustainable Development Goal Target 3.b lends support specifically to "research and development of vaccines and medicines for the communicable and non-communicable diseases that primarily affect developing countries". Total net Official Development Assistance (ODA) to medical research (as

---

[3] For example, see Birn's 2005 critique of Grand Challenge initiatives on the basis that their focus on technical and technological solutions neglects key economic, social and political factors which impede good health. Relatedly, a 2007 analysis by Leroy et al found that 97% of medical research grants made by the US National Institutes of Health (NIH) and the Bill & Melinda Gates Foundation between 2000 and 2004 were for developing new technologies, which would reduce child mortality by an estimated 22%. However, child mortality could be reduced by an estimated 63% if existing technologies were fully utilised. The same debate rages regarding domestic health research priorities (Clarke et al 2014).

specified in OECD DAC reporting criteria, discussed in Section 3.3) has been identified as the indicator for measuring progress towards this goal (UN Statistics Division 2017).

Owing to the large number of funding bodies and the lack of an established, centralised agency for tracking expenditure, identifying clear global trends in medical research spending is challenging (Young et al 2015). However, general indications are that the global volume of funding for medical research with a focus on developing countries has increased. An analysis of UK investments in infectious diseases research, for example, shows total investment rising (albeit with significant volatility year to year) from less than £100 million in 1997 to nearly £400 million by 2013 (Head et al 2016). However, there are still huge funding shortfalls and inequities. According to Røttingen et al 2013 only about 1% of all health R&D investments in 2010 were allocated to neglected diseases. A 2015 Chatham House report found that, as recently as 2013, US$3.2 billion in R&D funding – just 1-2% of total health R&D – was focused on neglected diseases (Schäferhoff et al 2015, p. 6).

Increased global medical research funding through the 2000s also contributed to the development of a number of new mechanisms for financing such research. One of the most prominent are Product Development Partnerships (PDPs). These are global co-financing partnerships that make use of both public and philanthropic funding to incentivise research for diseases that primarily or exclusively affect people in developing countries – diseases for which little commercial incentive exists to develop products. Examples of such partnerships include the TB Alliance and Medicines for Malaria Venture. According to one estimate, as much as US$469 million or 23% of external (donor to research organisation) research funding for neglected diseases in 2007 was directed to PDPs (Moran et al 2010).

The Grand Challenges model, pioneered by the Bill & Melinda Gates Foundation in 2003, is another mechanism that has proven popular. Grand challenges differ from PDPs by being smaller and time-limited, and are generally problem-driven (e.g., addressing high levels of maternal and child mortality) rather than focusing on a particular type of technology or disease. Like the PDP model, grand challenges are a form of 'push' funding. They award grants to research proposals that seek to respond to health challenges specified by the grantmaker. Because they are granted to fund proposals, this funding is not contingent on proof of efficacy or other measures of success. The GCC model has since been taken up by other countries, including by Canada, Brazil, India, South Africa, and Korea. A continent-wide Grand Challenges Africa program has been established with funding by the Gates Foundation and managed by the African Academy of Sciences and New Partnership for African Development.

'Pull' or 'prize' models (Wilson & Palriwala 2011), which offer cash rewards upon the delivery of a product or innovation which meets a specified need, have been less used. They are much more risky but have the advantage of being even more strongly results-oriented than PDPs and grand challenges. One example is the Advance Market Commitment (AMC) managed by Gavi to promote the production and implementation of pneumococcal vaccine.[4]

---

[4] An AMC is a contract offered by a government or multilateral agency which promises to purchase a product if and when it is developed and provided that it meets specified safety and quality standards.

3. Australian funding of global medical research

3.1 Funding overview

Medical research is a substantial industry in Australia; the peak body Research Australia estimates that a total of $5.9 billion per year is spent on 'health and medical research' across the private and public sectors, some 18% of Australia's total research expenditure. By contrast, agricultural research makes up approximately 4-5% of Australia's total research expenditure (authors' calculation, based on figures from Research Australia 2016 and Keogh 2014). Medical research is expected to expand significantly over the next decade, primarily as a consequence of the establishment of the Medical Research Future Fund (MRFF). Once fully capitalised, the MRFF is anticipated to disburse up to $1 billion funding per year, approximately doubling the amount of federal funding currently granted through the National Health and Medical Research Council (NHMRC). The Biomedical Translation Fund (BTF) will also contribute to growth in Australia's medical research spending in coming years. Launched in early August 2016, the BTF is a $500 million for-profit venture capital fund, composed of equal parts government and private funding, which is intended to "stimulate the transition from discovery to product to benefit the health and wellbeing of all."

Data on global medical research spending in Australia is partial.[5] We note at the outset that if those grants issued by the NHMRC and other public bodies which are directed to broader global health purposes were more closely tracked and easily identifiable, this would help to support more strategic investment decision-making by clarifying what kinds of research is being funded, and identifying existing gaps or opportunities for developing promising initial findings. Doing so would also facilitate counting these funds as Australian ODA, and might assist in attracting further funding for Australia-based medical research from multilateral, philanthropic and even private industry sources.

Whatever the data limitations, it is clear that, consistent with the situation worldwide, only a tiny fraction of Australian medical research is spent on research intended to benefit people in developing countries. The annual Global Funding of Innovation for Neglected Diseases (G-FINDER) survey, conducted by the non-profit research and advocacy organisation Policy Cures Research, provides an approximate indication of the volumes involved. The G-FINDER survey has collected global data on product-related research and development spending across 39 neglected diseases since 2007.[6] The data included in the G-FINDER database is provided directly by research funders, intermediaries, and product developers to Policy Cures.

G-FINDER data collection is limited to basic research and product-related research (Chapman et al 2017, pp. 9-11), meaning that it does not track funding targeted to other relevant and important research areas, such as non-pharmaceutical products or procedures (e.g., bednets, circumcision) or implementation and health policy and systems research. It is also limited to research on the specific subset of diseases identified by experts as disproportionately affecting the poor and needing new

---

[5] Poor data is not just a problem for Australia. It is widely acknowledged that coordination and information-sharing about global health R&D remains poor, resulting in a high level of fragmentation between donors. The WHO Global Observatory on Health R&D, intended to address this long-standing problem, remains under development.

products. G-FINDER excludes spending on products which might have dual applications in developed and developing countries (i.e., it focuses exclusively on developing country needs). It is the best current and publicly available source of data of this type, and the findings are indicative of the relevant Australian funding bodies that are likely involved in wider health and medical research of benefit to developing countries. In the remainder of this paper, references to the quantity of Australian funding for global medical research refer to G-FINDER data unless otherwise specified. When we use G-FINDER data in graphs and tables, we refer to it as 'neglected disease research' expenditure.

Another limitation of the G-FINDER data is that, while it includes private commercial funding, this is not presented by country. It therefore restricts us to examining Australian government and philanthropic funding for neglected disease research. However, there appears to be little Australian private funding for neglected disease research in any case.

G-FINDER data is presented in US dollars, and we use that currency for this analysis. As shown in Figure 1, on average, between 2007 and 2015 US$30 million per year was spent by the Australian public sector on research targeting neglected diseases. At approximately 0.6% of total Australian health and medical research expenditure (per Research Australia figures), this share of spending is on par with the global estimates cited in the previous section. The data shows little by way of trends. 2012 was the best year for funding with US$44 million; 2007 the worst with US$20.1 million, and 2015 the narrow second worst with US$20.4 million.

Figure 1: Australian public sector funders of neglected disease research, FY2007-2015

US$m (2015)
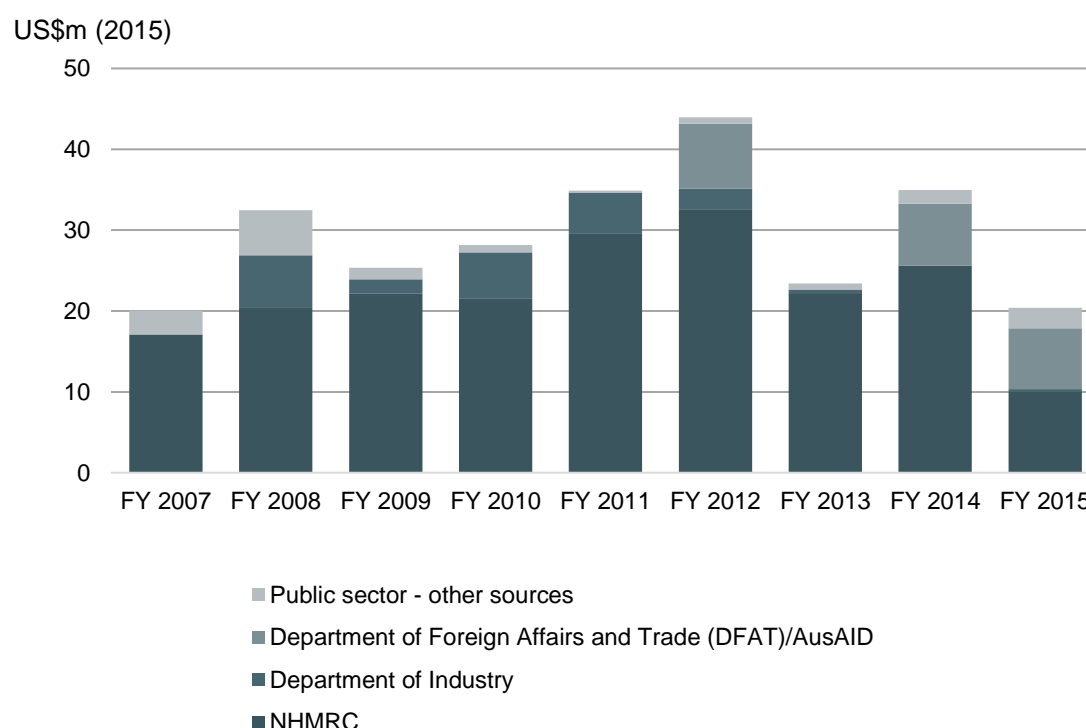
Source: Data extracted from Policy Cures G-FINDER Public Search Tool.

Of this public funding, over the last nine years, over 75 per cent was provided by the NHMRC, nine per cent by AusAID/DFAT, and eight per cent by the Department of Industry (Figure 2).

Figure 2: Public and philanthropic funders of neglected disease research in Australia, FY2007-2015 (annual average, US$m (current, 2015))
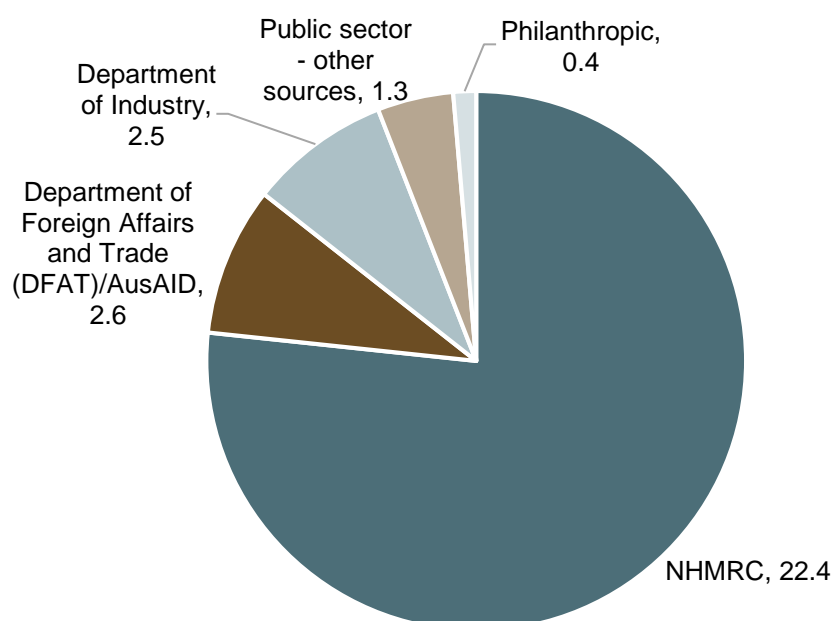
Source: Data extracted from Policy Cures G-FINDER Public Search Tool. Summary of data appears in Appendix 1.

The following sub-sections examine these various funding sources in more detail. First, however, we put Australian funding in the global context.

It is remarkably difficult to identify comparable data on global medical research expenditure by donor countries (Young et al 2015). The G-FINDER survey is again an important, partial source; using this data, Australia comes in seventh place (Figure 3). Notably, on an annual average basis India now spends more than Australia on product development for neglected diseases (Table 1), though all donors' contributions are dwarfed by the quantity of American funding.

Figure 3: Public sector neglected disease research expenditures by country, 2011-2015 (annual average)

US$m (2015)

Country	Value
United States	1501.9
United Kingdom	116.6
European Union	105.0
France	46.8
India	41.1
Germany	33.3
Australia	28.6
Canada	15.5
Sweden	15.5
Switzerland	13.3
Ireland	8.5
Japan	7.0
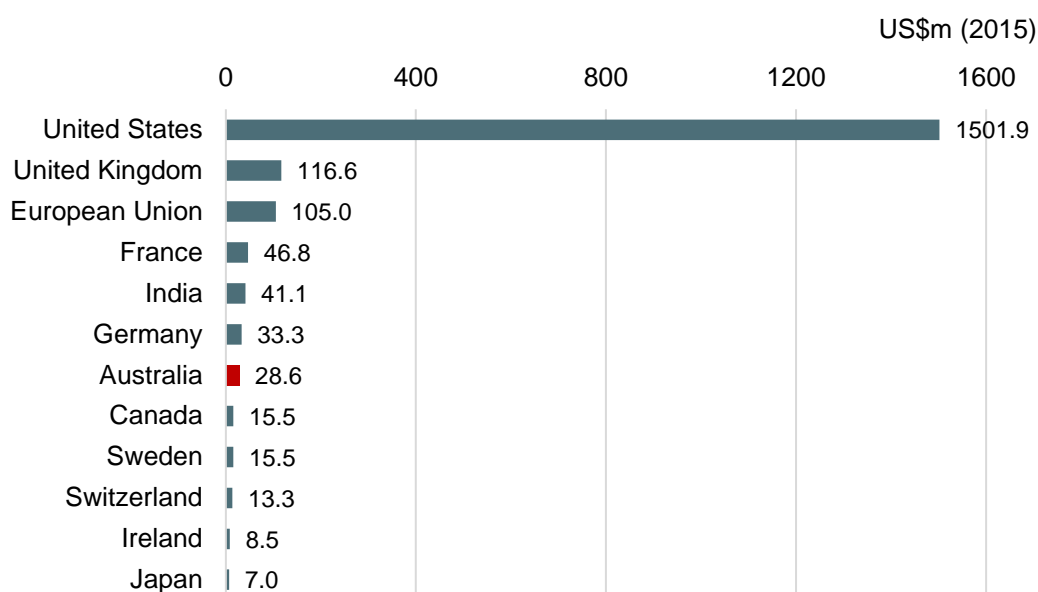
Source: G-FINDER data presented in Chapman et al 2017, Table 29 (p. 69). Includes public sector funding only.

Australia's public expenditure of an estimated US$20m, or US$0.84 per Australian, made it the seventh highest spender on neglected disease R&D on a per capita basis in 2015 (Table 1). As a share of the total public funding, we contribute just 1%, again reflecting US dominance in this field.

Table 1: Public sector neglected disease research expenditure per capita, 2015

		2015 neglected disease research expenditure (US$m)	2015 population (m)	Per capita expenditure (US$)	Share of total public neglected disease expenditure
1	United States	1387	319.9	4.34	72.1%
2	Switzerland	16	8.3	1.92	0.8%
3	Ireland	8.8	4.7	1.87	0.5%
4	United Kingdom	102	65.4	1.56	5.3%
5	France	60	64.5	0.93	3.1%
6	Sweden	8.3	9.8	0.85	0.4%
7	Australia	20	23.8	0.84	1.0%
8	Germany	51	81.7	0.62	2.6%
9	Canada	9.6	36.0	0.27	0.5%
10	Japan	12	128.0	0.09	0.6%
11	India	44	1309.1	0.03	2.3%
	Total public funding	1925	--	--	--

Sources: G-FINDER expenditure data from Chapman et al 2017, Table 29 (p. 69). Population data from UN Department of Economic and Social Affairs, Population Division (2017), World Population Prospects.

3.2 National Health and Medical Research Council (NHMRC)

The NHMRC, a statutory authority, is Australia's primary funder of health and medical research. It is mandated by the National Health and Medical Research Council Act 1992 (NHMRC Act) to "raise the standard of individual and public health throughout Australia" and to "foster medical research and training and public health research and training throughout Australia", among other objectives, none of which refer to developing countries.

In the 2016 calendar year the NHMRC awarded a total of $626 million in research support, under a variety of grant schemes (Table 2).

Table 2: NHMRC grant expenditure, 2016 calendar year

MAIN FUNDING GROUP	LOWER GRANT TYPE	2016 EXPENDITURE ($m)
Research Support	*Centres of Research Excellence*	$44.4
	Development Grants	$14.5
	International Collaborations	$8.9
	Partnerships	$21.2
	Program Grants	$107.7
	Project Grants	$409.7
	Targeted Calls for Research	$20.1
	Total Research Support	***$626.3***
People Support	*Various covering scholarships & fellowships*	***$155.5***
Infrastructure Support	*Various covering equipment grants, infrastructure support for independent research institutes*	***$35.8***
	GRAND TOTAL	**$817.6**

Source: NHMRC Summary Tables 2000-2016

Based on G-FINDER and NHMRC expenditure data, an estimated two per cent of NHMRC's total research expenditure in 2015 was dedicated to global medical research.[7] In earlier years, the ratio has been around four per cent.[8] For comparison, the current level of expenditure is about half the proportion of NHMRC funding dedicated to Aboriginal and Torres Strait Islander-related research (which was designated as one of the NHMRC's priority funding areas in 2002, and received $51.8m in 2016).

As is evident from the table above, the majority of NHMRC funding is awarded in the form of Project Grants. This funding mechanism supports investigator-initiated proposals to investigate new research ideas. 65 per cent of NHMRC's research support funding in 2016 was disbursed as Project

---

[7] This is based on 'Research Support' expenditure only; however, a cursory review of the publicly available NHMRC grants database suggests that some of the scholarships and fellowships awarded by NHMRC also support researchers with a primary focus on developing country-relevant research.
[8] A recent analysis of NHMRC and Australian Research Council funding patterns takes a wider definition of 'global health' to include research conducted in disadvantaged communities in Australia and accordingly comes out with a significantly higher estimate of an average of $71 million from 2002 to 2012 (Abimbola et al 2017).

Grants (based on NHMRC Summary Tables 2000-2016). This mainly explains why global medical research does receive some funding through the NHMRC, despite there being no formal targets or priorities associated with funding this type of research.

There are also a few small NHMRC funding schemes tailored to supporting global medical and health research; and most of these cater primarily to operational health research. These include the $8 million Northern Australia Tropical Disease Collaborative Research Programme (funded in collaboration with DFAT – more on this below) and the Global Alliance for Chronic Diseases, an international collaborative effort which focuses on chronic diseases affecting LMICs and low-income populations in developed countries, to which NHMRC has committed $5 million. In terms of strategy, NHMRC has an International Engagement Strategy which notes that "[c]ontributing to international research efforts assists in addressing global health challenges and concerns, especially for low-income countries" (p. 3) and cites DFAT's Health for Development Strategy, but does not otherwise identify pathways for supporting research to benefit those in developing countries. Notably, NHMRC funding for developing country-focused research is not presently counted as ODA, though much of it could be.[9] It is also important to note that, according to the 2016 G-FINDER survey report (Chapman et al 2017, p. 69), in the 2015 financial year NHMRC funding allocated to neglected disease research nearly halved, from approximately $20m to $12m.

Those grant types which are categorised by NHRMC as 'grants to create new knowledge' (Program and Project Grants) collectively received 6.5 times the funding allocated to 'grants to accelerate research translation' (Centres of Research Excellence, Development Grants, and Targeted Calls for Research): $517m versus $79m in 2015. Though the 2015 *Review to strengthen Independent Medical Research Institutes* noted (Department of Health 2015, p. 15) that the NHMRC has increasingly sought to support translational approaches to research, its focus on basic research (at the neglect of translation and implementation) remains a prominent criticism of NHMRC grantmaking. Moreover, 'translation' as it is typically referred to by the NHMRC tends to relate to translation in the operational sense, rather than product development.

NHMRC funding is highly competitive, and has been increasing in competitiveness even as the quantity of funding available has increased. The NHMRC 2014-15 Annual Report notes that approximately 18 percent of all grant applications were funded in the 2014 calendar year (p. 36); in 2015 just 13.7 percent of project grant applications were funded (NHMRC Structural Review Consultation Paper, p. 37). In February 2016 the NHMRC commenced a structural review of its grantmaking program in response to concerns that the current process is too cumbersome and may no longer be fit for purpose. However, the review excluded the subject of priority- versus investigator-driven research from consideration.[10]

---

[9] A review of OECD CRS data reveals some references in 2012 data to projects funded through an NHMRC-supported "Global Health Project Grants scheme" – however, no further information about this scheme has been located. OECD DAC guidelines allow for the costs of research that is "directly and primarily relevant to the problems of developing countries" to be considered as ODA, even if the research is carried out in a developed country.

[10] The review was completed in May 2017; details of the new NHMRC grant structure can be found here.

3.3 Australian aid

The Australian aid program has to date played only a minor and volatile role in the funding of global medical research. Per the G-FINDER data presented above (Figure 1), up to and including 2015, the aid program has thrice provided significant funding for research into neglected diseases: around $10 million allocated in 2012 and again in 2014 and 2015.

Data on aid-funded global medical research is also available from the OECD, based on data submitted by AusAID/DFAT to the OECD as 'medical research'. This is shown in Figure 4. It shows the same broad pattern as the G-FINDER data, though it does show a small amount of aid funding for medical research prior to the current decade, perhaps due to the OECD's broad definition of medical research, and/or inaccurate reporting.[11]

Figure 4: Australian ODA funding for medical research, 2002-2015
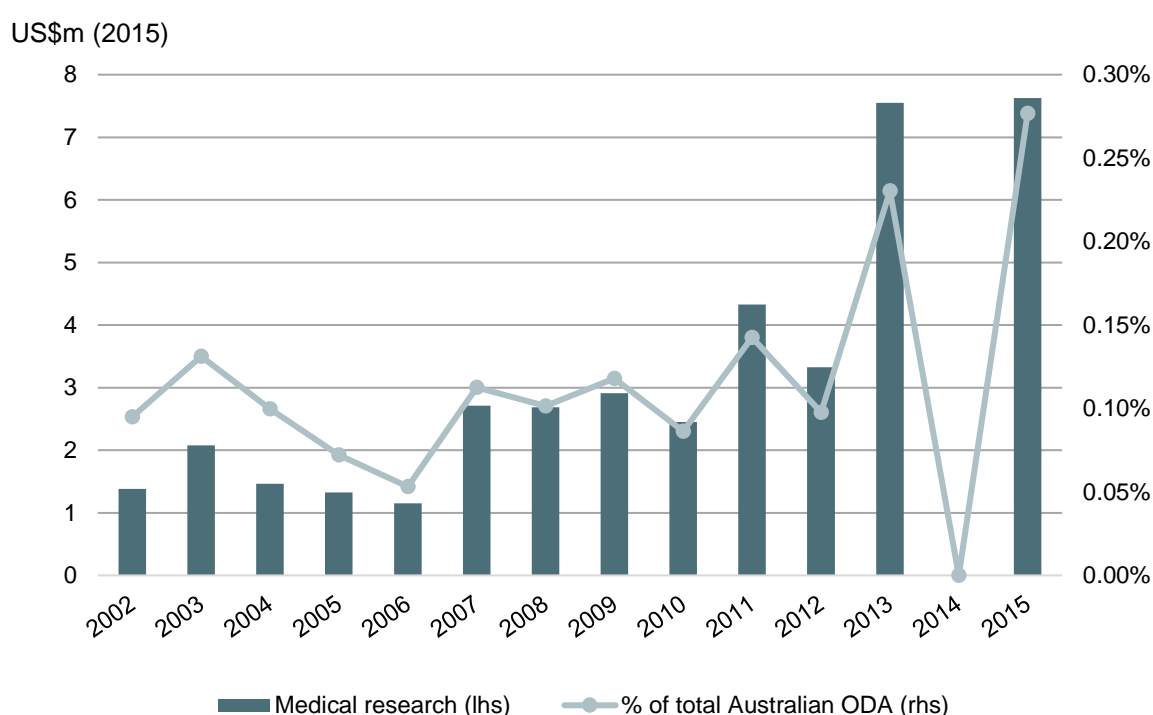
Source: OECD Creditor Reporting System (CRS) for 2002-2015 (Sector 12182: Medical research; disbursements data only). It is unclear why OECD data shows no spending on medical research in 2014. Years reported are calendar years.

It should be noted that DFAT itself reports spending on health research to be at $30 million, but the bulk of this is research into "health policy and system research." As noted earlier, this is beyond the scope of this paper. And it is clearly not reported by AusAID/DFAT to OECD as medical research, shown in Figure 4.

As a funder of research for development in general, Australia is more prominent. Every year between 2002 and 2015 Australia ranked within the top ten aid funders of research for development among DAC donor countries, again based on data recorded in the OECD CRS, which shows Australia

---

[11] The OECD DAC CRS Sector code for medical research (12182) defines it simply as "General medical research (excluding basic health research)".

allocated up to US$80 million of ODA per year to research (Figure 5).[12] Though Australia's total ODA spend on research has increased significantly since 2002 – from almost US$19m in 2002 to US$53m by 2015 – our rank in 2015 compared to other OECD DAC countries has remained in 7th place, just as it was in 2002.

Figure 5: Australian ODA research spending by discipline, 2002-2015
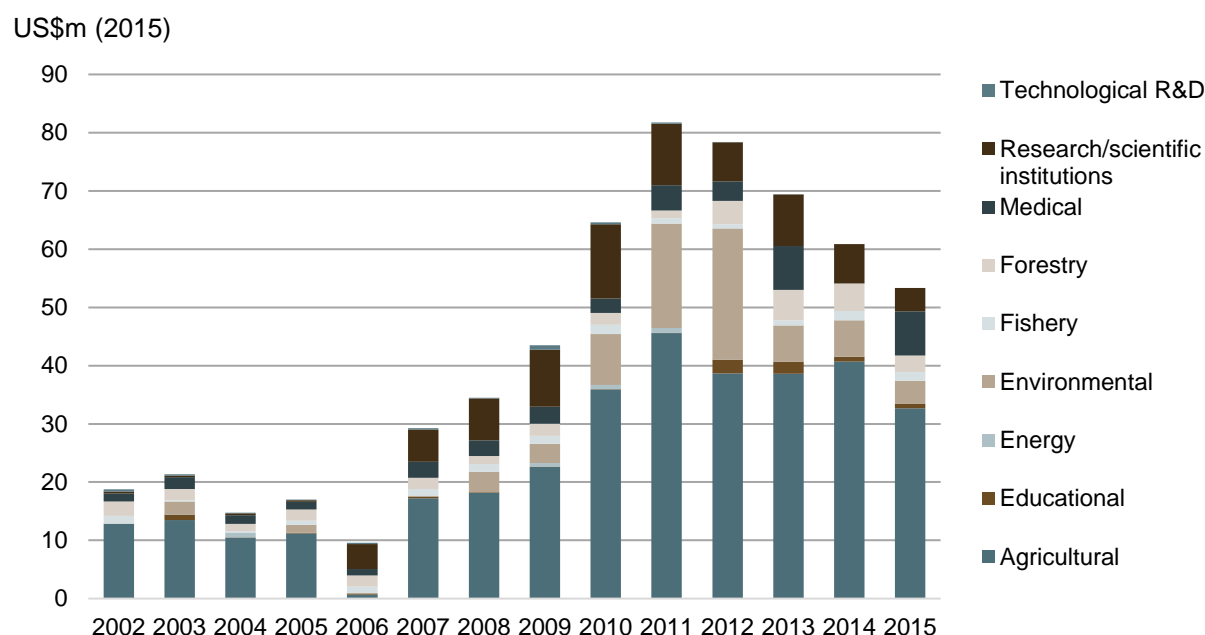
Source: OECD CRS. 2006 agricultural expenditure is assumed to be a reporting error (see footnote 13).

However, as also shown in Figure 6, available OECD data indicates that no more than 14% of Australian ODA research dollars in any given year between 2002 and 2015 were allocated to medical research. By contrast, agricultural research has consistently accounted for the greatest proportion of Australia's ODA research dollars, making up as much as 68% of total research dollars, and at minimum 49%[13] (Figure 6). Most of these agricultural research dollars are allocated to the Australian Centre for International Agricultural Research (ACIAR), a statutory authority within the aid program established in 1982. ACIAR benefits from significant political and financial support, with a budget of approximately $100 million per year or more since 2011.

---

[12] With the exception of 2006, in which Australia appears to rank 15th. However, figures reported for Australia in this year appear erroneous – see footnote 13 and Figures 5 and 6.

[13] Excluding 2006, in which the OECD CRS data indicates that agricultural research made up only seven percent of Australian research spending. However, this appears to be a reporting error based on Australian government budget documents which show that ACIAR's budget remained more or less constant between FY2001 and FY2010.

Figure 6: Medical and agricultural research as proportion of total Australian ODA research spending, 2002-2015
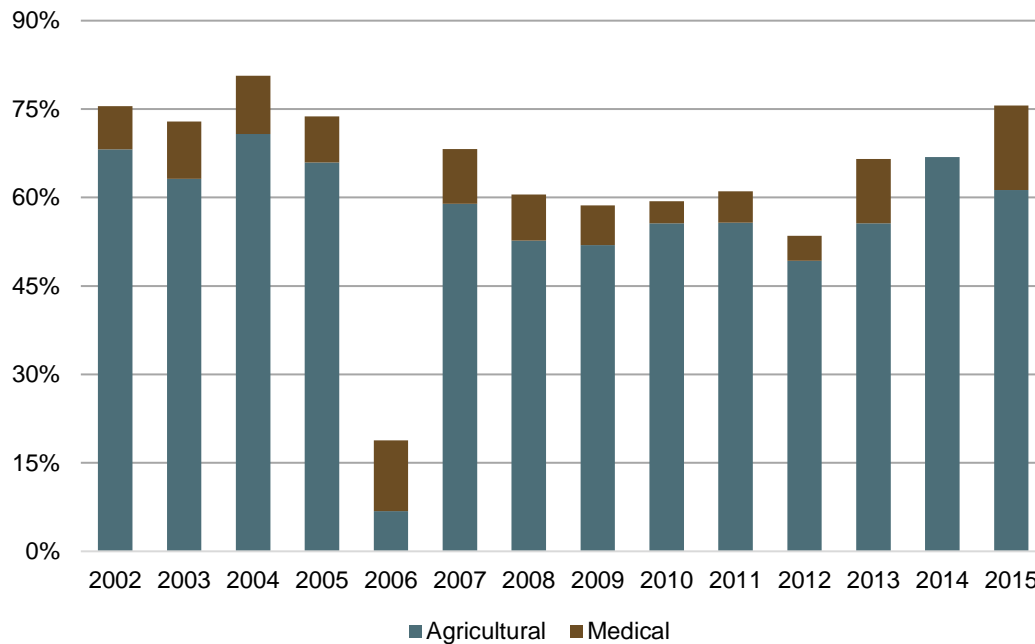
Source OECD CRS. 2006 agricultural expenditure is assumed to be a reporting error (see footnote 13). No spending on medical research was reported in 2014.

The recent increase in aid funding to medical research began in 2012 when AusAID announced an allocation of $10m to four PDPs working on tuberculosis (TB) and malaria in the 2012-13 budget (Davies 2015; see Section 5.1 for the background to this decision). The PDP contribution was not renewed in the 2013-14 financial year, but in March 2015 Foreign Minister Julie Bishop announced a commitment of $10 million per year over three years to support three PDPs working on TB and malaria drugs and diagnostics.[14] (Based on publicly available information, it's not clear why the decision was made not to renew funding to Aeras, a TB vaccine development partnership which was included in 2012 funding allocation).

In 2016, DFAT engaged in the direct funding of research in collaboration with NHMRC. In connection with the release of the White Paper on Developing Northern Australia in 2015, in early 2016 DFAT released a call for proposals for research on tropical health issues, the Tropical Disease Research Regional Collaboration Initiative (TDRRCI). The TDRRCI aims to "support research collaboration between Australian, regional and international research institutions on tropical diseases which pose a trans-boundary threat in Australia's region of Southeast Asia and the Pacific". The $2 million over two years provided by DFAT under this scheme is complementary to the $6 million over four years

---

[14] These were: the TB Alliance; the Foundation for Innovative New Diagnostics (FIND); and Medicines for Malaria Venture (MMV). On the same day, coinciding with the launch of the innovationXchange, the Foreign Minister also announced a contribution of approximately $20 million (US$15 million) over two years to a US$100 million Data for Health partnership with Bloomberg Philanthropies. Based on publicly available information, Data for Health appears to primarily be a capacity-building project, aiming to improve the ability of developing country governments to collect and use vital health statistics. However, the initiative also appears to include some health research activities, in the form of developing and evaluating risk factor surveys for non-communicable diseases.

that NHMRC is providing under its Northern Australia Tropical Disease Collaborative Research Programme. Applications to the TDRRCI underwent peer review through the NHMRC, though the award and administration of the grant remain with DFAT.

3.4 Other Australian government departments and organisations

As indicated in Figure 1, a number of other Australian federal and state government departments and authorities have provided funding for global medical research. The Department of Industry (now the Department of Industry, Innovation and Science) provided on average about US$5 million a year for neglected disease research between 2007 and 2012, but its role as a funder has diminished significantly more recently.

Similarly, the Australian Research Council (ARC; included under 'Public sector - other sources' in Figures 1 and 2) previously provided some funding for developing country-relevant health and medical research. For example, in 2014 the ARC's Linkage Program funded a Special Research Initiative for Tropical Health and Medicine[15]. It also engaged in some joint funding ventures, e.g., the ARC/NHMRC Research Network for Parasitology (ARC 2004). However, in mid-2014 the ARC adopted a new Medical Research Policy which places significant limitations on the eligibility of any medical research proposals for ARC funding.[16]

3.5 Philanthropic funders

Philanthropic donors and private not-for-profit foundations are an important part of the contemporary global health landscape (Anderson 2011). Most notably, since its establishment in 2000 the Bill & Melinda Gates Foundation[17] has been credited with significantly affecting both the volume and focus of research dollars from public agencies by shaping the discourse around, and resourcing efforts to address, global health challenges (Matthews & Ho 2008). Other key philanthropic donors in this sector include (in no particular order) the Wellcome Trust and the Clinton, Ford, and Rockefeller Foundations. Though philanthropy of this nature is not without its critics (see, e.g., The Lancet 2009, Stuckler et al 2011), the presence of these foundations and their capacity to 'crowd in' public funding have generally been appraised positively.

However, as Figure 2 illustrates, in Australia philanthropic donors play only a minor and highly fragmented role in the funding of global medical research. Just five Australian non-government donors, providing a total of US$3.6m between 2007 and 2015, were recorded in the G-FINDER survey. Based on these data, the largest contributor has been Newcrest Mining Ltd, which provided a total of US$3m in funding; since 2011, Newcrest has made several donations to the PDP Medicines for Malaria Venture (MMV), in connection with the planned elimination of malaria from PNG's Lihir Island (where Newcrest's largest mine is located), as well as the elimination of yaws (Woodall 2014). Other philanthropic donors include the Australian National Heart Foundation (US$0.28m), whose program of research funds projects related to cardiovascular diseases (for example, developing

---

[15] This Initiative, the result of an electoral commitment, resourced the establishment of the Australian Institute of Tropical Health and Medicine (AITHM) at James Cook University. The Initiative provided $42m over 4 years which was matched by the Queensland Government.

[16] Specifically, the policy states that research with human health and/or medical goals, or interventional research in humans aiming to modify the health of human participants, is ineligible for ARC funding.

[17] Disclosure: the Development Policy Centre is the recipient of a Gates Foundation grant.

drugs to treat rheumatic fever); and the Merchant Foundation (US$0.12m), established by Billabong surfwear founder Gordon Merchant, which has donated to malaria vaccine development at several Australian research institutes, among other causes.
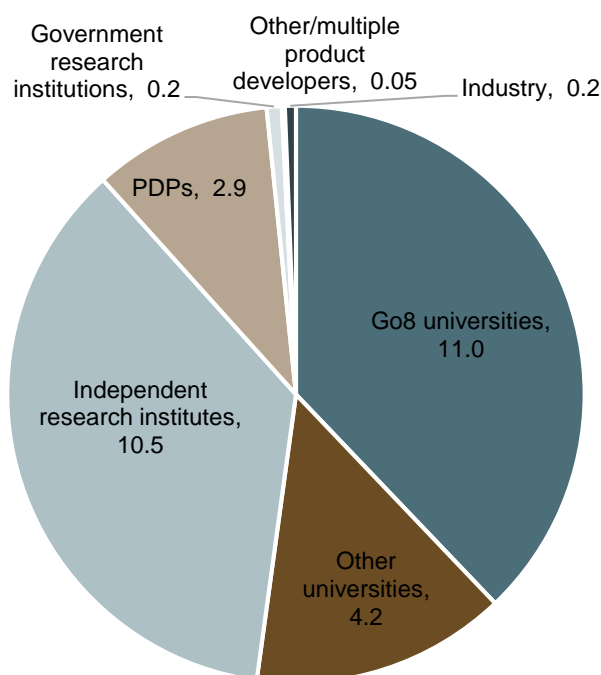
While philanthropy continues to play an important role in medical research internationally, within Australia it appears that the presence and impact of philanthropic donors in this space is limited and unlikely to drive advocacy for increased public funding for global medical research.

3.6 Recipients of Australian global medical research funding

Though the Australian government is the primary funder of global medical research in Australia, only a small percentage of that research is conducted within Australian government agencies such as the CSIRO and the Australian Army Malaria Institute. Rather, the bulk is conducted within universities and non-government research institutes. Major research universities, and particularly the Group of 8 (Go8), are well-represented as recipients of neglected disease R&D grants. Based on G-FINDER data, Figure 7 shows the same average volume of Australian neglected disease research funds over the 2007-2015 period as shown in Figure 2, but this time divided up by the recipients of that funding rather than the disbursers (see Appendix 2 for data). There are also numerous specialised, independent (or semi-independent) medical research institutes (iMRIs) in Australia which receive on average nearly as much public sector funding for neglected disease research as the Go8 universities (Figure 7). The Walter and Eliza Hall Institute of Medical Research (WEHI) received the greatest cumulative amount of public funding for neglected disease research between 2007 and 2015, totalling close to US$40m (source: G-FINDER Public Search Tool). More difficult to discern, but certainly less well-represented in this area of research, is the presence of pharmaceutical firms, biotechnology companies, and other private sector entities. Though the private sector is responsible for approximately 19% of all medical research expenditure in Australia (Research Australia 2016), only US$1.6m (less than 1%) of Australian public funds were received by industry for neglected disease R&D between 2007 and 2015.

Almost 90% of Australia's public sector neglected disease research funding flows to Australian institutes, with the only exception being the US$3 million to PDPs – a proportion of which would itself flow back to Australian researchers – and a modest contribution to the Barcelona Institute for Global Health.

Figure 7: Recipients of public sector funding for neglected disease research (US$m, annual average 2007-2015)

Government research institutions, 0.2

Other/multiple product developers, 0.05

Industry, 0.2

PDPs, 2.9

Go8 universities, 11.0

Independent research institutes, 10.5

Other universities, 4.2

Source: G-FINDER Public Search Tool

Australia is regularly described as having significant expertise and experience in the field of global health and medical research. The McKeon Review report, for example, highlights several examples of Australian-led research that have the potential to save hundreds of thousands of lives; these include the development of a point-of-care disposable HIV test (p. 119) and a new snake anti-venom which costs just five percent of the existing anti-venom (p. 121). Australian scientists such as Frank Macfarlane Burnet, Norman McAlister Gregg, Ian Frazer, and Ruth Bishop are responsible for foundational microbiology and virology research which contributed to the development of vaccines for influenza, rubella, human papilloma virus, and rotaviruses (see, e.g., Ruff et al 2012).

Whilst it is difficult to quantify the precise impact that Australian scientists, researchers, and developers have had on global population health, it is clear that there is an extensive network of individuals and institutions in Australia with interests in conducting medical research to benefit people in developing countries.

4. Key constraints on Australian global medical research funding

The analysis of patterns and distribution of funding for global medical research presented above suggests that there are various constraints preventing Australia from being able to fully optimise the skills and capabilities of its researchers for the good of people in developing countries. These include a lack of coordination and strategic guidance, and insufficient attention to the translation of basic research into products.

4.1 Lack of coordination and strategic guidance

Insufficient coordination and strategic guidance when it comes to global health and medical research in Australia has been pointed out by various reports. Policy Cures (2014) notes that there is currently "no strategic masterplan guiding R&D investments" intended primarily to benefit developing countries. The McKeon Review of Australia's health and medical research sector, discussed further below, notes (p. 119) that neither the aid program nor NHMRC (nor, indeed, any other department or agency) has assumed responsibility for steering Australia's investments in global medical research. NHMRC is the major funder, but this research is investigator-driven rather than the result of any strategy.

Indeed, it is surprising that so much funding flows through NHMRC to neglected diseases, especially given the mandate of the organisation. The mission statement of the NHMRC is "working to build a healthy Australia", and the NHMRC's activities are meant to be guided by the Australian Government's National Health Priority Areas: Aboriginal and Torres Strait Islander health, cancer, cardiovascular disease, mental health, diabetes, injury, obesity, dementia, arthritis, and asthma (AIHW 2017). While several of these 'lifestyle diseases' are increasingly prevalent in developing countries, they are all ones that are priorities for Australia. The fact that, despite this mission statement, NHMRC funds projects which are of primary benefit to developing countries shows how much it is driven by investigator priorities and track-record, and how global some Australian medical researchers are in their outlook.[18]

## 4.2 Lack of focus on translation

The flipside of Australian medical research being researcher-driven is that the focus is by no means typically or even often on actually getting a product to market. The aim of the research depends by and large on the interests of the researchers involved. And this often corresponds to basic rather than translational or implementation research (see Box 1 below). This basic research may get picked up later on; but it is more likely that it will not.

Box 1 The R&D pipeline and "valleys of death"

The process of transforming medical research into actionable products and interventions, ultimately leading to measurable improvements in population health, is normally a lengthy and expensive process. There are several key stages of the R&D 'pipeline' or 'funnel' (illustrated in general terms below – the precise pipeline will vary according to whether the research in question is related to drugs, diagnostics, or other types of products), starting from **basic research.** Here, the focus is knowledge creation: building understanding of the fundamental causes of disease and/or laboratory-based discovery of molecules or compounds with potential for development into therapies. Based on these findings, **translational research** can take place. In the case of pharmaceutical development, this stage encompasses preclinical, proof-of-concept, and Phases I-III clinical trials, which rigorously test the product in successively larger groups of human subjects. Once a product or intervention has received regulatory approval (where applicable), **implementation and**

---

[18] Applications for Project Grants (the largest category of NHMRC grants by both number of applications and total funding granted), for example, are assessed on scientific quality (50%), significance of the expected outcomes and/or innovation of the concept (25%) and team quality and capability (25%) (NHMRC 2015 presentation).

dissemination research can commence. This includes commercial marketing, Phase IV trials (which monitor the effectiveness of a new intervention in the general population), and assessments of broader efforts to integrate effective, evidence-based health and medical interventions into wider policy and practice.
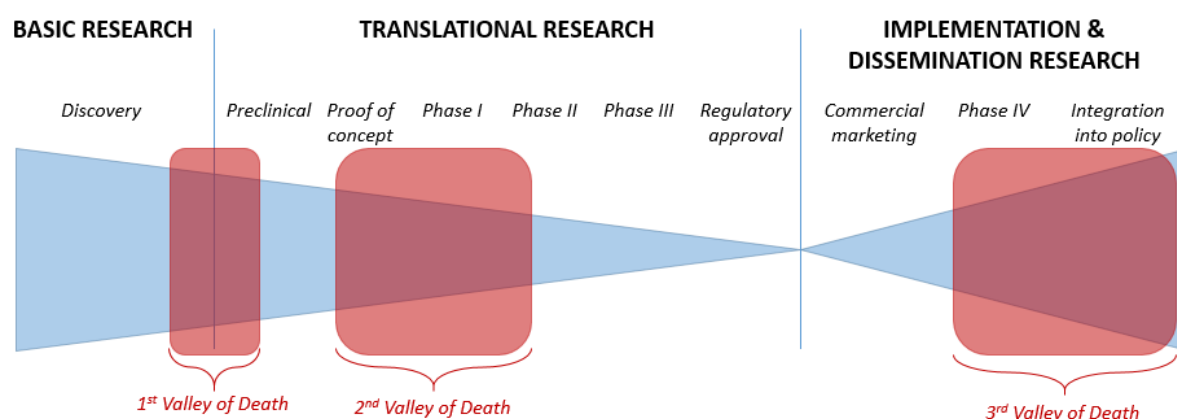
However, research rarely proceeds through this pipeline without encountering some pitfalls, for which the term 'valley of death' is invoked. Valleys of death are critical transition points in the R&D pipeline where continued development is at risk due to limited funding. The first valley exists at the transition from discovery to early translational research, when funding for laboratory or animal research is no longer available but the potential product is still too 'young' to attract industry or other private investment. A second valley is located in the early stages of translational research, where researchers require significant funding to collect data in order to support later stage, larger clinical trials. A third valley can be identified at the transition from Phase IV trials into policy and practice, as many researchers underestimate the cost of ensuring that products and interventions which have been proven efficacious under experimental conditions are integrated into practice.

This lack of focus on translation is a concern more broadly in relation to medical research in Australia. The importance of commercialisation and the commercial viability of research findings is receiving increased emphasis in the Australian and global scientific communities (Anderson 2016). Moves towards commercialisation can be seen both in the introduction and expansion of specific initiatives (e.g., NHMRC Development Grants[19], the Biomedical Translation Fund) and as a more general principle. For example, the NHMRC Funding Rules 2016 (clause 6.1) note the agency's commitment to the translation of research, including specifically in the form of commercialisation, and therefore take into consideration applicants' industry-relevant experience as part of the grant application process. However, an emphasis on, or perceived favouring of, commercial viability as part of grant application processes may disadvantage global medical research proposals, whose resulting research outputs may face a range of commercial incentives and barriers to implementation (Chao et al 2014). However, it is encouraging to see that the MRFF Strategy 2016-2021 explicitly acknowledges and seeks to address the 'valleys of death' in the research pipeline.

---

[19] The value of these grants have increased significantly in recent years – from $190,000 awarded in 2000 to over $14.5m in 2015.

5. Towards an Australian strategy for global medical research

We now start to examine the way forward. We first note recent attempts to develop an Australian global medical research strategy, and then outline desirable features of any new approach.

5.1 Policy background

In recent years, two high level reviews have expressed support for increasing aid funding for global medical research: the Hollway and McKeon Reviews.

The Review Panel of the 2011 Independent Review of Aid Effectiveness (Hollway Review) included among its recommendations that there should be additional funding for medical research. In the interests of maximising the potential benefits to the world's poor, the panel recommended that research funds "should support the world's best researchers", regardless of whether they are based in Australia, developing countries, or international research institutions. The review went so far as to suggest that an expanded medical research program could become a 'flagship' for the aid program, that is, "[an area] where Australia would aim to be a significant and high-quality contributor and receive recognition for its efforts" (p. 175).

The response to the 2011 Aid Effectiveness Review recommendation to increase Australia's aid investment in global medical research can best be described as halting and modest. In 2012 AusAID released a draft Medical Research Strategy. The Strategy sought explicitly to invest in medical research projects with the potential to "save the lives of poor people in the Asia Pacific region". However, from the outset its intended scope was more limited than the flagship model advocated for in the Hollway Review. The Medical Research Strategy proposed three focal areas: supporting Product Development Partnerships (PDPs) for malaria and TB vaccines, diagnostics and treatments; working specifically with the NHMRC to support implementation research on quality of clinical care; and funding capacity-building activities for individual researchers and institutions throughout the region via Australia Awards scholarships and core funding to medical research institutes in partner countries. The draft Medical Research Strategy provided little detail on funding volume, but it seems to have been targeting expenditure of about $10 million a year on medical research. Consistent with this, the first and most visible expression of this new commitment was the allocation of $10m to four PDPs working on TB and malaria in the 2012-13 budget (Davies 2015).

Though at the time the draft strategy appeared to be attempting to move Australia towards a more strategic approach to global medical research, it was never finalised, and, as noted earlier, the PDP contribution was not renewed in the 2013-14 financial year (though it was resumed in 2014-15). One lesson that can be drawn from this episode is the need to institutionalize any Australian aid-funded medical research effort if it is to be sustained.

Since the Liberal-National Coalition government came to power in 2013, although it has announced several new medical research initiatives (outlined in Sections 3.1 and 5.2), no new strategy on global medical research has been developed. There is, however, a relatively new Health for Development Strategy 2015-20 (released June 2015), the fifth priority of which relates to 'Investments to promote health innovation'. This document indicates that DFAT will invest in "[i]nnovative approaches and

solutions to combat diseases such as malaria and TB" and "[r]esearch and learning relevant to country and regional health program contexts and to answer key operational questions." (p. 13). However, it includes no details on funding.

Most recently, the Coalition's interest in global medical research was also demonstrated by its announcement in June 2016 as part of its 2016 election foreign policy platform (its only aid announcement) of the establishment of a 'regional health security partnership fund' with an investment of $100 million over five years funded from the ODA budget. The pre-election announcement indicated that this fund would support "partnerships with academia, private sector, non-government and medical institutions to tackle the emerging health security risks in our region", as well as internships for Australian students and young professionals with regional partner institutions.

Health security is clearly a Coalition priority: the topic receives extensive treatment in the Health for Development Strategy 2015-20, which includes "[c]ombatting health threats that cross national borders" as one of five priorities, and "strengthen[ed] regional preparedness and capacity to respond to emerging health threats" as one of two strategic outcomes it is seeking (p. 3). But the June 2016 announcement also suggested an interest in research, through the highlighting of the role of academia and medical institutions. This would be consistent with the Coalition's broader commitment to medical research, as illustrated by its establishment of the Medical Research Future Fund (MRFF), cited by former Coalition Treasurer, Joe Hockey, in *The Australian* as his "single proudest achievement".

Interest in global medical research has also come from the Australian Federal Parliament with the March 2014 Aid Inquiry report of the Senate Foreign Affairs, Defence and Trade References Committee endorsing a commitment to global medical research. The report recommended annual funding of about $50 million a year, and continued funding of PDPs.

Though it was focused on Australian medical research, the Strategic Review of Health and Medical Research (the McKeon Review) released in February 2013 also identified 'global health research' as a key strategic area. It asserted that Australia has a strong track record in this area and that advances in medical research "can have a strong flow-on effect to support other aspects of international aid assistance" (p. 117).

Citing the Independent Review of Aid Effectiveness, the McKeon Review made two related recommendations. The first was that AusAID should outsource the management of competitive global grant processes to the NHMRC. This was regarded by the report's authors as particularly important given the expectations at the time that the ODA budget would increase significantly (p. 119-20).

The second recommendation was that the NHMRC itself should "more fully embrace grant assistance for global health", by opening up its grants to international researchers (either alone or in partnership with Australian researchers and institutions) and establishing co-funded grants with global philanthropic organisations (p. 120).

As noted in Section 3.2, the latter has occurred to a very limited extent. Beyond this, we are not aware of any further follow-up to the recommendations of the McKeon Review in the area of global medical research.

5.2 The way forward

Australia already provides significant funding through the NHMRC for investigator-initiated global medical research. And, as discussed in the first section of this paper, the volume of Australian public medical research funding available is expected to expand rapidly in coming years, through the MRFF. While there are various problems associated with investigator-driven research – notably that most investigators are primarily focused on achieving publication, and may not be interested in or informed about the various issues associated with translating research into products – the first priority for anyone interested in Australian support for global medical research should be to ensure continued access to NHMRC and MRFF funding.

According to the legislation that established it, the MRFF is mandated to consider (among other requirements) how disbursements will alleviate the burden of disease in the Australian community, and deliver practical benefits and medical innovation to as many Australians as possible. While this sounds like it might exclude the funding of global medical research, it is worth reiterating that the NHMRC has a similarly Australia-centric mandate. The MRFF is designed to provide a source of funding that is 'complementary' to existing funding, and members of the MRFF Advisory Board have publicly indicated[20] that they intend to encourage collaboration and co-funding with other federal and state authorities. [21] Accordingly, the MRFF Strategy specifies that the MRFF "should provide support for Australian consortia to participate in and leader international research projects focusing on major global health challenges and threats, and these should be complementary to the international collaborative research activities of the NHMRC." (pp. 7-8).

Given the size of the anticipated disbursements once the fund matures, if just five per cent of MRFF disbursements could be directed to global medical research purposes (roughly the same proportion that has historically been allocated by the NHMRC [Policy Cures, 2015]) it would result in close to a tripling of the current average annual spend of $28m on neglected disease research via the NHMRC.[22] The first round of MRFF disbursements in 2016-17 saw $2 million disbursed over two years to the international Coalition for Epidemic Preparedness Innovations (CEPI), to support the development of vaccines against infectious diseases with epidemic potential. While this is less than five per cent of the total $65 million disbursed in this round, it is nevertheless an encouraging sign that the MRFF may make a meaningful contribution towards medical research extending beyond Australia's borders going forward.

If working to retain and increase access to existing and new research funds should be one objective going forward, the other should be to obtain significant funding from the aid program for medical

---

[20] MRFF public consultation in Canberra, 3 August 2016
[21] The MRFF Strategy will be in place for a five-year period; the Priorities will be reviewed and updated, as necessary, every two years.
[22] The Biomedical Translation Fund (BTF) is also in its infancy. It may represents another potential opportunity for increasing Australia's global medical research impact, though its commercial orientation may be a limiting factor.

research. This is partly to "future proof" the aid program, as more and more countries graduate from bilateral aid yet continue to inhabit a world with pressing humanitarian demands. It is also because a new aid-funded initiative could provide something currently missing from the Australian global medical research scene, namely a coordinated, results-focused approach.

The next section sets out and assesses the viability and merits of alternative models for administering a scaled-up volume of funds for global medical research.

6. Alternative models

This section discusses seven alternative models for a new aid-funded global medical research initiative, developed and extended from a list of options outlined in the MRC-DFID Concordat (p. 16). These alternative approaches can be categorized, as per Table 3 below, as global versus Australian in their focus, and as involving 'hands off' or 'hands on' management on the part of the aid administering body, the Department of Foreign Affairs and Trade (DFAT). 'Hands-off' options would involve DFAT making relatively few funding decisions. 'Hands-on' options would require more intensive efforts by DFAT.

Table 3: Alternative possible global medical research models

		Administrative requirements on the part of DFAT	
		Hands-off	*Hands-on*
Funding primarily for global or Australian researchers	*Primarily global*	1. International research institutes 2. PDPs	3. Grand challenges
	Primarily Australian	4. NHMRC 5. Global medical research centre ('The ACIAR model')	6. Research consortia 7. Individual research project grants

6.1 Funding established international health research institutes

A simple, straightforward approach for donor countries looking to increase their investment in global medical research would be to provide core funding to established international health and medical research institutes. An example of such an institute is the International Centre for Diarrhoeal Disease Research, Bangladesh (icddr,b), which focuses on diarrhoeal disease, reproductive health, and emerging infections. It is perhaps best known for its role in the development of oral rehydration solution (ORS) which is widely used in the treatment of diarrhoea and cholera and credited with having saved more than 50 million lives globally (Yee 2013). Another example is the International Vaccine Institute (IVI), based in Seoul, which is involved in the development of a vaccine against cholera, among other diseases.

Established international institutes have the advantage of offering an already concentrated technical and specialist knowledge in global medical research. Provided that these institutes undergo independent evaluation with positive results, donors can be generally satisfied that their contributions are being effectively spent. Moreover, each donor's funds are typically pooled with those of other countries and philanthropic donations, and thus may enable funds from a particular country to stretch further than they otherwise would. As the case of icddr,b shows, the products and

interventions developed by these institutes, with support from a range of donors including Australia,[23] have the potential to significantly improve the lives of millions.

The drawbacks of giving core funds to established international health research institutes are similar to those associated with giving to multilateral organisations. This is a largely 'hands off' funding mechanism: while Australia may be acknowledged as an appreciated donor, it may be difficult to demonstrate the return on investment of *Australian* aid funds. And by giving core funds, Australia may have limited to no say over the particular projects that its funds support.

6.2 Funding Product Development Partnerships (PDPs)

As noted earlier, Product Development Partnerships (PDPs) are public-private partnerships which pool funds in order to finance the development of medical products – such as drugs, diagnostics, and vaccines – to address diseases prevalent in low- and middle-income countries, which struggle to attract commercial capital for further development (Grace 2010). By reducing the risk associated with product development by pooling funds from multiple donors, and brokering partnerships between pharmaceutical and other private sector actors and academic researchers, PDPs have accelerated the development of medical products that otherwise would not become available for many years, if ever. Leading PDPs include Medicines for Malaria Venture (MMV), TB Alliance, Drugs for Neglected Diseases Initiative (DNDi), the Foundation for New Innovative Diagnostics (FIND), and PATH.

PDPs adopt a 'portfolio' approach to R&D – meaning that they hold the rights to and seek to evaluate a wide range of potential compounds and discovery research findings. Most focus their efforts on a specific disease area (e.g., malaria) and/or a particular type of technology (e.g., diagnostics). PDPs are an attractive option for potential donors in that they present a means of bridging the valleys of death between discovery and commercialisation in the R&D pipeline,[24] and they are generally (as their name suggests) focused on only a particular kind of global medical research: that which is aimed at the development of discrete products.

PDPs also have a strong results focus, and are characterised by their adoption of private sector approaches to portfolio and industrial project management (PDP Funders Group). They are credited with significantly increasing the number of medical products and technologies in the development pipeline. According to a 2012 Policy Cures report, PDPs accounted for over 40% of new global health products registered between 2000 and 2010.

As discussed earlier, the Australian aid program is no stranger to the PDP model, with $10 million granted to four PDPs in 2012, and $30 million over three years to three PDPs working on malaria and TB in 2015 (as discussed above). However, this support has always been ad hoc, and as of time of writing it is unclear whether this support to PDPs will be replenished in 2018.

---

[23] In the past Australia has provided funding to icddr,b through the bilateral aid program (e.g., icddr,b 2011), but no longer does.
[24] As some products have matured, some PDPs have become increasingly engaged in addressing issues of delivery and access (Grace 2010, p. 6), challenges which often constitute or contribute to the third 'valley of death'.

Australia is in good company as a funder of PDPs. A number of other bilateral and multilateral donors, and even some NGOs and private foundations, have invested in PDPs over the last decade. According to G-FINDER data, in 2015 PDPs received US$450m (Chapman et al 2017, p. 83); 15% of total investment in neglected disease R&D. The three largest contributors to PDPs in 2015 were the Gates Foundation (56% of total PDP funding), USAID (13%), and DFID (12%) (Chapman et al 2017, p. 84). An evaluation of PDP funding activities between 2009 and 2013, conducted on behalf of DFID and the German Ministry for Education and Research, concluded positively that "PDPs have played a major and important role in the development and deployment of much-needed interventions for the control and elimination of neglected infectious diseases", but also importantly noted that providing unrestricted and long-term funding is key to maximising the potential impact of PDPs (Boulton et al).

PDPs do not carry out research themselves, but instead fund research all around the world, including in Australia. One of these, MMV, reports that while it provided some $22m directly between 2005 and 2015, that funding has been a catalyst for attracting a total of $72m via other funding sources (including the NHMRC, ARC, DFAT, and international sources), and that it has entered into agreements with 20 Australia-based malaria research partners (MMV 2017). This makes funding PDPs more attractive than funding international health research institutes, which have fewer direct links to Australian research institutes. Otherwise, they have the same advantages (making the greatest use of global expertise, low transactions costs) and disadvantages (limited control, branding and direct benefits to Australia).

6.3 Participating in grand challenges

A model that has some similarities with the PDP modality, but offers broader opportunities in terms of the scope and types of research that may be funded, is collaboration or co-funding of targeted, one-off research initiatives with other bilateral, multilateral and/or philanthropic donors. A successful example of this model is the 'Saving Lives at Birth: A Grand Challenge for Development' partnership, which was founded in 2011 and is jointly backed by US, Norwegian, Canadian, British, and Korean aid, as well as the Bill & Melinda Gates Foundation and the World Bank. Like other grand challenge models this partnership, which is administered by USAID, issues strategic requests for research proposals related to maternal and newborn health. This ability to make strategic requests, based on gaps identified by consortia who are invested in the needs of particular patient groups, is key for ensuring a targeted, results focus. It is worth noting that even though the Australian aid program is not a contributor to the Saving Lives at Birth partnership, Australian researchers are nevertheless eligible to submit proposals and in the 2016 round researchers from Australian universities won three of the six 'validation' awards offered.

As with the PDP model, this model allows for the pooling of funds and shared administration of funds, as well as opening up opportunities for funding to the wider global research community. However, it might require more work since there are few existing vehicles for collaboration, and they tend to involve relatively small amounts of funding (i.e., in the hundreds of thousands of dollars), with the focus historically on basic, early, or operational research rather than later stage

product development.[25] Australia would need to help create new grand challenges, and this would add to the administrative burden.

6.4 Funding through NHMRC

We know turn to the four options that have more of an Australian focus than the three international options discussed so far.

The first of these and the least demanding in terms of set-up and oversight costs would be to channel aid funding through the NHMRC. Given the technical expertise required to rigorously evaluate scientific research proposals, making use of the knowledge and peer-review systems already established in national councils can help to ensure the quality of research remains high while increasing the quantity.

This is one of the primary approaches taken by the UK's Department of International Development, which has jointly funded global health research with the UK Medical Research Council (MRC) for nearly 25 years.[26] Under the terms of the MRC-DFID Concordat (DFID 2014), DFID provides £9 million annually (£45 million over five years) to the MRC's Global Health Group budget, which is matched on a one-for-one basis by MRC. In terms of both quality and quantity of research outputs the partnership appears highly successful, and was rated as 'exceeding expectations' in its 2015 and 2017 annual reviews (DFID 2017). 121 of the 2014 awards (59%) supported by the partnership reported at least one policy impact, and nearly half (44%) of projects in the 2013/14 portfolio was led by a (co-)principal investigator from a developing country.[27]

The idea of using ODA to fund global medical research through the NHMRC is not a new one in Australia. DFAT is currently experimenting with this approach (albeit to a very limited extent) with the Northern Australia Tropical Disease Collaboration, which involved a joint request for proposals and making use of NHMRC's peer review system (though this approach could also be considered as more closely resembling individual research project funding, and is discussed further in section 6.7).

There are certainly some advantages to this approach, in particular that it avoids duplicating administrative and review systems. However, any attempt to more significantly support global medical research using aid funds channelled through the NHMRC might prove challenging in practice for both structural and practical reasons.

From a structural perspective, it is not clear how effective NHMRC would be in establishing the translation and results orientation that we argue would be critical for additional funding. In addition, the NHMRC grants structure does not currently entail a dedicated global health stream or panel, as does the UK's MRC. Nor do the NHMRC's standard criteria for evaluating research proposals

---

[25] For example, the *Saving Lives at Birth* Sixth Call for Innovations provided "more than [US]$3.4 million' in funding." (USAID 2016).

[26] NB this is distinct from the UK's support of product development research funded through direct grants to PDPs.

[27] Recently, the British aid program has combined funding through other research councils with the establishment in late 2015 of the Global Challenges Research Fund (GCRF). The GCRF (a UK-only initiative) will allocate a massive £1.5 billion in ODA over five years across the UK's various research councils to support "innovative health and food security research".

currently take into consideration the potential for the proposed research to impact on health outcomes in developing countries.

From a practical perspective, the NHMRC's grantmaking rules place restrictions on the types of researchers and institutions eligible to apply for funding, which in effect limit the pool of eligible candidates mostly to Australian researchers and institutions. Only limited funding accessible by overseas and developing country researchers has been made available through occasional special initiatives and joint calls for research such as that with the Global Alliance for Chronic Diseases for research on hypertension and Type 2 diabetes (to which the NHMRC contributed $5m in 2011 and again in 2014). The awarding of NHMRC funding is also a time-consuming process; for example, the interval between the opening of Project Grant applications and funding announcements stretches to nearly a year.

6.5 Establishing a global medical research centre: the ACIAR model

Given the potential structural and logistical challenges involved with channelling ODA through the NHMRC, an alternative option would be to establish a centre for global medical research. This might be referred to in shorthand as the 'ACIAR model', after the Australian Centre for International Agricultural Research, which was established in 1982 as a statutory agency to fund agricultural research for the benefit of people in developing countries. ACIAR has since developed a strong reputation with respect to supporting high quality, relevant, and cost-effective research related to agriculture in developing country settings. As we suggest below, either an ACIAR equivalent could be created for medical research, or ACIAR's mandate could be broadened to include health and medical research.

Grand Challenges Canada (GCC), modelled after the Gates Foundation's Grand Challenges in Global Health program, provides an example of how this kind of model might work. GCC was established in 2010 as a federally incorporated organisation with the specific mandate of supporting innovative global health research projects and proposals. GCC is a "purpose-built not-for-profit organization" which was created to be the "implementation arm" of the Development Innovation Fund-Health (DIF-H) (Adams et al 2015, p.3). DIF-H is managed by a consortium comprised of GCC and two other organisations: the International Development Research Centre and the Canadian Institutes of Health Research. It was established in 2008 with initial funding of CAD$225m (approx. A$220m) over five years (Adams et al 2015, p. ii); GCC has since leveraged more than CAD$328 million from funding sources outside of the Canadian government – mainly other donors and philanthropic organisations, but also individual and venture capital investors, corporate entities, local governments, and NGOs (GCC 2016, p. 34). Managed by a team of 34 full-time staff in 2015-16, GCC is governed by a Scientific Advisory Board (29 members) and a Board of Directors (12 members), who approve all Grand Challenge topics (GCC 2016). Proposals received undergo technical review through the Canadian Institutes of Health Research. Notably, the challenges funded solely by GCC are open only to Canadian researchers and researchers based in low- and middle-income countries, but not those based in other donor countries, which appears to be an effective method to both support national interests and extend opportunities to developing country researchers. (Some the challenges within the GCC portfolio, such as the 'Saving Lives at Birth' challenge described above, are co-funded with other bilateral and philanthropic partners, and their funding rules vary accordingly.)

A dedicated national research management body for global medical research would allow for significant control over what types of proposals receive funding, and would be able to ensure a strong results-orientation. It would be able to manage a portfolio of risky, long-term research projects with the aim of bringing products to market.

Creating a new agency would have significant upfront costs. One alternative would be to broaden the mandate of ACIAR to focus on both agricultural and medical research. Under this scenario, ACIAR would become ACIR: the Australian Centre for International Research. This would significantly reduce any upfront costs. It would require legislative change, but this could be a positive, and it is likely that any move in this direction would have significant bipartisan support. Of course, it would be important to ensure that this change did not adversely affect ACIAR's work in agricultural research, which is well-regarded. The expansion of this mandate may not be a great a leap as it might at first glance appear. ACIAR interprets its agriculture research mandate broadly to encompass issues related to biosecurity, climate change, gender and food system value chains, thus bringing it within grasping distance of research on global health and medical research.

Adoption of the ACIAR model would result in a focus on funding of Australian researchers, but in collaboration with developing country counterparts. It is also relevant that ACIAR funds the international agricultural research network (CGIAR), as well as some non-CGIAR international agricultural research centres on behalf of the Australian Government (e.g., CABI, the Asia Pacific Association of Agricultural Research Institutions, the Pacific Community [SPC]). About 20% of ACIAR's funding goes offshore to the CGIAR network (ACIAR 2016). In a similar way, ACIR could be responsible for managing Australia's international research investments, such as into PDPs. This would have the advantage that this responsibility was given to a body that itself was expert in the area and so able to reach informed and credible judgements about the best strategic allocation of funds.

Whether a new body was created or ACIAR's mandate expanded, careful attention would need be given to how processes such as peer review would be managed. The NHMRC peer review system is already under strain due to the volume of proposals submitted (NHMRC 2016 (Jul), p. 10), and might not be in a position to manage additional proposals (i.e., in the way that GCC outsources review to the Canadian Institutes of Health Research). Review processes could be designed in such a way that would alleviate some of the pressure associated with reviewing applications; for example, enacting a two-step procedure with only a small number of researchers invited to submit detailed research proposals.

Another variant of this model would be to create some sort of global health equity fund. The nature of neglected global diseases is that such a fund could not operate along purely commercial lines, but it could operate on a semi-commercial basis, for example, as a revolving fund. Such an initiative might receive philanthropic support (as might a new research centre). It is unlikely that the current expertise exists to explore the feasibility for such a fund let alone to establish one, but it is a task that could be pursued by a specialized global medical research centre.

6.6 Funding research consortia

The remaining two Australia-focused models would be managed by DFAT: they are the two Australian, hands-on options. The first of these would be to fund research consortia on topics of strategic interest to the aid program. This would involve assembling one or a number of specialised research centres or groups of institutions which already have a track record of producing high quality research in a given area.

The ARC and NHMRC's Centres of Research Excellence (CRE) model provides a template for how similar, ODA-funded consortia might be established and managed. Given the current government's particular interest in health security and regional biosecurity threats as part of its foreign policy, it is worth noting that in July 2016 NHMRC announced the award of $5 million in funding to a new Infectious Disease Emergency Response Research CRE, which is charged with establishing a partnership of Australian researchers to "deliver a coordinated and evidence-based response to infectious diseases".

One advantage of the consortia model is that it capitalises on existing research expertise, and provides some flexibility with respect to the geographic location and affiliation of the member centres. It could be led by an Australian institution, for example, but include institutions in other donor and/or developing countries as collaborators. It would also likely require a smaller budget as compared to establishing a new research centre, and could feasibly be limited to a funding commitment of, say, three to five years.

However, this model is somewhat limiting in terms of the scope and breadth of research that might be pursued, as compared to a dedicated research centre. Consortia tend to be short-lived. They can be beset by institutional rivalry. Their track record in the aid program in areas other than medical research is not inspiring. The International Mining for Development Centre, a collaboration of the University of Queensland and the University of Western Australia, has come and gone.

The most fundamental problem with this approach is that, in the absence of any intermediary such as NHMRC or a dedicated research centre, the job of selecting and monitoring the consortia would fall to DFAT. Yet DFAT would not be well placed to judge between competing proposals or to supervise the performance of consortia during the implementation phase. Research is a long-term, specialized endeavour; research leading to product development can take some 15 years. Sustained support for such an uncertain task is not at all suited to the generalist, high-rotating culture of DFAT. High staff turnover is the longest-standing and most common complaint of stakeholders in relation to the aid program (Wood et al 2015). A research program needs stable, expert management. It is not a slight on the department to say that this is unlikely to come from DFAT.

6.7 Funding individual research projects

A final model that could be considered is the direct funding of individual research projects by DFAT, through a range of contracting channels. Even more than the previous option, this approach would have low set-up costs, but would be expensive for DFAT to maintain. While there will likely always been a need for aid programs to commission specialised pieces of applied research (e.g., to examine specific operational issues in particular contexts), this model is unlikely to be effective in terms of promoting and supporting medical research which requires a sustained effort over several years. As

noted above in relation to the consortia proposal, DFAT, to whom the job would fall under this approach, is not well suited to be a long-term research manager. Moreover, this approach would likely constitute a relatively fragmented, and therefore not particularly strategic, approach to funding global medical research. This model might appeal particularly when there is only limited and short-term funding available. However, in this context any available funds would likely be more effectively spent as a contribution to an existing international research agency or PDP.

The experience of the Australian Development Research Awards (ADRAs) tells a sobering story. The ADRAs were established in 2007, and involved the expenditure of tens of millions over three rounds. The current DFAT website contains a listing of research projects from the most recent round (2012) but no detail at all on research completed. Remarkably, no evaluation has ever been undertaken of the ADRAs.[28] This is just one case, but one which is strongly supportive of the argument that DFAT is not a suitable home for research endeavours.

Andrew Campbell, the current ACIAR Chief Executive Officer, has written convincingly on the arguments against housing research management within the public service. It is worth quoting him at length:

"As a general observation, research management tends to be more competently delivered by organisations or agencies established, staffed, equipped and dedicated for that purpose than it is by policy Departments. Policy Departments operating under the [Financial Management and Accountability] Act generally suffer from a number of constraints in delivering research management services, including that they:

- perform a wide range of roles other than research management, many of which impose more urgent daily requirements and deadlines;
- are subject to the FMA Act, which (compared with the [Commonwealth Authorities and Companies] Act) places restrictions on the management of multi-year funding and partnering with commercial organisations;
- have a high level of staff turnover (compared with most research providers and dedicated research funding organisations) which undermines continuity, cohesion, credibility and corporate memory;
- find it difficult to train and retain sufficient staff in research or knowledge management roles;
- lack specialised project and contract management systems designed for managing research activities (e.g. with on-line application processes and sophisticated measures for keeping registers of and managing intellectual property);
- tend to use generic professional services contracts to procure research (rather than contracts designed specifically for the purpose of research investment);

---

[28] It was included as a case study in the Office of Development Effectiveness' 2015 evaluation of DFAT's investments in research for better aid; but the evaluation focuses mainly on DFAT's uptake of DFAT-funded research outputs, rather than the merits of the research funded more broadly (Davies 2015 (4 Mar)). (At the time of writing, a fuller evaluation of the ADRAS scheme was being undertaken by the ACFID-affiliated Research for Development Impact Network, but had not yet been released.)

- lack dedicated outreach systems to communicate and promote research outputs (beyond passive communication mechanisms such as press releases), and have difficulties with publishing findings that are inconsistent with the policies and priorities of the government of the day; and

- find it difficult to manage knowledge legacy issues, especially after the funding period for the relevant project or program has ended. Departments often can't even find project or consultancy outputs funded five years ago, let alone ten or twenty years ago. Their evaluation processes tend to be oriented to accountability within particular programs, rather than adaptive learning across a whole portfolio through time."

<div align="right">(Campbell 2010, p.15; see also Campbell & Schofield, 2007)</div>

6.8 Recommended model

We have already characterised these seven models as either hands-on or hands-off, and as directed primarily at Australian or global researchers. The choice between a global and Australian approach is ultimately a political one. Based on experience to date, it is clear that a purely global approach will not get off the ground. A mixed approach might work, but some direct funding of Australian researchers seems essential if only for political reasons, and perhaps desirable, or at least not costly, given Australia's existing strong medical research capabilities. This rules out the three 'primarily global' approaches, at least as constituting the thrust of any major new initiative.

Concerning the last four, which have a much stronger domestic focus, the choice is between managing a scaled-up medical research program within DFAT and giving the job to another body: either a new, specialized global medical research centre, or an existing international research organisation, either NHMRC or ACIAR.

While funding research consortia and individual research projects would have limited upfront costs, as both could be pursued within DFAT, experience suggests that they would both have limited prospects for success. DFAT, whatever its strengths, should be not be tasked with large-scale, complex research management in a field with which it lacks familiarity. It does not have the expertise, and its culture of rotation is not consistent with cultivating the expertise required.

This reasoning eliminates the last two proposals and leaves the proposals of working through NHMRC, and of establishing a new research centre (or broadening the mandate of ACIAR). We argue that the second option is superior. The tail of aid cannot be expected the wag the dog of Australian medical research. Significant funding for global medical research already flows through NHMRC, largely on the basis of the interests of individual scientists. More looks likely to follow through the MRFF.

If an aid program initiative is undertaken in the global medical research space, it should be on the basis of a different approach, squarely focused on tangible outcomes. This would be much more likely to be achieved through a body other than NHMRC.

This leaves the question of whether a new research body should be created or whether instead it should be attached to ACIAR. The existing close link between ACIAR and the Australian aid program is also an advantage, as is ACIAR's experience on the international stage. The main drawback of creating an ACIR is that medical research, and certainly that part of it which is focused on translation

and product development, is a long way from agricultural research. Much of ACIAR's research is now operational in nature, relating more to the social rather than the physical sciences. This means it would be much more readily suited to absorbing health programs, policy, and systems research, as compared to drug, diagnostic and similar biomedical research, as we are proposing. However, what it might lack in technical expertise in these particular areas, it makes up for in its strong track record in research management.

Ultimately, the choice between setting up a new research centre and expanding the remit of ACIAR would be finely balanced. Both options could work well, and a number of other choices would need to be made as well (for example, whether the research centre would focus only on global medical research, or on health research too). Creating an entirely new research centre would be a major undertaking, and Australia is fortunate to have ACIAR already in existence. Expanding its mandate to become the Australian Centre for International Research or drawing on its experience to create a new Australian Centre for International Medical Research would both be significant but feasible and high-return undertakings.

7. Conclusion

The executive summary at the start of the paper summarizes our main recommendations. The main conclusion can be simply stated. We recommend that the Australian government scale up spending on medical research through the creation of a new research centre or by expanding ACIAR's remit. This new body would have responsibility for disbursing funds to both global research bodies and directly to Australian researchers, and for supporting coordination and providing strategic guidance for Australian global medical research.

While we argue that a global medical research centre in Australia is the best way in which to scale up Australia's contribution to global medical research, we also note that the government is taking a somewhat different route. As per its June 2016 election announcement and as confirmed in the 2017-18 Federal Budget, it is moving to introduce a 'regional health security partnership fund'. This overlaps with the recommendation of this paper in that it clearly will have an emphasis on research, but differs from it in two regards. First, this new initiative will have an operational as well as a research focus. Second, there is no indication that the government is looking to any entity other than DFAT to oversee this initiative.

The merits of a health security operational initiative can be debated, but even if accepted do not undermine the case for greater spending on global medical research, implemented by a body external to DFAT.

Scaling up Australia's contribution to global medical research is long overdue. Our approach to supporting global agricultural research has worked well; we should take a similar approach with regard to global medical research.

References

2011. *Independent Review of Aid Effectiveness* ("Hollway Review"). Commonwealth of Australia. http://www.aidreview.gov.au/index.html

2013. *Strategic Review of Health and Medical Research in Australia – Better Health Through Research* ("McKeon Review"). Commonwealth of Australia.

Abimbola, S., Negin, J., & Martiniuk, A. 2017. "Charity begins at home in global health research funding". *The Lancet Global Health* 5(1): e25-e27. http://dx.doi.org/10.1016/S2214-109X(16)30302-3

Adams, O., Guimaraes, L., Atherton, F., & Franzen, S. 2015 (Oct). "Development Innovation Fund – Health. Summative Evaluation Report". Oxford Policy Management. http://www.grandchallenges.ca/wp-content/uploads/DIF-H_SummativeEvaluation_web_10-20-15.pdf

Anderson, I. 2011. "The Bill and Melinda Gates Foundation: business versus bureaucracy in international development". Development Policy Centre Discussion Paper 3. https://devpolicy.anu.edu.au/pdf/papers/DP_3_-_The_Bill_and_Melinda_Gates_Foundation_-_business_versus_bureaucracy_in_international_development.pdf

Anderson, W. 2016 (21 Apr). "How to pick Australia's health and medical research priorities". *The Conversation*. https://theconversation.com/how-to-pick-australias-health-and-medical-research-priorities-57810

Australian Agency for International Development [AusAID]. 2012. *Medical Research Strategy (Draft)*. Commonwealth of Australia. http://devpolicy.org/pdf/2012-AusAID-medical-research-strategy-draft.pdf

Australian Centre for International Agricultural Research [ACIAR]. 2016. "Annual Operational Plan 2016-17". http://aciar.gov.au/files/aop2016-17/files/global-program.pdf

Australian Clinical Trials. 2015. "Phases of clinical trials". National Health and Medical Research Council and Department of Industry, Innovation and Science. https://www.australianclinicaltrials.gov.au/what-clinical-trial/phases-clinical-trials (updated 19 Feb 2015).

Australian Government. 2015 (26 Aug). *Medical Research Future Fund Act 2015*. Commonwealth of Australia. https://www.legislation.gov.au/Series/C2015A00116

Australian Institute of Health and Welfare [AIHW]. 2017. "National health priority areas". http://www.aihw.gov.au/national-health-priority-areas/

Australian Research Council [ARC]. 2004 (25 Aug). "Media release: $42 million for new research networks". https://www.nhmrc.gov.au/media/releases/2004/42-million-new-research-networks

ARC. 2014 (27 May). "Funding Rules for schemes under the Linkage Program for 2014 – Special Research Initiative for Tropical Health and Medicine". http://www.arc.gov.au/sites/default/files/filedepot/Public/NCGP/SRIs/PDF/SRI14_tropical_health_funding_rules.PDF

ARC. 2014 (25 Aug). "ARC Medical Research Policy – Version 2014.3". http://www.arc.gov.au/arc-medical-research-policy

Bill & Melinda Gates Foundation [BMGF]. 2015 (10 Sept). Grand Challenges Africa. https://gcgh.grandchallenges.org/announcement/grand-challenges-africa

BMGF. 2016. Grand Challenges (home page). https://grandchallenges.org/#/map

Birn, A.-E. 2005. "Gates's grandest challenge: transcending technology as public health ideology". *The Lancet* 366(9484), 514-9. http://dx.doi.org/10.1016/S0140-6736(05)66479-3

Bloomberg Philanthropies. 2015 (23 Mar). "Press release: Bloomberg Philanthropies launches $100 million Data for Health program in developing countries". https://www.bloomberg.org/press/releases/bloomberg-philanthropies-launches-100-million-data-health-program-developing-countries/

Boulton, I., Meredith, S., Mertenskoetter, T., & Glaue, F. "Evaluation of the Product Development Partnerships (PDP) funding activities – UK Department for International Development (DFID), The German Ministry for Education and Research (BMBF)." https://assets.publishing.service.gov.uk/media/57a0897140f0b649740000b0/Evaluation_of_the_Product_Development_Partnerships_funding_activities.pdf

Campbell, A. 2010 (Nov). "Renewing the Rural RDC Model. Submission to the Productivity Commission Inquiry into Rural R&D Corporations". http://www.pc.gov.au/inquiries/completed/rural-research/submissions/subdr271.pdf

Campbell, A. & Schofield, N. 2007. *The Getting of Knowledge: a guide to funding and managing applied research (2nd ed).* Land & Water Australia. http://lwa.gov.au/products/pk071243

CGD Advance Market Commitment Working Group. 2005. "Marking Markets for Vaccines: Ideas to action". Center for Global Development. https://www.cgdev.org/publication/9781933286020-making-markets-vaccines-ideas-action

Chao, T. E., Lo, N. C., Mody, G. N., & Sinha, S. R. 2014. "Strategies for last mile implementation of global health technologies". *The Lancet Global Health* 2(9): e497-e498. http://dx.doi.org/10.1016/S2214-109X(14)70253-0

Chapman, N., Abela-Oversteegen, L., Doubell, A., Chowdhary, V., Gurjav, U., & Ong, M. 2017. "G-FINDER 2016 Neglected disease research and development: a pivotal moment for global health". Policy Cures Research. http://www.policycuresresearch.org/downloads/Y9%20GFINDER%20full%20report%20web.pdf

Clarke, P., Barnett, A., Herbert, D., & Graves, N. 2014 (May 15). "Better ways to spend the medical research future fund". *The Conversation*. https://theconversation.com/better-ways-to-spend-the-medical-research-future-fund-26685

Davies, R. 2015 (4 Mar). "Missing, one kangaroo with crossbones: ODE evaluates DFAT's support for development research". Devpolicy Blog. http://devpolicy.org/missing-one-kangaroo-with-crossbones-ode-evaluates-dfats-support-for-development-research-20150304/

Davies, R. 2015 (26 Mar). "Funding for TB and malaria product development partnerships: Australia's back". Devpolicy Blog. http://devpolicy.org/funding-for-tb-and-malaria-product-development-partnerships-australias-back-20150326/

Davies, R. & Howes, S. 2012 (Dec). "Fowl or Fish? A submission to the ACIAR Review". http://devpolicy.anu.edu.au/pdf/2012/fowl-or-fish-devpolicy-submission-to-the-ACIAR-review.pdf

Department for International Development [DFID]. 2014 (Dec). "DFID-Medical Research Council Concordat 2013-18 [GB-1-203085]: Business Case and Summary 2030085 (December, 2014)". DFID Development Tracker. https://devtracker.dfid.gov.uk/projects/GB-1-203085/documents

DFID. 2017. "DFID-Medical Research Council Concordat 2013-18 [GB-1-203085]". DFID Development Tracker. https://devtracker.dfid.gov.uk/projects/GB-1-203085/documents

Department of Foreign Affairs and Trade [DFAT]. 2015 (15 Jun). *Health for Development Strategy 2015-2020*. http://dfat.gov.au/about-us/publications/Pages/health-for-development-strategy-2015-2020.aspx

DFAT. 2016 (22 Feb). "Tropical Disease Research Regional Collaboration Initiative". http://dfat.gov.au/about-us/business-opportunities/tenders/Pages/tropical-disease-research-regional-collaboration-initiative.aspx

DFAT. 2017. 2017-18 Portfolio Budget Statement – Australian Centre for International Agricultural Research (ACIAR): Entity resources and planned performance. http://dfat.gov.au/about-us/corporate/portfolio-budget-statements/Documents/2017-18-foreign-affairs-and-trade-pbs-aciar.pdf

Department of Health. 2015 (Apr). "Review to strengthen Independent Medical Research Institutes: Final Report". http://www.health.gov.au/internet/main/publishing.nsf/Content/FC5882EA77349CDFCA257D770016B72F/$File/11145_Review%20to%20Strengthen%20Independent%20Medical%20Research%20Institutes%20Final....pdf

Department of Health. 2017 (9 May). "Further information on the Medical Research Future Fund". Updated 9 May 2017. Commonwealth of Australia. http://health.gov.au/internet/main/publishing.nsf/Content/mrff-more

Department of Health. 2017 (9 Jun). "Medical Research Future Fund – National Security Against Pandemic Risk". Commonwealth of Australia. http://www.health.gov.au/internet/main/publishing.nsf/Content/medical-research-future-fund-National-Security-Against-Pandemic-Risk-budget-2017

Department of Health. 2017 (13 Jun). "First disbursements from the Medical Research Future Fund". Commonwealth of Australia. http://www.health.gov.au/internet/main/publishing.nsf/Content/medical-research-future-fund-budget-2017-factsheets

Department of Industry, Innovation and Science, & Department of Health. 2016 (Dec). "Biomedical Translation Fund: Factsheet". Commonwealth of Australia. https://www.business.gov.au/~/media/Business/BTF/Biomedical-Translation-Fund-Factsheet-PDF.ashx?la=en

Gavi, the Vaccine Alliance. 2017. "How the pneumococcal AMC works". http://www.gavi.org/funding/pneumococcal-amc/how-the-pneumococcal-amc-works/

Grace, C. 2010 (2 Jun). "Product Development Partnerships (PDPs): Lessons from PDPs established to develop new health technologies for neglected diseases". DFID Human Development Resource Centre. https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/67678/lssns-pdps-estb-dev-new-hlth-tech-negl-diseases.pdf

Grand Challenges Canada [GCC]. 2016. "Annual Report: April 2015-March 2016". http://www.grandchallenges.ca/wp-content/uploads/2016/03/Annual_Report_EN_Sept2016.pdf

Gray, A., Fenn, P., Garau, M., Pritchard, C., Godber, E., & Towse, A. 2006. "Donor investment choices for global health: modelling the value for money of investing in Product Development, Public Private Partnerships as compared to other health care interventions." Summary Report (December 2006), OHE Consulting. London. https://www.ohe.org/system/files/private/publications/305%20-%202006_Donor_Investment_Choices_Gray.pdf?download=1

Head, M. G., Fitchett, J. R., Nageshwaran, V., Kumari, N., Hayward, A., & Atun, R. 2016. "Research investments in global health: a systematic analysis of UK infectious disease research funding and global health metrics, 1997-2013". *EBioMedicine* 3: 180-90. https://doi.org/10.1016/j.ebiom.2015.12.016

icddr,b. 2011. "Australia to provide icddr,b AUD14.85 million under a new four year funding agreement". http://www.icddrb.org/news-and-events/news?id=553&task=view

Institute for Health Metrics and Evaluation. 2016. "Financing Global Health 2016". University of Washington. http://www.healthdata.org/sites/default/files/files/infographics/Infographic_FGH2016.pdf

Keogh, M. 2014 (27 Jul). "Does public agricultural R&D investment 'crowd out' or encourage private sector investment?" Australian Farm Institute. http://www.farminstitute.org.au/ag-forum/public-rd-investmet

Leroy, Jef L., Habicht, Jean-Pierre, Pelto, Gretel, & Bertozzi, Stefano M. 2007. "Current priorities in health research funding and lack of impact on the number of child deaths per year". *American Journal of Public Health* 97(2): 219-23. https://doi.org/10.2105/AJPH.2005.083287

Lewis, R. 2015 (21 Oct). "Joe Hockey makes valedictory speech in Parliament". *The Australian*. http://www.theaustralian.com.au/national-affairs/joe-hockey-makes-valedictory-speech-in-parliament/news-story/a7bd71f43afb45430fe1f48c4ab2296b?login=1

Liberal Party of Australia. 2016. "The Coalition's Policy for a Safe and Prosperous Australia". https://www.liberal.org.au/coalitions-policy-safe-and-prosperous-australia

Matthews, D. 2015 (3 Dec). "Spending review: winners and losers from the new Global Challenges Research Fund". *Times Higher Education.* https://www.timeshighereducation.com/news/spending-review-winners-and-losers-from-new-global-challenges-research-fund

Matthews, K. R. W. & Ho, V. 2008. "The grand impact of the Gates Foundation. Sixty billion dollars and one famous person can affected the spending and research focus on public agencies". *EMBO Reports* 9(5): 409-12. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2373372/

Medical Research Council [MRC]. 2017. "Global health". https://www.mrc.ac.uk/research/strategy/aim-3/objective-13/

Medical Research Future Fund (MRFF). 2016. *Australian Medical Research and Innovation Strategy 2016-2021*. http://www.health.gov.au/internet/main/publishing.nsf/Content/mrff/$FILE/Australian%20Medical%20Research%20and%20Innovation%20Strategy%202016.pdf

Medicines for Malaria Venture [MMV]. 2016 (Nov). "Supporting malaria elimination in Papua New Guinea". https://www.mmv.org/access/products-projects/supporting-malaria-elimination-papua-new-guinea

MMV. 2017. "Submission to the Foreign Affairs White Paper: Australia's continued leadership in global health through support of Product Development Partnerships". DFAT. http://dfat.gov.au/whitepaper/submissions/documents/170303-559-Medicines-for-Malaria-Venture.PDF

Minister for Foreign Affairs. 2015 (23 Mar). "Media release: Tackling TB and Malaria in the Indo-Pacific". http://foreignminister.gov.au/releases/Pages/2015/jb_mr_150323a.aspx?w=tb1CaGpkPX%2FlS0K%2Bg9ZKEg%3D%3D

Minister for Foreign Affairs. 2015 (23 Mar). "Address to launch of InnovationXchange – InnovationXchange, Canberra". http://foreignminister.gov.au/speeches/Pages/2015/jb_sp_150323a.aspx

Moran, M., Guzman, J., Ropars, A. L., & Illmer, A. 2010. "The role of Product Development Partnerships in research and development for neglected diseases". *International Health* 2(2): 114-22. https://doi.org/10.1016/j.inhe.2010.04.002

National Health and Medical Research Council [NHMRC]. 2002. "Media release: NHMRC New Development Grants to Foster Research Commercialisation". https://www.nhmrc.gov.au/media/releases/2002/nhmrc-new-development-grants-foster-research-commercialisation?

NHMRC. 2015. "Annual Report 2014-15". https://www.nhmrc.gov.au/_files_nhmrc/file/publications/nh169_nhmrc_annual_report_2014_15_web.pdf

NHMRC. 2015. "Grantspersonship – NHMRC Project Grants: tips and hints". PowerPoint presentation. https://www.nhmrc.gov.au/_files_nhmrc/file/grants/apply/projects/2015/2016_project_grants_grantspersonship_0.pdf

NHMRC. 2016. "NHMRC Funding Rules 2016". https://www.nhmrc.gov.au/book/nhmrc-funding-rules-2016/NHMRC-funding-rules-2016

NHMRC. 2016 (Jul). "Structural Review of NHMRC's Grant Program: Consultation Paper". https://www.nhmrc.gov.au/_files_nhmrc/file/grants/consultation_paper_structural_review.pdf

NHMRC. 2016 (Nov). "Northern Australia Tropical Disease Collaborative Research Programme". Updated 21 November 2016. https://www.nhmrc.gov.au/grants-funding/apply-funding/northern-australia-tropical-disease-collaborative-research-programme

NHMRC. 2017. "Apply for funding". Updated 3 Aug 2017. https://www.nhmrc.gov.au/grants-funding/apply-funding

NHMRC. 2017. "Global Alliance for Chronic Diseases". Updated 16 Jan 2017. https://www.nhmrc.gov.au/grants-funding/apply-funding/global-alliance-chronic-diseases

NHMRC. 2017. "Structural Review of NHMRC's Grant Program". Updated 2 June 2017. https://www.nhmrc.gov.au/grants-funding/structural-review-nhmrc-s-grant-program

NHMRC. 2017. "NHMRC International Engagement". Updated 21 June 2017. https://www.nhmrc.gov.au/research/international-engagement

NHMRC. 2017. "NHMRC Summary Tables 2000-2016". Updated 28 Mar 2017. Retrieved from https://www.nhmrc.gov.au/grants-funding/research-funding-statistics-and-data

NHMRC. 2017. "Research funding statistics and data – NHMRC and other Australian Government priorities". https://www.nhmrc.gov.au/grants-funding/research-funding-statistics-and-data

National Innovation & Science Agenda. 2017. "Biomedical Translation Fund to commercialise promising discoveries". Commonwealth of Australia. http://www.innovation.gov.au/page/biomedical-translation-fund

OECD Development Assistance Committee [OECD DAC]. 2008 (Nov). "Is it ODA? Factsheet". http://www.oecd.org/dac/stats/34086975.pdf

OECD DAC. 2017. "Aid to Health". http://www.oecd.org/dac/stats/aidtohealth.htm

OECD DAC. 2017. Creditor Reporting System (CRS). http://stats.oecd.org/Index.aspx?datasetcode=CRS1

Office of Development Effectiveness. 2015 (Feb). "Research for better aid: an evaluation of DFAT's investments". DFAT. https://dfat.gov.au/aid/how-we-measure-performance/ode/Documents/research-for-better-aid-an-evaluation-of-dfats-investments.pdf

Office of Northern Australia. 2015. "Our North, Our Future: White Paper on Developing Northern Australia". Commonwealth of Australia. http://northernaustralia.gov.au/files/files/NAWP-FullReport.pdf

PDP Funders Group. "PDP Characteristics". http://www.pdpfundersgroup.org/pdp-related-materials/pdp-characteristics.html

Policy Cures. 2012. "Saving lives and creating impact: Why investing in global health research works". http://www.policycures.org/downloads/Saving%20lives%20and%20creating%20impact.pdf

Policy Cures. 2014. "G-FINDER Factsheet – Australia's global health R&D investment: achieving its potential". http://policycures.org/downloads/Australia%20GH%20R&D%20Fact%20Sheet.pdf

Policy Cures. 2015 (July). "Submission to the Inquiry into the Medical Research Future Fund Bill (2015) and the Medical Research Future Fund (Consequential Amendments) Bill 2015". Senate Community Affairs Legislation Committee. http://www.aph.gov.au/DocumentStore.ashx?id=646e02ba-354d-4795-9531-37ae8eea6708&subId=355325

Policy Cures Research. 2017. G-FINDER Public Search Tool. https://gfinder.policycuresresearch.org/

Reddy, D. & Spigelman, M. 2014 (28 May). "Product Development Partnerships: an innovative approach to tackling neglected diseases". Devpolicy Blog. http://devpolicy.org/product-development-partnerships-an-innovative-approach-to-tackling-neglected-diseases-20140528/

Research Australia. 2016 (21 Jan). "Funding health and medical research in Australia". http://researchaustralia.org/australian-research-facts/

Røttingen, J. A., Regmi, S., Eide, M., Young, A. J., Viergever, R. F., Ardal, C., Guzman, J., Edwards, D., Matlin, S. A., & Terry, R. F. 2013. "Mapping of available health research and development data: what's there, what's missing, and what role is there for a global observatory". *The Lancet* 382(9900): 1286-307. doi: 10.1016/S0140-6736(13)61046-6

Ruff, T. A., Taylor, K., & Nolan, T. 2012. "Australia's contribution to global immunisation". *Australian and New Zealand Journal of Public Health* 36(5): 564-71.

Schäferhoff, M., Suzuki, E., Angelides, P., Hoffman, S. 2015 (September). "Rethinking the Global Health System". Centre on Global Health Security, Chatham House: The Royal Institute of International Affairs. https://www.chathamhouse.org/sites/files/chathamhouse/field/field_document/20150923GlobalHealthArchitectureSchaferhoffSuzukiAngelidesHoffman.pdf

Senate Foreign Affairs, Defence and Trade Committee. 2014 (27 March). "Australia's overseas aid and development assistance program". Commonwealth of Australia. http://www.aph.gov.au/Parliamentary_Business/Committees/Senate/Foreign_Affairs_Defence_and_Trade/Overseas_aid/Report/index

Stuckler, D., Basu, S., & McKee, M. 2011. "Global health philanthropy and institutional relationships: how should conflicts of interest be addressed?" *PLoS Medicine* 8(4): e1001020. https://dx.doi.org/10.1371%2Fjournal.pmed.1001020

The Lancet. 2009. "Editorial: What has the Gates Foundation done for global health?" *The Lancet* 373(9675): 1577. http://dx.doi.org/10.1016/S0140-6736(09)60885-0

UN Department of Economic and Social Affairs, Population Division. 2017. "World Population Prospects". https://esa.un.org/unpd/wpp/

UN Statistics Division. 2017 (17 July). SDG Indicators: Metadata repository. https://unstats.un.org/sdgs/metadata/

United States Agency for International Development [USAID]. 2016 (1 Aug). "Press release: Twelve innovators get funding from Saving Lives at Birth". USAID Press Office. https://www.usaid.gov/news-information/press-releases/aug-1-2016-twelve-innovators-get-funding-saving-lives-birth

Wilson, P. & Palriwala, A. 2011. "Prizes for Global Health Technologies". Centre for Global Health R&D Policy Assessment, Results for Development Institute. http://www.r4d.org/wp-content/uploads/Prizes-for-Global-Health-Technologies.pdf

World Health Organization [WHO]. 2004. "The Mexico Statement on Health Research". Ministerial Summit on Health Research, Mexico City, 16-20 November 2004. http://www.who.int/rpc/summit/agenda/en/mexico_statement_on_health_research.pdf

WHO. 2008. "The Bamako Call to Action on Research for Health". Global Ministerial Forum on Research for Health, Bamako, Mali, 17-19 November 2008. http://www.who.int/rpc/news/BAMAKOCALLTOACTIONFinalNov24.pdf

WHO. 2017. Global Observatory on Health R&D (home page). http://www.who.int/research-observatory/en/

Wood, T., Burkot, C., & Howes, S. 2015. "Australian aid: signs of risk. The 2015 Australian aid stakeholder survey". Development Policy Centre. http://devpolicy.org/publications/reports/2015%20Stakeholder%20Survey/2015%20Australian%20Aid%20Stakeholder%20Survey%20Final%20Online.pdf

Woodall, D. 2014 (1 Dec). "Lihir Operations". Presentation, 2014 PNG Mining and Petroleum Investment Conference. Newcrest Mining Ltd. http://www.newcrest.com.au/media/presentations/2014/FINAL_Lihir_2014_PNG_Mining_and_Petroleum_Investment_Conference.pdf

Yee, A. 2013. "Profile: The icddr,b—saving lives in Bangladesh and beyond". *The Lancet* 381(9875): p.1350. http://dx.doi.org/10.1016/S0140-6736(13)60870-3

Young, A. J., Terry, R. F., Røttingen, J.-A., & Viergever, R. F. 2015. "Global trends in health research and development expenditures – the challenge of making reliable estimates for international comparison." *Health Research Policy and Systems* 13(7). https://doi.org/10.1186/1478-4505-13-7

Appendix 1: Public and philanthropic funders of neglected disease research, FY2007-2015

	US$
Public sector - Governments	**258,786,254.90**
Australian National Health and Medical Research Council (NHMRC)	201,182,737.02
Australian Department of Foreign Affairs and Trade (DFAT)/AusAID	23,419,706.63
Australian Department of Industry	22,229,601.86
Queensland Health	4,362,996.32
Australian Research Council (ARC)	1,824,843.57
NSW Government (including the Office for Health and Medical Research)	1,300,000.00
Burnet Institute	1,245,810.41
Australian Centre for HIV and Hepatitis Virology Research (ACH2)	1,003,826.41
Australian Science and Industry Endowment Fund (SIEF)	597,207.54
Commonwealth Scientific and Industrial Research Organisation (CSIRO)	507,714.36
Australia - India Strategic Research Fund	240,653.42
Australian Defence Force	240,611.18
ARC/NHMRC Research Network for Parasitology	222,503.43
Australian Centre for Vaccine Development (ACVD)	203,340.45
State Trustees Victoria	77,269.74
University of Melbourne	73,024.62
University of Western Australia (UWA)	54,407.94
Philanthropic	**3,584,417.17**
Newcrest Mining Ltd	3,079,831.07
Australian National Heart Foundation	279,643.02
The Merchant Foundation	120,892.21
CASS Foundation	68,862.89
ANZ Trustees Program - Buckland Foundation	35,187.98
TOTAL	**262,370,672.07**

Source: G-FINDER Public Search Tool

Appendix 2: Recipients of Australian neglected disease research funding (public and philanthropic sources), FY2007-2015

	US$	# grants received
Academic and other research institutions	**231,778,563.07**	**1,053**
The Walter and Eliza Hall Institute of Medical Research	39,531,660.03	70
University of Melbourne	30,751,739.72	175
Queensland Institute of Medical Research (QIMR)	29,757,189.04	104
Monash University	17,624,907.13	81
University of Sydney	17,077,566.12	75
Griffith University (including the Institute for Glycomics)	16,485,067.00	57
Burnet Institute (previously the Macfarlane Burnet Institute for Medical Research and Public Health)	15,504,997.41	85
The University of Queensland	12,005,321.77	100
University of New South Wales (UNSW)	11,699,376.43	19
Menzies School of Health Research	10,610,297.26	38
Australian National University (ANU)	5,795,946.50	61
Australasian Biosecurity Cooperative Research Centre	3,852,433.53	3
Murdoch Children's Research Institute	3,778,266.28	17
La Trobe University	3,626,188.17	25
University of Western Australia (UWA)	3,610,101.50	29
Macquarie University	1,686,877.05	12
James Cook University	1,461,316.86	18
Deakin University	1,193,777.54	11
University of Adelaide	808,426.44	8
Flinders University	693,680.69	6
Institute for Immunology and Infectious Diseases, Murdoch University	611,774.65	7
Mater Medical Research Institute Ltd	590,451.25	4
University of Technology Sydney	576,956.18	7
Menzies Research Institute	511,001.93	5
Queensland University of Technology	335,391.33	4
University of Canberra	314,124.69	5
Garvan Institute of Medical Research	263,940.76	5
Curtin University of Technology	245,966.96	5
The University of South Australia	213,895.16	5
The Alfred Hospital	154,766.66	2
Centenary Institute of Cancer Medicine and Cell Biology	151,120.16	7
St. Vincent's Institute of Medical Research	134,253.53	1
University of Tasmania	80,594.81	1
Queensland Centre for Mental Health Research	39,188.53	1
Government research institutions	**2,211,178.68**	**16**
Commonwealth Scientific and Industrial Research Organisation (CSIRO)	1,791,150.04	9
Australian Army Malaria Institute	420,028.64	7
Product Development Partnerships (PDP)	**26,320,120.24**	**17**

Medicines for Malaria Venture (MMV)	10,154,970.72	9
TB Alliance	7,075,139.65	3
Foundation for Innovative New Diagnostics (FIND)	7,075,139.64	4
Aeras	2,014,870.23	1
Other intermediary	**40,517.41**	**2**
Barcelona Institute for Global Health (ISGlobal) (including Fundacio Clinic per a la Recerca Biomedica (FCRB), Centro de Investigación en Salud Internacional de Barcelona (CRESIB), and Centro de Investigación en Epidemiología Ambiental (CREAL))	40,517.41	2
Aggregate Pharmaceutical and Biotechnology Companies	**1,621,724.26**	**4**
Multiple product developers	**398,568.41**	**1**
TOTAL	**262,370,672.07**	**1,093**

Source: G-FINDER Public Search Tool