Global Forum
for Health Research

HELPING CORRECT THE 10|90 GAP

10

1998-2008

Data on research and development (R&D) investments for health provide an indicator of current research priorities, trends, overlaps and gaps. As health is dynamic, it is vital to regularly track these investments to make sure they are used in more efficient, effective and equitable ways.

The Global Forum for Health Research is the only organization that regularly tracks and reports on the world's R&D investments for health. This 2007 collection of studies looks behind the global totals, analysing R&D for health expenditures in Argentina, China, Mexico and the United States. It also looks at investments in the research of cancer and 20 historically high-burden infectious diseases.

The rich tapestry of evidence provided reveals key conclusions:

• Investments in research for a range of globally important diseases and conditions remain inadequate – especially with respect to health problems in low- and middle-income countries.
• Matching investments with research priorities is of paramount importance for many poor countries affected by the double burden of both noncommunicable and communicable diseases.
• Large investors in high-income countries and governments in low- and middle-income countries pay insufficient attention to local, national and global priority needs when allocating resources.

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1998-2008

Monitoring Financial Flows
for Health Research 2007
Behind the Global Numbers

2007

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Monitoring Financial Flows
for Health Research 2007
Behind the Global Numbers

Edited by Mary Anne Burke, Andrés de Francisco and Stephen Matlin

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Note on the "10/90 gap"

In 1990, the Commission on Health Research for Development estimated that only about 5% of the world's resources for health research (which totaled US$ 30 billion in 1986) were being applied to the health problems of developing countries, where 93% of the world's burden of "preventable mortality" occurred. Some years later, the term "10/90 gap" was coined to capture this major imbalance between the magnitude of the problem and the resources devoted to addressing it.

Since then, the landscape of health research for development has changed in important ways:

• global expenditure on health research has more than quadrupled to over US$ 125 billion in 2003;
• there are many more actors engaged in funding or conducting health research relevant to the needs of developing countries;
• but the epidemiology of diseases has shifted substantially, so that many developing countries are now experiencing high burdens of non-communicable diseases such as cancer, diabetes, heart disease and stroke, as well as continuing high burdens of infectious diseases and injuries.

As a result of these changes, the total global expenditure applied to research relevant to all the health problems of developing countries cannot be estimated with any meaningful degree of accuracy.

Nevertheless, studies by the Global Forum for Health Research and others continue to demonstrate that health research applied to the needs of developing countries remains grossly under-resourced in may areas and the term "10/90 gap", while not representing a current quantitative measure, has become a symbol of the continuing mismatch between needs and investments.

Since its foundation in 1998, the work of the Global Forum for Health Research has focused on helping to redress this imbalance.

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Foreword

Linking resources with priorities for research for health

Research has made huge contributions to improving health during the course of the last century. People in many countries are living longer, healthier lives, as evidenced by large increases in average life expectancy and decreased risks of dying from causes such as pregnancy and childbirth, neonatal and early childhood conditions and infectious diseases. Research has also brought understanding of the origins, prevention and treatment of many chronic conditions.

In a world in which the highest attainable standard of health is one of the most highly valued aspects of fundamental human rights and in which resources are limited, it might be expected that research and development (R&D) would be focused to address the priority health problems for which adequate knowledge and tools are lacking. Sadly, this is not the case. In practice, far too little research has been devoted to finding solutions for the health problems affecting the least well-off – especially populations living in low- and middle-income countries (LMICs). Evidence of this can be found in the imbalances between funding for different areas of research compared with the magnitude of health problems; and similarly in imbalances measured by the outputs of publications on research in different areas of health.

Nowhere are these imbalances more evident than with regard to the health problems of LMICs. The absence of adequate knowledge and tools – including preventive vaccines, diagnostic methods and effective, affordable treatments – for a range of infectious diseases has led to the global recognition of this group of "neglected diseases" and the establishment of a number of international R&D initiatives and funding mechanisms to tackle them.

Much more needs to be done in this field. The chapter in this volume by Shiffman examines funding for 20 historically high-burden communicable diseases and makes a clear case not only for more public funding for R&D but also for a better balance in resources devoted to different diseases that affect LMICs. His study shows that donor behaviour is often not sufficiently based on rational assessments of health needs.

The health problems of the poor are not confined to communicable diseases. There has been an explosive growth in noncommunicable diseases (NCDs), including cancer, diabetes, heart disease, stroke and mental and neurological conditions, with the result that these now represent the major burden of disease in LMICs collectively and are the predominant causes of morbidity and mortality in every region except Africa. Much of the world's biomedical R&D has been focused on these chronic diseases in recent decades, with the result that major risk factors (lack of physical activity, poor diet, tobacco use) have been identified and tools for prevention, management and treatment have been developed. However, little research has been undertaken on the adaptation of prevention and treatment approaches to resource-poor settings. As a result, we still know very little about what works in practice to reduce risks and improve outcomes in different countries and among different socio-economic groups, or which diagnostic and treatment tools are most appropriate or affordable in different settings. Moreover, approaches to prevention and treatment of many chronic conditions require the presence of well-functioning health systems, conditions that often do not apply in LMICs.

The chapter by Sullivan, Eckhouse and Lewison for the European Cancer Research Managers Forum looks at one aspect of the complex picture for NCDs. It estimates global funding for cancer research to have been about 12% of world biomedical expenditure in 2001, compared with a global cancer burden of barely 5% of the total burden of disease (BoD). While this may be interpreted to suggest that cancer research may be relatively well funded compared with other areas, the disaggregated picture is also important. For example, the cancer burden in the United Kingdom was 15.5% of the total BoD, while the United Kingdom's output of cancer research papers was 10.7%. The approaches used in this study provide a means to assess the extent to which each country is devoting its research efforts towards its own priority health problems.

In its 1990 report, the Commission on Health Research for Development recommended that developing countries should have their own capacity to conduct and use essential national health research to address priority areas. However, few LMICs have developed the machinery to regularly collect, analyse and synthesize information on research resource flows and to utilize this information in priority setting. This volume presents three studies from countries which demonstrate the feasibility of doing this. The chapter by Pérez-Núñez and colleagues provides an analysis of resource flows in the National Institutes of Health in Mexico and demonstrates the weakness of linkages of the resources to national health priorities. The study by Maceira and Alcat on funding by the main public sector agencies in Argentina reaches similar conclusions. In her assessment of the health research system in the Shanghai province in China, Chen notes that, while public sector research resources have increased over several years, there are inequities in the allocation of research funds and insufficient utilization of the results to improve policy, programmes and service delivery affecting health.

Worldwide, the USA is by far the largest investor in R&D for health in both the public and private sectors. The chapter by Woolley, Connelly and Propst examines the historical trends and patterns of research resource flows. They note that, in relative terms, the R&D investments are modest compared with the magnitude of overall health spending, that resource flows for the National Institutes of Health (the main public sector body responsible for health research in the USA) have effectively shrunk in real terms since 2003, and that research on global health challenges such as neglected infectious diseases was only 8% of total US investment by public and private entities in 2006.

Overall, the rich tapestry of evidence provided in this volume, derived from studies in a number of high-, middle- and low-income countries and covering a range of communicable and noncommunicable diseases and conditions, leads to some common conclusions:
• Investments in research for a range of globally important health conditions remain inadequate – especially with respect to the health problems of the poor.
• Investors in R&D for health, whether large investors in high-income countries, donors to global health and development or public sector funders in LMICs, pay insufficient attention to local, national and global health priorities in allocating their resources.
• Machinery for regularly gathering, analysing, synthesizing and using data on research expenditures is generally weak or lacking, non-standardized and poorly applied to help guide future investment priorities.

As part of its overall strategy, the Global Forum for Health Research will continue to draw attention to these deficiencies and to the importance of creating better linkages between resources and priorities for research for the health of the poor.

Stephen Matlin
Executive Director
Global Forum for Health Research

Chapter 1

Public funding of health research in Argentina[1]

Daniel Maceira and Martín Peralta Alcat

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Using a political economy approach, the authors of this chapter sought to quantify public sector investments in health research by three main funding agencies in Argentina. The main conclusions that can be drawn from the study are:

- *Public investment in health increased over the ten-year study period and was heavily concentrated (75%) in the province of Buenos Aires and the Federal District (Buenos Aires City) where most researchers and research institutions were located. Only 3% of funding went to rural jurisdictions.*
- *Funds were not allocated on the basis of identified local regional health needs.*
- *Government funding for health research reveals a gap similar to the global '10/90 gap'. Less than 10% of grants and subsidies were allocated to research on endemic illnesses.*
- *Expenditures on health technology research increased two and half times, rising from 3.3% of total funding in 1997 to 8.2% at the end of 2006.*
- *The balance between expenditures on endemic and non-endemic issues may be improved by investing more in research on social determinants of health and health systems management and resources administration.*
- *There is no strategy for inter-agency coordination and specialization in particular areas of research.*
- *Although process in health research has been significant, there are still many challenges, ranging from strengthening efforts in building a national innovation system; to monitoring and evaluating the flow of funds by type of illnesses, region, institution and determinants of health; and to studying the contributions from the private sector and the international community.*

Public funding of health research in Argentina

Introduction

The last century witnessed great advances in the prevention, diagnosis and treatment of illness that have translated into better quality of care and longer life expectancy. Nevertheless, big health challenges remain, many around health inequities among countries and income groups. While world epidemiological patterns show that high-income countries are facing the challenge of new infectious diseases, like severe acute respiratory syndrome (SARS) and HIV/AIDS, low- and middle-income countries countries must meet those posed by a great variety of communicable and non-communicable diseases and in the context of limited resources.

Health research – defined as the creation of new knowledge and technologies towards increasing life expectancy and improving quality of life[2] – is a unique tool to respond to these challenges, contributing not only to prevention and treatment, but also to a better comprehension of socioeconomic determinants of health, and the strengthening of design and implementation of effective and efficient health programmes.

In 1990, the Commission on Health Research for Development estimated that only about 5% of the world's resources for health research (which totaled US$ 30 billion in 1986) were being applied to the health problems of high-income countries, where 93% of the world's burden of "preventable mortality" occurred[3]. Some years later, the term "10/90 gap" was coined to capture this major imbalance between the magnitude of the problem and the resources devoted to addressing it.

Argentina is no exception in the imbalance between health research investment and the population's health needs. Indeed, following a national macroeconomic crisis in 2001, it is presumed that the disparity has deepened. As with other low- and middle-income countries, Argentina faces the challenge of providing quality health care services, in an equitable and effective way, to address the double epidemiological burden of communicable and non-communicable diseases, and with limited resources. To meet this pressing need, a group of researchers from a variety of health care disciplines generated a space for debate on the present and future health research agenda in the country. The Health Research Forum for Argentina (FISA) was created to promote research utilization in policy-making and planning – a process that also demands additional efforts and training from the research community to communicate research results to policy-makers.

This chapter summarizes the main findings of a more extensive study, undertaken by the authors for FISA. Using a political economy approach, the study sought to quantify public sector investment in research for health by three main funding agencies in Argentina: CONICET (National Scientific and Technical Research Council), FONCYT (Scientific and Technological Research Fund of the National Agency of Scientific and Technological Promotion, Ministry of Education) and CONAPRIS (National Commission of Health Research Programs, National Ministry of Health). It also looked at the types of research funded and whether this research reflected national health priorities.

Political economy approach to the analysis of health research systems

A political economy approach to the analysis of health research systems locates such systems at the intersection of two larger systems: one related to the provision of **health care goods and services**, and the other associated with **innovation**. Both systems involve a tension between the creation and provision of socially preferable goods and their distribution.[4] In the case of the health care system, acknowledgement of health as a human right and health care as a fundamental human need involves a discussion about the mechanisms of financing services and improving equity and effectiveness. The innovation system, in turn, involves a tension between "creation of knowledge" as a public good and intellectual property rights, in which there may be fewer incentives to innovation production, given that the authors of innovation often cannot appropriate the benefits resulting from their work.[5]

From an economic perspective, the study of these systems, and the flow of resources within them, entails understanding relations between supply and demand of goods and services. Both systems share similar characteristics.[6] Firstly, they involve asymmetric information between the suppliers of goods and services (physicians and researchers) and users of those goods and services. In the health care system, for example, patients may perceive the need for care, but generally are not able to identify the treatment to "demand". Physicians rather than users, dictate consumption as they are in charge of the supply side. A similar tale can be told about the "markets of innovation". Secondly, both systems must operate with imperfect knowledge about threats to demand and supply. Thirdly, health and innovation have far-reaching effects on society, not included in third party consumption or investment decisions, known as externalities. And finally,

given the natural lack of homogeneity among providers, financiers and both types of goods, prices and the allocation of resources are greatly influenced by the bargaining power of physicians and researchers, patient/insurance systems and research funders.

These characteristics (lack of perfect/symmetric information among parties, externalities and unbalanced power to set and agree upon the rules of the game) are usually labeled as "market failures" in the economic literature, and are seen to prevent a socially preferable allocation of resources. According to basic economic theory, the existence of market failures requires the participation of the state to define an intervention framework for reducing the negative impacts on effectiveness and equity. Such a framework may involve alternative public-private cooperation schemes and varying levels of state involvement. The choice of action path will depend on the government's ability to identify social needs, its regulatory and/or financial capacity and also political preferences.

The health research system shares the same characteristics and constitutes a similar challenge to governments. The priority-setting mechanisms established by the public authority for allocating social research resources constitutes the "national innovation system". Such a system determines the sources of financing, defines the main areas of investment and designs the cooperation mechanisms between public agencies and other social actors (private enterprises, research institutes, patient associations, nongovernmental organizations)[7]. A political economy approach to studying health research systems thus involves an analysis of interests, actors and the relative power of each of them to set the sector's research agenda.[8]

Data and methodology

The authors began by creating a database of grants and scholarships awarded by the three Argentine national agencies between 1997 and 2006. Each entry included annual information on researchers and/or institutions awarded, province where the grant was located, research topic, and funding amounts (in Argentine pesos). In the case of multi-year grants, the amounts were uniformly divided by the number of years of the project. Grants were categorized by eight CONICET-defined research fields (see Box 1.1).

Box 1.1

Typology of research fields

1. Hygiene, food and nutrition
2. Endemic illness - applied research
3. Endemic illness - basic research
4. Non-endemic illness - applied research
5. Non-endemic illness - basic research
6. Curative and sanitary technologies (new vaccines, processes and techniques applied to health care)
7. Non-curative and sanitary technologies (health policy, management of health institutions, social factors)
8. Other

The final result was a panel database with 12 123 observations. Each observation constitutes an annual scholarship or project grant. Of the observations recorded 764 were for CONAPRIS, 9940 for CONICET and 1419 for FONCYT. These observations were the source for the descriptive and econometric analysis that follows.

Provincial and regional concentration patterns in the allocation of funds

As Figure 1.1 indicates, more than 75% of the scholarships and subsidies awarded by the three agencies went to individuals or institutions located in the Buenos Aires Federal District or Buenos Aires Province. Adding Córdoba, Santa Fe and Mendoza, that share reached nearly 97% of all funds allocated. Only 3% of funding went to rural jurisdictions. CONAPRIS was somewhat more "federal" than CONICET and FONCYT in its distribution of funds outside the city of Buenos Aires and Buenos Aries Province.

Figure 1.1

Geographical distribution of grants and subsidies

CONAPRIS

- Buenos Aires 28.53 %
- Córdoba 6.84 %
- Santa Fe 4.56 %
- Tucumán 4.19 %
- Chubut 2.09 %
- Mendoza 1.57 %
- City of Buenos Aires 43.19 %
- Salta 1.44 %
- Jujuy 1.31 %
- Misiones 1.18 %
- Others 5.36 %

CONICET

- Buenos Aires 15.09 %
- Córdoba 10.92 %
- Santa Fe 4.67 %
- City of Buenos Aires 63.45 %
- Mendoza 3.32 %
- Others 2.55 %

FONCYT

- Buenos Aires 11.63 %
- Córdoba 14.16 %
- City of Buenos Aires 64.06 %
- Santa Fe 5.92 %
- Others 4.21 %
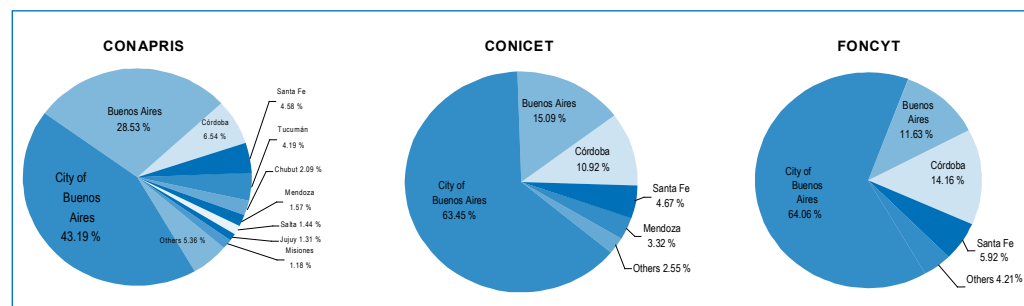
Source: Based on information provided by CONICET, FONCYT and CONAPRIS.

Trends in public funding for health research

Between 1997 and 2006, all three agencies showed positive rates of growth in funds allocated, in constant prices, despite fluctuations in the annual growth rate of two of the agencies (see Figure 1.2). FONCYT's funds grew by 30.2% in 2004 constant prices, while CONICET's and CONAPRIS' funds grew by only 4.7%. If they continued to grow at the same rate, the funds awarded by FONCYT to pursue health research would have surpassed those of CONICET by 2006, becoming the main public source of research for health financing.

Figure 1.2

Trends in public financial flows, 1997–2006 (constant prices from 2004)
(1 US dollar = 3.15 Argentine pesos)

Average growth CONICET 4,7 %

Average growth FONCYT 30,20 %

Average growth CONAPRIS 4,66 %

CONAPRIS

Million US dollars

CONAPRIS — CONICET — FONCYT

Year
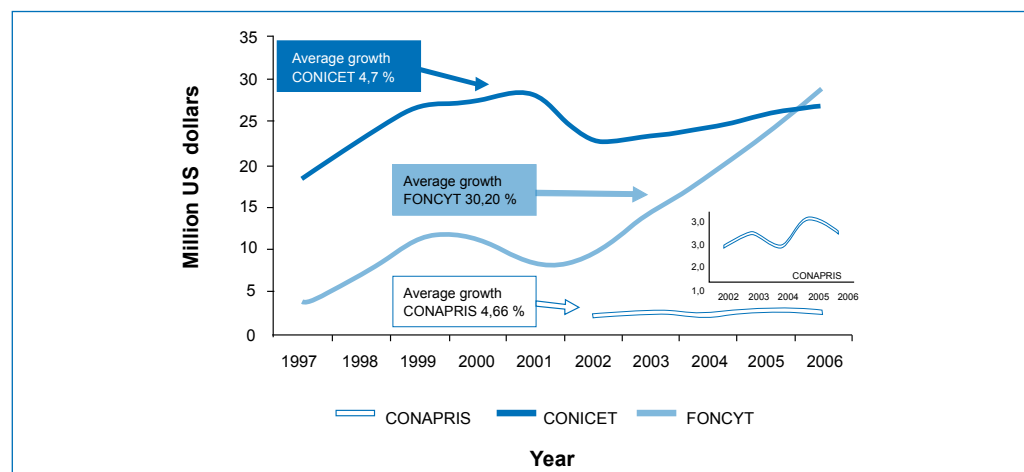
Source: Based on information provided by CONICET, FONCYT and CONAPRIS.

Types of research funded

Together, basic and applied research on non-endemic illnesses received over three quarters (77.3%) of the total number of grants and subsidies awarded by the three agencies (see Figure 1.3). Basic and applied research on endemic and communicable illnesses received 8.9%. Defined using this typology, government funding revealed a gap similar to the global "10/90 gap". Less than 10% of grants and subsidies were allocated to research on endemic illness.

Figure 1.3

Research topics as percentage of total

- Other — 5.3%
- Basic research on non-endemic illnesses — 44.7%
- Basic research on endemic illnesses — 2.3%
- Non-curative health technology — 4.0%
- Curative health technology — 2.2%
- 32.6%
- 6.6%
- Hygiene, food and nutrition — 2.3%
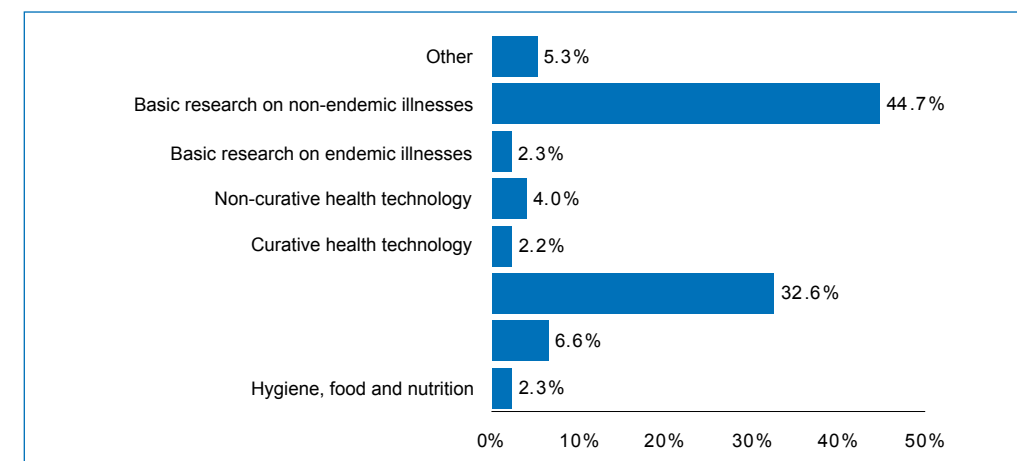
Source: Based on information provided by CONICET, FONCYT and CONAPRIS.

Looking at the allocation of funds by research type within each of the three agencies (see Table 1.1 and Figure 1.4), the authors found that CONICET and FONCYT devoted most of their funds to the study of non-endemic illnesses. CONAPRIS, on the other hand, provided a relatively significant amount of resources to the study of topics related to non-curative health technology (see Table 1.1). These included research on hospitals and their administration as well as the design and management of public health programmes (see Figure 1.4).

Table 1.1

Allocation of Argentina's research funding

Disease-specific research	Argentina total	(National Commission of Health Research Programs, National Ministry of Health) CONARPIS	(National Commission for Scientific and Technological Research) CONICET	(Scientific and Technological Fund) FONCYT
Basic research on non-endemic illnesses	44,70%	15,00%	46,40%	52,40%
Basic research on endemic illnesses	2,30%	1,30%	2,20%	3,60%
Applied research on non-endemic illnesses	32,60%	13,80%	35,50%	25,60%
Applied research on endemic illnesses	6,60%	6,70%	6,50%	8,00%
Curative health technologies	2,20%	0,90%	2,20%	3,00%
TOTAL	88,40%	37,70%	92,80%	92,60%
Other research (Some of which is disease-specific)				
Non-curative health technologies	4,00%	38,90%	1,20%	3,00%
Hygiene, food and nutrition	2,30%	7,50%	1,90%	1,90%
Other	5,30%	16,30%	4,20%	2,50%
TOTAL	11,60%	62,70%	7,30%	7,40%
GRAND TOTAL	100,00%	100,40%	100,10%	100,00%

Source: Based on information provided by CONAPRIS, CONICET and FONCYT.

Figure 1.4

Research themes by agency
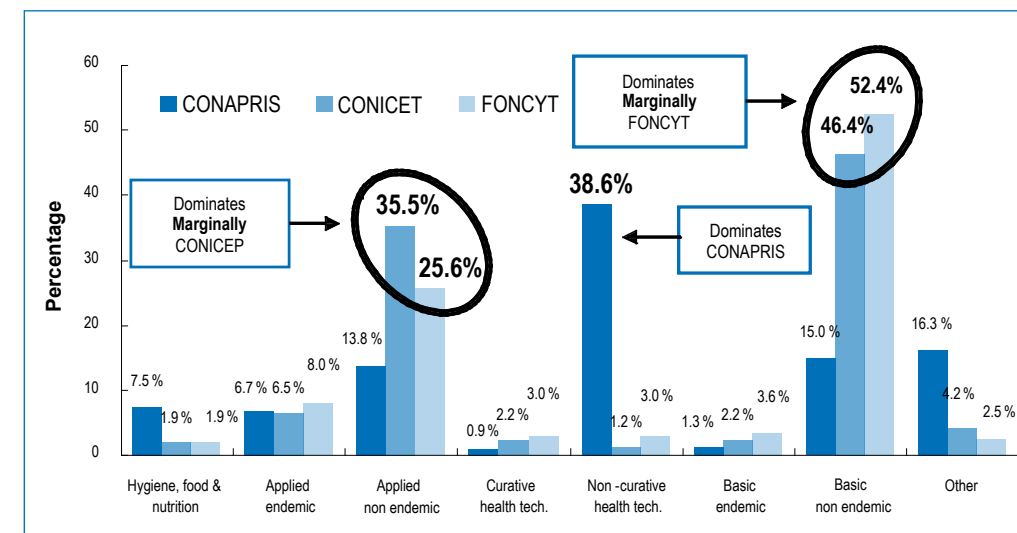
Source: Based on information provided by CONICET, FONCYT and CONAPRIS.

As noted in Figure 1.3 above, only 8.9% of grants and subsidies were awarded to basic and applied research on endemic illnesses. Of these, some illnesses such as hepatitis A, hemolytic uremic syndrome, Chagas disease and Argentina Chronic Hydro-Arsenicism (ACHE) were more prevalent in Argentina than in other countries in the world. As Figure 1.5 shows, 29.5% of grants and subsidies for research on endemic illnesses went to the study of Chagas disease, while 13.6% went to HIV/AIDS-related studies and 9.2% to projects focused on the hemolytic uremic syndrome. Studies devoted to tuberculosis represented 5.6% of the grants allocated to endemic illnesses.

Figure 1.5

Research on endemic illnesses[9] (percentage of all funds for endemic illnesses)
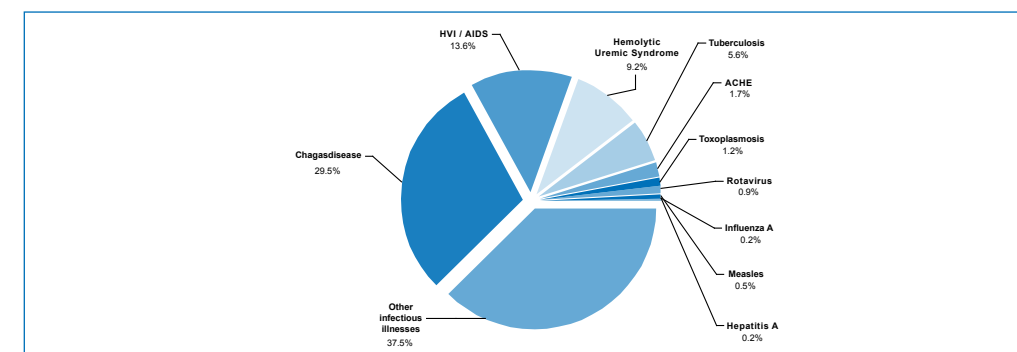
Source: Based on information provided by CONAPRIS, CONICET and FONCYT.

The distribution of funding for endemic diseases within each agency demonstrates the interest of the national government in investing in research related to Chagas disease, HIV/AIDS, hemolytic uremic syndrome and tuberculosis (see Table 1.2), but not a strategy for inter-agency coordination and specialization in particular areas of research. Endemic research in all three agencies is concentrated on the same four research topics.

Table 1.2

Distribution of funding for endemic diseases by agency

CONAPRIS		CONICET		FONCYT	
Illness	%	Illness	%	Illness	%
Chagas disease	34.4	Other infectious diseases	47.1	Chagas disease	40.0
ACHE	16.4	Chagas disease	24.0	Other infectious diseases	25.5
HIV/AIDS	14.8	HIV/AIDS	13.8	HIV/AIDS	12.7
Other infectious diseases	13.1	Hemolytic uremic syndrome	9.6	Tuberculosis	9.1
Hemolytic uremic syndrome	11.5	Tuberculosis	3.9	Hemolytic uremic syndrome	7.3
Tuberculosis	6.6	Toxoplasmosis	1.1	Rotavirus	1.8
Rotavirus	1.6	Hepatitis A	0.3	Measles	1.8
Influenza A	1.6	Rotavirus	0.2	Toxoplasmosis	1.8
Hepatitis A	0.0	Measles	0.0	Hepatitis A	0.0
Measles	0.0	ACHE	0.0	ACHE	0.0
Toxoplasmosis	0.0	Influenza A	0.0	Influenza A	0.0
TOTAL	100.0	TOTAL	100.0	TOTAL	100.0

Source: Based on information provided by CONAPRIS, CONICET and FONCYT.

As Figure 1.6 shows, during the ten-year study period, funding for research on endemic diseases (both basic and applied research) peaked at 10.6% of total funding in 2003 before falling to 9.2% in 2006. This represented a 13% loss in overall expenditures on endemic diseases.

Figure 1.6

Research funding on endemic illnesses (percentage of total)
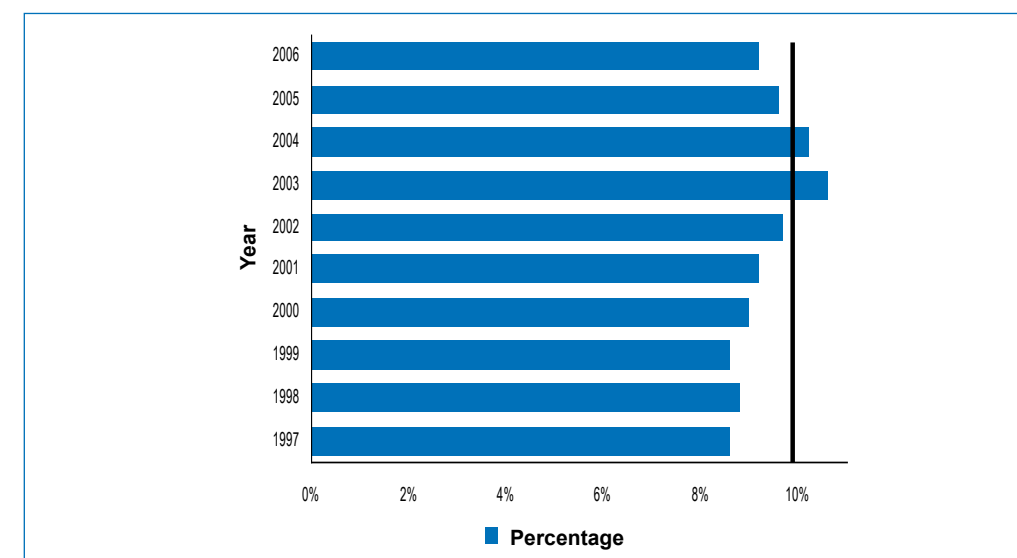
Source: Based on information provided by CONAPRIS, CONICET and FONCYT.

The authors' analysis showed that research funding for non-endemic illnesses also decreased over time, but less dramatically with a 6% loss in overall expenditures on non-endemic diseases, from more than 80% of public funding in 1997 to 75.4% in 2006. Health technology research benefited the most over the ten-year study period, with R&D expenditures increasing by 148% from 3.3% of total funding in 1997 to 8.2% in 2006.

Econometric analysis

In addition to the above descriptive analysis, the authors undertook an econometric analysis to explore the relationship between the decision-making mechanism and investments in R&D for health. The analysis tested the strength of the relationship between the probability of public investment in health research, by category with a series of explanatory variables. These variables included characteristics of the researchers (sex and age), as well as the location of the project (given by geographical region). A dummy variable was introduced to identify the presence of coordination or complementarities among institutions. Finally, a variable identifying the amount awarded to each project was included to capture differences in funding allocation based on project characteristics.

The results confirmed and qualified the findings of the descriptive analysis. The coefficients associated with FONCYT were significant and positive in four thematic areas, representing a relatively low degree of research specialization within the agency. Additionally, CONAPRIS presented positive and significant coefficients for research related to hygiene, food and nutrition; non-curative health technology; and management and health system performance. In turn, CONICET showed a wide diversity in projects awarded, although the data supported

a more significant relative bias towards non-endemic research.

From a geographical perspective, the authors detected a pattern of regional specialization, although that pattern does not show a link between local epidemiological and public health needs and types of research projects funded. The coefficients associated with the amount of research funds received by project were marginal, suggesting that relatively low specialization among financing agencies reduces

the chances of differences in the scale of resources allocated among fields and research topics.

The analysis also showed a higher degree of participation by female than male researchers in research on endemic and curative health technology, and lower involvement in research on non-endemic illnesses. There was also a clear bias towards funding initiatives by young researchers in CONAPRIS, while CONICET and FONCYT favoured proposals by senior researchers.

Conclusions

The process of generating knowledge within the health research system needs revisiting, not only from a theoretical perspective (motivations, interests, social health objectives and priorities), but also from an empirical point of view, measuring the scale of research activity and the effectiveness and equity of that activity. The study reported on in this chapter provides a picture of research activity in Argentina, focusing on the allocation of public resources in health research by the three most relevant local health research institutions.

The main conclusions that can be drawn from the study are that public investment in health increased over the study period and was heavily concentrated in the province of Buenos Aires and the Federal District (Buenos Aires City) where most researchers and research institutions were located, and that funding allocations were not made on the basis of identified local regional health needs.

The study also points to the need to strengthen efforts in building a national innovation system. In spite of demonstrating some relative specialization among institutions by types of heath research conducted.

Finally, the study provides evidence of a health research gap in Argentina, similar to the one that exists globally. Considering the allocation

of funds to endemic illnesses against the other categories of research, the public research gap in Argentina is 9/91. This important finding aside, the balance between expenditures on endemic and non-endemic issues may be improved, by the inclusion of other topics in the group of recommended research issues to be addressed. These might include themes that are traditionally considered weaknesses in health systems development in middle-income countries, such as management and resources administration, and by the inclusion of more research on social determinants of health rather than the heavy investments in disease-related research.

Although progress in health research has been significant, there are still many challenges. One of these is the need to build and strengthen research capacities. Another is sustaining a healthy flow of funds to research capacity strengthening. This requires the development of methodologies for prioritizing health needs and a systematic effort to monitor and evaluate the flow of funds by type of illnesses, region, institution, and determinants of health. Specifically for Argentina, the agenda should include a more comprehensive look at the provincial public investment in health research and contributions from the private sector and the international arena.

[1] This chapter synthesizes the main findings of a paper developed for the Health Research Forum for Argentina (FISA), and financed by the Pan American Health Organization, available at www.cedes.org. The opinions expressed in this chapter are the authors' own; they do not necessarily represent those of the FISA Scientific Committee members, nor those of the institutions that constitute the Forum. Correspondence to: danielmaceira@cedes.org

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[9] Other infectious illnesses include brucellosis, salmonella and dengue.

Chapter 2

Financial flows for research for health and development in Mexico: an analysis of the National Institutes of Health

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Insufficient information about the amount and the allocation of investment in health research and development (HR&D) is available in Mexico to inform policy- and decision-making and to monitor and evaluate the performance of health research institutions. The authors studied research for health expenditures in the Mexican National Institutes of Health (INSALUD) for the years 2004 and 2005 and the extent which they coincide with research priorities:

- *Total expenditures on research by the Mexican National Institutes of Health in 2004 was Mex$ 767 million. Spending increased by 7.6% to Mex$ 826 million in 2005.*
- *The institutes vary significantly in the percentage of their overall budget dedicated to research. The HIM, INCAN, INCAR, INNN, INPED, INPER and INR all dedicated less than 10% of their budget to health research in both 2004 and 2005.*
- *The INSP, INCMNSZ and INER are the three most important institutions for health research among the INSALUD institutes. Together they accounted for 55% of all health research expenditure in 2004 and 46% in 2005. The INSP alone contributed the greatest share to health research in 2005, accounting for 22% of all research expenditure within the INSALUD.*
- *The type of research carried out by the INSALUD is predicated on the population that they serve. The perinatal and pediatric institutes (INPED, INPER and HIM) dedicate a significant portion of their research effort to Group I diseases. The other institutions offering medical care concentrate their research efforts on Group II diseases and conditions. Finally, the INSP has a more heterogeneous portfolio of research, as expected of a public health institution.*
- *While some institutions have developed their own priority lines of research, other INSALUD institutes lack priorities for allocation of core funding. They appear instead to follow the personal interests of their researchers.*
- *The finding that none of the institutes tracks the use of federal research funds in a way that enables them to assess whether the allocation of funds is consistent with institutional priorities suggests an opportunity for institutional strengthening.*

Financial flows for health research and development in Mexico: an analysis of the National Institutes of Health

Introduction

In Mexico, the 2002 Science and Technology Act was passed to consolidate national research efforts.[1] The legislation defines priorities and criteria for the allocation of public expenditures in science and technology at the federal level. It also defines the programmatic and budgetary guidelines to be followed by federal government agencies in planning and evaluating the use of financial resources. This law establishes some principles and state policies regarding: public/private participation; mechanisms for the selection of recipient individuals and institutions; types of programmes or projects eligible for financial support; mechanisms to guarantee timely and adequate financial support for approved projects; and mandatory evaluation of the use of public resources for research.

In this context, the Action Programme for Health Research (PAIS) with the National Science and Technology Council (CONACyT) and health sector stakeholders sought to reorient and consolidate health research, its translation into policy and its diffusion and scientific and technological innovations through the creation of a Sectoral Fund for Research in Health and Security (FOSISS).[2] The Ministry of Health (SSA), the Mexican Institute of Social Security (IMSS) and the Social Security and Services Institute for Federal and State Workers (ISSSTE) contribute to the FOSISS, with matching funds from CONACyT.

Nonetheless, insufficient information about the amount and the allocation of investment in health research and development (HR&D) is available in Mexico to inform policy- and decision-making and to monitor and evaluate the performance of health research institutions. Andrés de Francisco, Deputy Executive Director of the Geneva-based Global Forum for Health Research, said at the Forum 8 meeting in Mexico City in November 2004 that "… there is continuing under-investment in health research aimed at reducing inequities in health and health research for the world's most disadvantaged populations, especially women, children and the elderly…," adding "[w]e need to know how current research dollars are being spent by whom and for whom. But that is not enough. We also need to ask where the resources will come from and who is responsible for finding the resources, determining the research priorities and using the results".[3]

To address this pressing need, the authors adapted the methodology recommended by the Global Forum for Health Research in its *A Manual on Tracking Resource Flows for Health Research and Development*[4] to estimate research for health expenditures in the Mexican National Institutes of Health (INSALUD) for the years 2004 and 2005. The authors also analysed the extent to which research priorities and funding coincided.

Why monitor resource flows for research for health and development?

It was estimated that only 10% of the US$ 70 billion spent on research for health worldwide by the public and private sectors in 1998 addressed health problems in low- and middle-income countries (LMICs) that bear the burden of 90% of the world's health problems.[5] The term "10/90 gap" captures the magnitude of the discrepancy between the burden of disease and the financial flows to research for health.[6] This gap – first brought to light by the Commission on Health Research for Development in 1990[7] – persists despite significant increases in health research investments over the past 17 years.[8]

At the Global Forum for Health Research's Forum 8, policy-makers declared that research for health – in particular, research on the determinants of health in low-income country settings and among vulnerable populations – is fundamental for achieving the Millennium Development Goals (MDGs). Such research should encompass a wide spectrum of biomedical sciences, policy and health systems, social sciences, health economics and operational and behavioural research. It should also delve into the relationship between health and different cultural, physical, political and social environments. In other words, research should be transdisciplinary and intersectoral in nature.[9]

The Global Forum advocated for governments to spend at least 2% of their national health budget on research for health, a recommendation first made by the Commission on Health Research for Development in 1990.[10] These funds should be employed locally for research for health and building capacity for research. The Commission also recommended that donors earmark 5% of their financing in the health sector for research and capacity building in LMICs. Monitoring progress towards these recommendations is a complementary activity of vital importance.[11]

Several recent studies carried out in LMICs, however, indicate that the wide gap between the Commission's recommendations and spending patterns for HR&D persists. Under-funding of research for health at the national level means that scientists must depend on external sources of funding. Such funding is often driven by the priorities of international donor agencies or large transnational pharmaceutical and biotechnology companies, neither of which may be in line with local health needs and priorities. These collaborations also pull highly qualified and already scarce personnel away from more relevant and pressing research issues in their countries.[12]

In LMICs where public funds for health and social development are limited, it is important that these resources are used wisely and efficiently. Policy-makers have the difficult task of defining the best way to distribute resources to achieve health goals.[13] Past decisions guiding the allocation of resources have not always been equitable, nor has much attention been paid to cost and efficiency. As a result, highly specialized and expensive curative activities have been prioritized to the detriment of strategies aimed at preventing and addressing the primary health needs of the population, or at generating knowledge that improves the public response to priority health conditions.[14]

A detailed mapping of resource flows will thus help decision-makers to better assign funds for HR&D by identifying areas that do not attract sufficient financing and by avoiding unnecessary duplication of research efforts.[15] It will also encourage transparency regarding the management and governance of funds for research for health.[16]

Conceptual framework

Mapping resource flows for research for health is a complex and daunting task that should start with a conceptual framework for (i) understanding systems of research for health and their functions, and (ii) defining research for health needs.

Understanding systems of research for health and their functions

The **health system** is comprised of all actors, sectors, organizations, institutions and resources whose mission is to improve health. A **system of research for health** can be defined widely as the persons, institutions and activities whose primary goal is the generation and application of high-quality knowledge to promote, improve and/or maintain the health of the population. The mechanisms that promote the utilization of this research are also part of the health research system.[17] Health and systems of research for health are mutually dependent. An adequately functioning health system is critical for the development and provision of interventions that affect public health and health outcomes. On the other hand, a well-constituted research for health system is important for an effective and efficient health system. Both systems are equally complex, complicating their administration.[18]

The principal objectives of a system of research for health are the production of scientifically valid knowledge and innovations, promotion of the use of research results and, ultimately, improvements in health and health equity.[19] This knowledge base does not need to come exclusively from original research.[20] It can also result from the adaptation of existing knowledge to local conditions, the synthesis of existing research, or the generation of evidence based on public health interventions.[21]

There are four clearly identified functions of all systems of research for health to achieve the system's intrinsic objectives:[22]

Stewardship
- Define and articulate the vision of the national system of research for health
- Identify adequate priorities for research for health and coordinate the adherence of different actors to those priorities
- Establish and monitor ethical standards for research for health and research alliances
- Monitor and evaluate the system of research for health

Financing
- Secure research funds and allocate equitably and accountably

Resource generation
- Build, strengthen and maintain human and physical capacity to conduct and foster research for health, as well as its practical application

Production, synthesis and application
- Produce scientifically valid research in priority areas
- Translate, synthesize and communicate research findings to inform decision-makers (policy-makers), health personnel and public opinion
- Promote the use of research in the development of medications, vaccines and other strategies to combat disease and improve health

Evaluating the functioning of health research systems and monitoring the flow of resources to and within such systems requires a second conceptual framework – one for defining research for health needs.

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Defining priorities of research for health

Priorities of research for health should respond to the health conditions and needs of the population,[23] be founded on expert opinion,[24] and include the priorities defined by civil society.

A **health need**, however, is not necessarily a **health research need**. Indeed, the Commission on Health Research for Development and the Global Forum for Health Research argue that part of the "10/90 gap" is attributable to health needs that do not necessarily have a direct link to research.[25]

According to WHO, a health need speaks to a measurable deficiency upon which an intervention can be carried out.[26] In some instances research has already produced the information needed to act on specific health needs, but this evidence has not been implemented into daily practice. Moreover, available evidence may not result necessarily in modifications or interventions that lead to reduced incidence.[27] Focusing research on previously identified health needs can create a research environment that is fixed and unable to adapt to new health problems or improve knowledge in a subject area. Emerging and re-emerging diseases challenge this circular focus by presenting an obvious problem requiring immediate attention. The case of endemic diseases is more complex; their prevalence and many of their determinants have already been studied. Research into the most effective and efficient interventions should be carried out, without indefinitely replicating studies in different populations. This unfortunately common phenomenon has been described in the specialized public health literature as "circular epidemiology".[28]

Given that there are nearly as many ways of defining health research priorities as there are challenges in doing so, the authors opted for an inclusive definitional framework that includes: priorities from both a policy and burden of disease standpoint; the twelve areas of research, identified by the WHO's Advisory Committee on Health Systems Research, which constitute the main barriers to the adequate performance of health systems in developing a research agenda that will support the achievement of the Millennium Development Goals (MDGs);[29] the MDGs themselves; and the ten risk factors identified by WHO as principal causes of a large portion of the burden of disease in low-mortality developing countries like Mexico.[30]

Study design and methodology

The authors chose to employ a case study approach to document expenditures in health research and development in Mexico's INSALUD for the years 2004 and 2005 and to analyse the extent to which research priorities and funding coincide.[31] As previous experience has shown, key informant interviews and personal contact are especially useful in obtaining information about the flow of governmental financial resources (both in Ministries and research institutions).[32] As such, the authors began by contacting directors of the individual INSALUD institutes to acquaint them with the project's objectives. They received an initial positive response from all 12 institutes including the INSALUD (see Box 2.1).

Next, the authors invited research directors and administrators of each of the INSALUD institutions to a meeting where they presented the project in detail and outlined their information needs and proposed analysis. They also clarified concerns and scheduled dates with each of the institutions to begin data collection.

To gather information on the specific characteristics of each institute (name, mission, objectives, budget) the authors adapted a questionnaire developed by the Global Forum for Health Research for this purpose, carefully keeping changes to a minimum to permit cross-national comparisons with other countries using the same questionnaire. Since an important objective of this work was to investigate specific expenditures by project, a second questionnaire was also used for this purpose.

Interviews with key personnel at the six INSALUD institutions that ultimately agreed to participate (see Box 2.1), elicited information about institutional policies related to research (especially those related to prioritization of research projects), management of resources, financial information systems, and HR&D research projects that were ongoing during the study period. Clarifications and corrections were made as necessary, and to facilitate comparison all figures were standardized to 2005 Mexican pesos (Mex$), using the Bank of Mexico's consumer price index.[33]

Encountering a lack of cooperation from some administrators and inefficiencies in information systems of several of the INSALUD institutes, the authors also employed secondary sources to complete the data collection and analysis. Using the report that all INSALUD institutes are required to submit to the Mexican Treasury (Secretaría de Hacienda y Crédito Público) and the list of projects registered in each INSALUD institution, the amount of resources allocated to different research areas was estimated.

A search of national and international literature was conducted to compile a list of identified priority health needs in Mexico and Latin America from both a policy and burden of disease perspective. Agreement across a variety of sources, including the Mexican National Plan for 2000-2006, was evaluated. Priorities defined from a burden of disease perspective relied on two types of indicators: those related to mortality and those to morbidity. As expected, those

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related to mortality were consistent across all sources, while those for morbidity were less so. While this may be a rough approach to estimating identified health priorities in Mexico, the authors believe it to be adequate for the exploratory focus of the present study. A complete list of the priority areas identified, along with those derived from the framework outlined above are summarized in Table 2.1.

Table 2.1

Priorities for health research

Leading causes of morbidity and mortality in Mexico and Latin America[34]	Acute respiratory illnesses Alcohol consumption Alzheimer's and other dementias Birth asphyxia and trauma Asthma Bipolar disorders Breast cancer Cardiovascular diseases Cervical cancer Cerebrovascular diseases Chronic obstructive pulmonary disease Dengue and malaria Depressive dementias Diabetes mellitus Diarrhoeal diseases Endocrine problems (apart from diabetes) Fractures (arm and leg) Hepatic cirrhosis HIV/AIDS Hypertension Intestinal infection, amoebae and helminthiasis Ischaemic heart disease Kidney disease Lower respiratory infections Maternal mortality and morbidity Lead-related mental retardation Nutrition (protein-energy malnutrition, iron deficiency) Osteoarthritis Perinatal conditions and mortality Protein-energy malnutrition Road traffic accidents Schizophrenia Trachea, bronchus and lung cancers Tuberculosis Unipolar depressive disorders Violence and self-inflicted injuries
Task Force on Health Systems Research[35]	**Financial and human resources:** Community-based financing and national health insurance Human health resources at the district level and below Human health resources at the national level

	Organization and provision of health services: Community participation Equitable, efficient and effective medical attention Organization of health services Policies for medicines and diagnostics **Governance, stewardship and knowledge management:** Governance and accountability Health information systems Priority setting and evidence-based policy formulation Effective approaches for intersectoral commitments for health **Global influences:** Effect of global initiatives and policies (including trade, donors and international agencies) on health systems
Millennium Development Goals[36]	Eradicate extreme poverty and hunger Achieve universal primary education Promote gender equality and empower women Reduce infant mortality Improve maternal health Combat HIV/AIDS, malaria and other diseases Ensure environmental sustainability Develop a global partnership for development
Risk factors leading to greatest amount of burden of disease[37]	Alcohol use High blood pressure Smoking and oral tobacco use Underweight Obesity, overweight and high body mass High cholesterol Low fruit and vegetable intake Indoor smoke from solid fuels Iron deficiency Unsafe water, sanitation and hygiene

INSALUD expenditures

According to the administrative reports on expenditures obtained directly from the Treasury (Cuenta de Hacienda Pública),[38] expenditures by all 12 institutions totaled Mex$ 7 244 623 782 in 2004 and Mex$ 7 259 105 301 in 2005. These amounts represent 3.04% and 2.98% of public health expenditure in 2004 and 2005, respectively, and less than 0.09% of the gross national product in both years.[39]

Figure 2.1 shows that the INNN received the most funding (Mex$ 1 042 220 627 in 2004 and Mex$ 1 103 075 695 in 2005), while the INPSI received the smallest amount of federal funding (Mex$ 194 185 532 in 2004 and Mex$ 188 387 239 in 2005). Figure 2.1 also displays the breakdown of expenditure by budget category. Administrative support tended to be higher in 2004 than in 2005 across all the INSALUD institutes, while expenditure for human resources increased across the two years. This should be interpreted with caution, as there may be differences in the coding of expenditures between the two years. Nearly all the institutes

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dedicate the majority of their budgets to medical care. The exceptions are the INSP and the INMEGEN, which do not provide medical care. In INMEGEN, a significant portion of the budget is allocated to construction of infrastucture, which is unsurprising given that this institute was founded in 2004.

INSALUD expenditures by budget category[40]
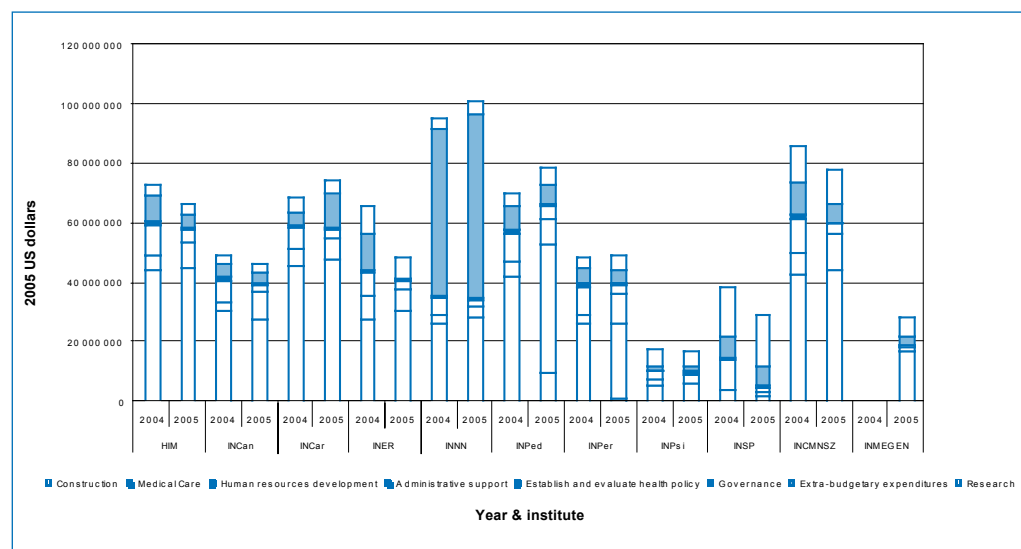
Of the total federal funds received by the INSALUD, total expenditure for health research and development in 2004 was Mex$ 767 376 823, representing 10.6% of the total expenditures (see Table 2.2).

Table 2.2

INSALUD expenditure

Year	Total expenditure (millions of 2005 Mex$)	Research expenditure (millions of 2005 Mex$)	Research expenditure as % of total expenditure
2004	7245	767	10.6%
2005	7259	826	11.4%

The amount spent on health research varied across institutes, from Mex$ 24 547 799 at the INCAN (representing only 3% of total federal resources for the INSALUD dedicated to HR&D) to Mex$ 179 906 583 at the INSP representing 23% (see Figure 2.2). The INSP invested the largest proportion of its own resources in research, close to 59% of its federal funds. As mentioned earlier, this high percentage is because the INSP does not provide medical care, an area to which the other INSALUD institutes must allocate a significant portion of their budget (see Figure 2.1).

Figure 2.2

Institutes' contribution to HR&D in the INSALUD, 2004-2005
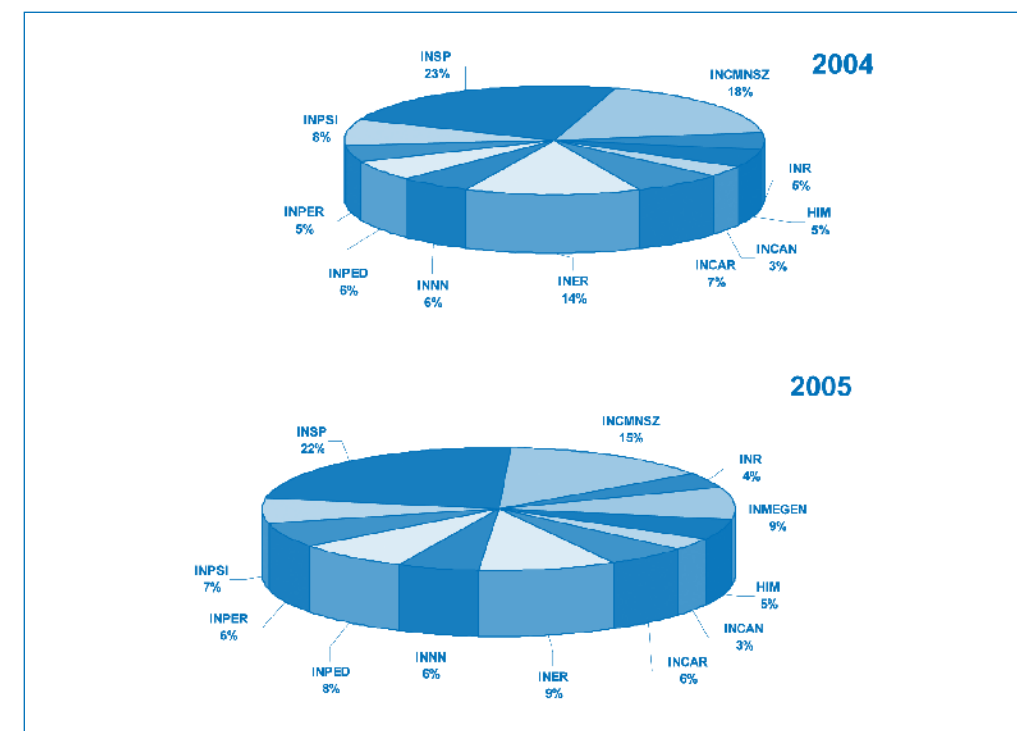
Table 2.2 also shows that from 2004 to 2005, the INSALUD expenditure for HR&D increased by over 7.6% to Mex$ 825 711 313 in 2005. The distribution of federal funding among the institutes changed in 2005 because of the inclusion of the newly created INMEGEN, which started reporting expenditures in 2005. Nonetheless, the INSP remained the institute with the most resources dedicated to HR&D, totaling Mex$ 188 741 705 (23% of the INSALUD total), and the INCAN the least, at Mex$ 27 854 408 (4% of the total). Half of the INSALUD institutes recorded increases in federal resources dedicated to HR&D over the two-year period. The INCAR recorded a budget increase from 2004 to 2005, yet dedicated a smaller proportion of its budget to HR&D in 2005 (see Figure 2.3). While the total budget of the HIM and INSP decreased over the two years, the percentage of funds expended on research increased.

Figure 2.3

Research expenditure as a percentage of each institute's total expenditures
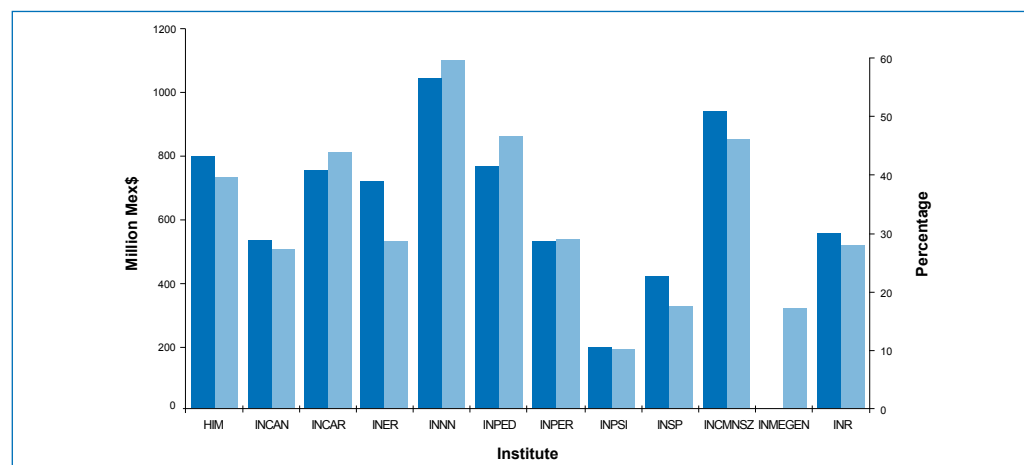
Figure 2.4 shows expenditures on salaries, materials and supplies, general services, capital expenditures, and other operating expenses within each institute's research expenditure. Substantial differences in reporting are observed between the two years. The expenditure item, "other operating expenditures" represented a significant proportion of expenditures in 2004 for most of the institutes; however in 2005 none of the INSALUD reported expenditures in this category. This is particularly evident in the HIM, INER, INSP and the INCMNSZ. This increase can be attributed to changes in reporting requirements to the Treasury between the two years.

Figure 2.4

Research expenditures by budget category[41]
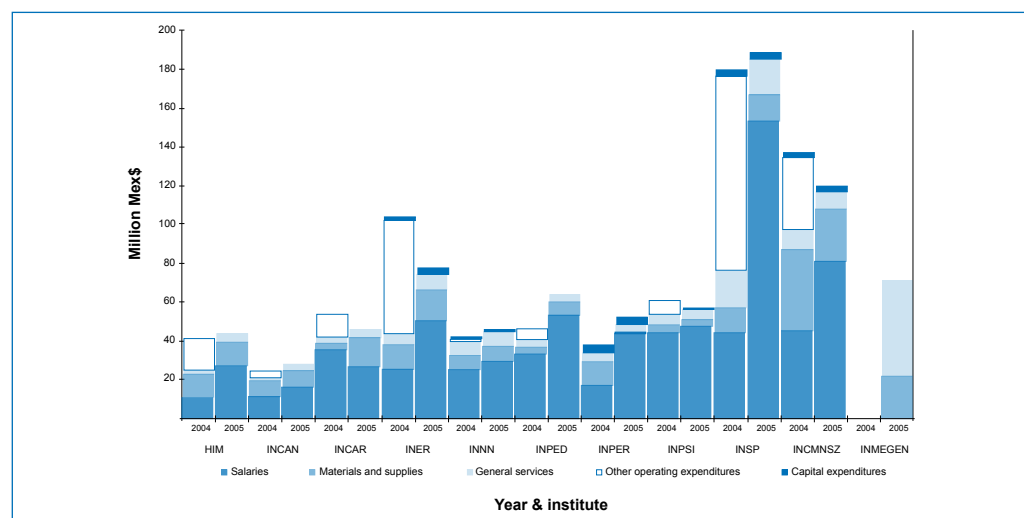
Regrettably, these reporting requirements did not obligate institutes to provide information about the areas of health, or more specifically the priority health research areas being financed. Only a few of the INSALUD institutes had a list of ongoing research projects for each year, and not all tracked expenditures by project. Instead, the study turned to interview data for information on which priority areas were being financed. The following section presents the interview findings for the eight INSALUD institutes that took part in the administrator interviews and the six that provided budget detail.

INSALUD case studies

All of the INSALUD directors initially showed interest in participating in the study, as did all of the INSALUD administrators. However, the INCAN and HIM participated only in the initial interview and decided not to provide detailed financial information once the specific informational needs of this study were discussed. Ultimately, the INCAR, INNN, INPED, INPER, INR and INSP provided the specific financial data requested. The data provided displayed great heterogeneity across institutes.

Reasons for non-participation varied. In some cases it was because of administrative difficulties in obtaining the requested information as it was not captured as such by their accounting procedures and information systems. This was a consistent problem among projects financed by federal resources. The majority of the INSALUD institutes that finance HR&D with federal funds do so indirectly via salary payments and purchase of supplies, materials and other items requested by each researcher or priority health area. For this reason, the majority of the INSALUD institutes could not specify expenditures by project for federally-funded research projects, as this information was available only on an aggregate level. Nearly all institutes maintained better accounting records for third-party funds.

The HIM was the only institution that mentioned that it has an internal competition to assign federal funds for research, although it too referred to deficient accounting systems for monitoring expenditure of these resources.

Although most of the INSALUD institutes did not have explicitly-defined research priorities during the study period, a number mentioned that efforts were under way to begin defining institutional research priorities. Many of the INSALUD institutes allowed researchers considerable freedom to develop their own research agendas and to search for third-party funding.

Some institutions, such as the INPED, INPER and the INSP had established policies for institutional re-financing that allowed for charging overhead to projects funded by third parties. Other INSALUD institutes, but not all, charged the pharmaceutical industry higher cost-recovery fees for patients who participated in studies funded by the industry.

National Institute of Rehabilitation (INR)

In 2004, nearly all research carried out in the INR was financed by federal funds (96%); only a small part was funded by CONACyT. According to INR administrators, the decentralization of the National Center for Rehabilitation and its consequent conversion into the INR not only facilitated the legal basis to seek third-party funding, but also increased its income as it was

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then able to retain the fees charged for medical care. As a result, the INR reported income for research from national non-profit institutions totaling more than Mex$ 9.7 million (16% of total research expenditures) in 2005. Likewise in 2005, there was a substantial increase in CONACyT resources, representing 19% of the INR's research budget.

The decentralization of the INR also precipitated a redefinition of research priorities through a consensus-building process within the institute. During the study period, each investigator was free to seek external funding or to carry out research within the institute according to his/her interests, following approval of the research protocol by the research and ethics committees. The INR did not impose any overhead. To date, the INR has not reported receiving funding from the pharmaceutical industry. Accounting for external resources was supported by a special unit within the Research Division that is responsible for documenting the appropriate use of resources. The majority of research was carried out with federal resources, for which there are no records, making it impossible to identify expenditures by project. The INR also received in-kind funding for some research projects, which did not enter into the accounting system.

National Institute of Cardiology (INCAR)

Research at the INCAR was supported fully by national sources. The most important source of research funding was the federal government, followed by for-profit and non-profit sector sources, and finally by CONACyT. While federal government funding held steady across the two years, the other sources fluctuated, as expected with third-party funding. In the case of CONACyT, research funds varied in a given programme year and were competed for by researchers across many institutes.

In the case of the INCAR, cost-recovery fees were an important strategy for funding research. In 2005 these fees represented 15% of total resources invested in research. External financing for research at the INCAR was 31% and 22% of total research expenditure for 2004 and 2005, respectively.

As with the INR, the INCAR had a specialized unit for the management of external research funds; but, for projects funded with federal resources it was still unable to track expenditures. No clear amounts were assigned to each project. Once research projects were approved by the Research, Ethics and Bio-safety Committee, they were supported through the purchase of materials and supplies (medications, laboratory tests) and through funds to attend conferences and present findings. Resources assigned to principal investigators for all approved projects were combined in one central fund. This style of financial management was requested by researchers to ease the administrative burden of managing multiple projects. A register of number, type and duration of personnel participation in each research project was also lacking.

National Institute of Paediatrics (INPED)

At the INPED, over two thirds of research was carried out by personnel that split their time between medical/clinical care and research. There were few staff dedicated entirely to research. At the time of the study, there were approximately 300 active projects, of which only 30%, or 90 projects, received financing. Of the funded research projects, 83% received federal funds and 17% were funded by the pharmaceutical industry. Federal funding for research was administered through a single account and it was not possible to link expenditures to specific projects, although this was possible with third-party funds.

At the beginning of the second quarter of 2005, the INPED began to implement new policies related to research. It was expected that these new policies would have a positive impact on the number and quality of publications. The policies included the formulation of explicit research priorities and the creation of an area to manage research resources, and strengthen the Research Division through the creation of coordinating groups that receive and evaluate project proposals for their originality and alignment with established priorities. Additionally, a policy of charging 15% overhead to each project was implemented as a refinancing strategy. In 2004-2005, only 35% of publications originating from a research project were registered with the institutional review board, a proportion that has been increasing since the new policies were implemented.

The INPED has managed to generate resources through the sale of products and consulting services, something which is not a common practice among other institutes.

National Institute of Perinatology (INPER)

Research carried out at the INPER during the study years relied almost entirely on federal funds. Research received a high level of support from policy-makers and the administrative area of the INPER. However, as with other institutes, financial information systems could give project-level information only for projects receiving third-party funds. The control of federal funds was managed using general expenditure categories, without any detail regarding project-specific expenditures.

According to the list of projects, the research priorities were reduction of maternal, neonatal and infant mortality. Investigators, however, were at liberty to choose topics of interest within these priority areas. Investigators were also free to pursue third-party funding opportunities. While a policy to charge an overhead fee on each research project was being discussed in the INPER, no final decision had been implemented by the end of the study.

National Institute of Neurology and Neurosurgery (INNN)

The INNN did not maintain records of expenditures by project for federally funded projects. Again, much more detailed data were available for those projects funded by third parties, such as CONACyT. The majority of research in the INNN in 2004 and 2005 was carried out with federal funds (87% and 95%, respectively, of the total research budget). Institutional research productivity is reflected mainly through the significant number of publications, mostly in less prestigious journals, although more than a third were published in higher level journals.

National Institute of Public Health (INSP)

The INSP is the INSALUD institute that is least dependent on federal funding for research. In 2005, only 16% of total research expenditures came from federal funds, down from 28% in

2004. This reflected a significant effort in the INSP to compete for and procure third-party funding for research. The INSP also employed a strategy of charging a 10% overhead fee to research projects.

Children's Hospital of Mexico (HIM)

While the HIM reported to the Mexican Treasury that it spent Mex$ 43 million on research, it was not possible to disaggregate expenditures per project, nor per budget line. The HIM received a large amount of "micro" in-kind donations that benefited research projects, but which could not be quantified. The management of resources for research was directed by each investigator or unit.

Disaggregated expenditures by research project were not available for 2004. Only in 2005 did the financial department begin to record this data, although in an incomplete manner that did not permit analysis. Little coordination between financial management and research areas was observed. No feedback regarding the monitoring of financial resources existed. The principal investigators were informed only of the total amount that HIM had spent on research. Thus, the authors were unable to obtain project-specific data, although such information existed.

National Cancer Institute (INCAN)

In the initial interview with INCAN administrative personnel, the authors were informed that expenditures related to third-party funding was privileged information and could not be provided, especially when funding came from the pharmaceutical industry. As pharmaceutical companies require the INCAN to sign a secrecy clause within each contract, the authors were unable to obtain information on which companies provided funding and for what types of projects.

Comparative analysis of HR&D expenditures

All six of the INSALUD institutes participating in the interviews reported receiving funding from third parties to finance research. Thus, when estimating total HR&D expenditures, both federal and external resources had to be taken into account, although the importance of external resources for financing health research varied considerably among the INSALUD institutes. While external resources represented slightly more than 60% of all resources invested in health research by the six INSALUD institutes during 2004 and 2005, contribution to the combined health research expenditures varied greatly among institutes, from 5%, in the case of the INPER, to 79%, in that of the INSP.

The largest investment in research in the six INSALUD institutes came from core budget federal funds. CONACyT was the second most important funding source (see Figure 2.5). With the exception of the INSP, the data suggested that greater efforts might be made within each of the INSALUD institutes to seek out alternative sources of health research funding. It would be useful, in future, to monitor INSALUD trends in this respect.

Figure 2.5

Sources of health research funding in six INSALUD institutes
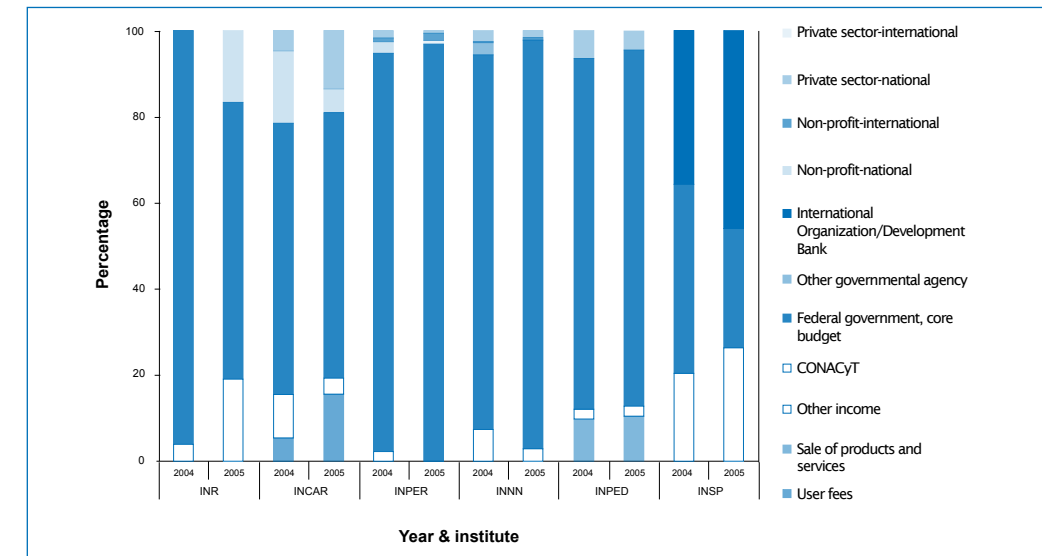
An analysis of the type of research funded was also carried out, based on the research typology proposed by the Global Forum for Health Research.[42] As the authors were not always able to determine the funding amount for each project, they looked instead at numbers of projects. Hence, each project is weighted equally, regardless of their funding levels. Figure 2.6 displays the results for seven INSALUD institutes.

Figure 2.6

INSALUD research projects by type of research

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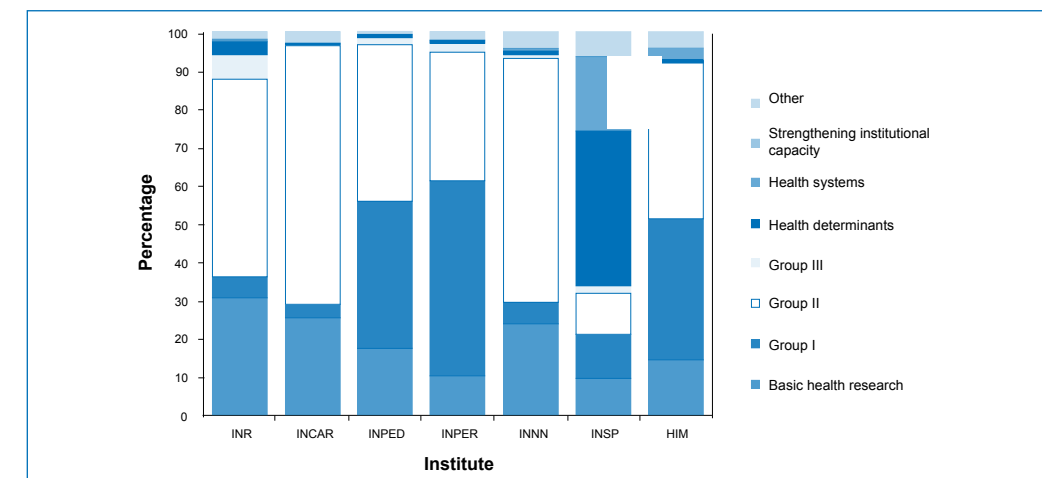
With the exception of the INSP, research projects carried out by the seven INSALUD institutes focused on Group I (transmissible diseases, maternal, perinatal or nutritional conditions) and Group II (non-transmissible and chronic-degenerative) diseases. The proportion of research projects each institution dedicated to one of these areas depended on the population that it served: maternal/infant (Group I) or adult (Group II). The INSP differed from the others, as it prioritized research on health determinants (40%) and health systems (19.4%).

In institutes whose primary purpose is provision of medical and clinical services, research tended to be focused on clinical or basic sciences (see Figure 2.7). This contrasts with the INSP where the majority of research projects were categorized as health and social science research. This difference was to be expected and reflected the inherent differences between the INSP, which was founded to fill the need for population-based research, and the other institutes that were oriented to providing clinical and medical care. The "other fields" category included biological sciences, statistics and mathematics, engineering and technology, and earth sciences. None of these areas represented a significant portion of the total research carried out by the institutes.

Figure 2.7

Classification of research projects by science and technology field
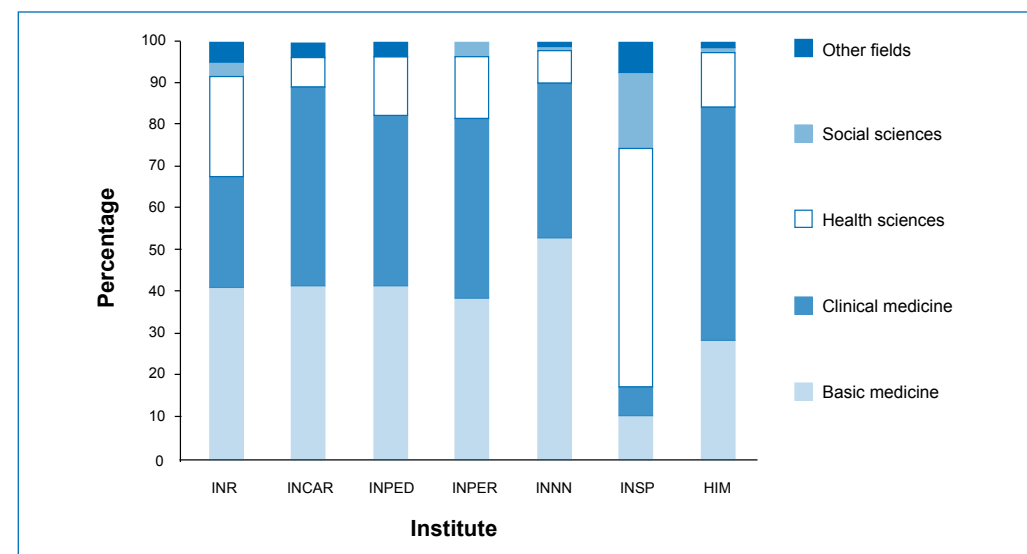
Figures 2.8 and 2.9 display aggregate data for type of research across the seven institutes for which information was available.[43] Note, in Figure 2.8, that given the characteristics of the institutes in this study, Group I and II research was most common. However, research into health determinants represented an important percentage of resources dedicated to HR&D.

Figure 2.8

Classification of research projects by type of research, 2004-2005
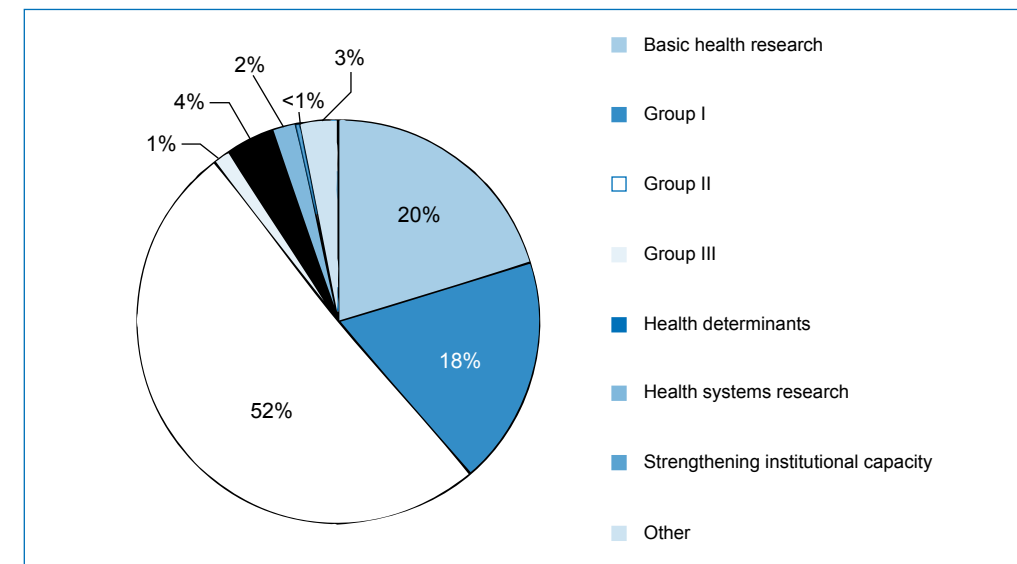
When data from all institutes by science and technology field (see Figure 2.9) were aggregated, a similar pattern was observed. A tendency towards basic and clinical science research was observed in institutes that provide medical and clinical care. Indeed, over 80% of the research across the seven INSALUD institutes focused on basic and clinical medicine. In the INSP, however, health sciences predominated, representing an important portion of the total research.

Does INSALUD research reflect Mexican and Latin American priorities?

A rough analysis was conducted to answer this question, employing broad criteria for determining whether or not a research project addressed a priority area. The HIM, INCAR, INNN, INPED, INPER, INR and INSP institutes were included in the analysis. In most cases, the analysis was limited to looking at the title of the research project, as most did not have a more detailed abstract on the project's goals. A research project was considered "priority" if the area of study fell within priority areas outlined in Table 2.1. Field of study and type of research were excluded from the analysis.

Using this broad definition of priority health research, just 591 (40%) of the 1486 research projects active during the 2004-2005 period, and for which there were data, addressed priority research areas. This proportion varied significantly by institution, from 15% of the research projects at the INR to 98% at the INSP (see Table 2.3 and Figure 2.9). Additionally, Table 2.3 lists the priority research areas, identified earlier in Table 2.1 that each INSALUD institute might be expected to address.

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Table 2.3

Distribution of priority research in seven INSALUD institutes

Institute	Total number of projects	Priority project (%)	Predicted priority areas to be addressed (see Table 2.1)
HIM	159	46%	Congenital cardiac abnormalities, acute respiratory infections, diarrhoeal disease, chicken pox, drowning, lead-related mental retardation, mild malnutrition, helminths and other intestinal infections
INCAR	145	43%	Cardiovascular disease, ischaemic heart disease, chronic obstructive pulmonary disease, hypertension and hypertensive cardiopathies, streptococcal angina
INPED	232	34%	Congenital cardiac abnormalities, acute respiratory infections, diarrhoeal disease, chicken pox, drowning, lead-related mental retardation, mild malnutrition, helminths and other intestinal infections
INR	101	15%	Leg and ankle fractures, osteoarthritis, shoulder and upper and lower arm fractures
INNN	608	24%	Schizophrenia, cerebrovascular disease, Alzheimer's, migraines
INSP	121	98%	All areas with a health systems and public health perspective
INPER	120	82%	Maternal conditions, perinatal conditions, obstetric haemorrhage, preclampsia and other pregnancy-related hypertensive disorders
TOTAL	1486	40%	

Figure 2.9

Percentage of INSALUD research projects in priority area

	INSP	INNN	INR	HIM	INCAR	INPER	INPED	Total
Priority	98	24	15	46	43	82	34	40

Institute & percentage
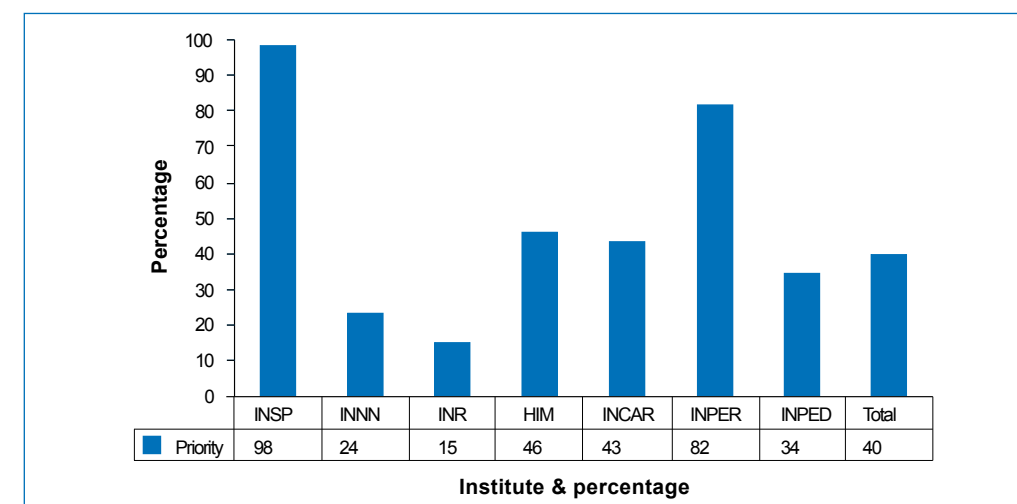
Caution should be exercised in interpreting these findings. The institutes included in this analysis, with the exception of the INSP, are highly specialized medical institutions. As such, their research is geared to specific, complicated diseases that present in the populations they serve. Having the research team based at the INSP resulted in more information about the content of the projects it conducted. Yet, this potential bias cannot fully explain the magnitude of the observed differences. It is not surprising that a public health institute would have a much higher proportion of its research focused on priority areas defined from a public health perspective than would tertiary, clinical research centres.

Finally, this exercise was seriously hampered by lack of participation of nearly half of the INSALUD institutes. The INCMNSZ, the second largest contributor to research in the INSALUD, as measured by expenditures on research, specialized in many priority areas including AIDS, nutrition and diabetes. Other institutes that would potentially address priority areas included the INER, which focuses on respiratory diseases, and the INCAN, which addresses priority areas related to cancer. It would be interesting to see how results would have differed had data from these institutions been included in the study.

Lessons learned

The Mexican government's commitment to making information more widely available is evidenced in its landmark 2004 Transparency Law. While this Law aims to facilitate access to information by individuals and organizations for a variety of reasons, including studies such as this one, the authors encountered significant obstacles in obtaining information. They found that even when administrators were willing to cooperate, the administrative and financial systems were not in place to retrieve detailed information at the project level.

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Without doubt, lack of access to timely and precise financial information hampers the ability of administrators and directors of research within the INSALUD to manage a research portfolio intended to address national priorities.

A significant challenge of this study was compiling and analysing data across different administrative systems. The INSALUD institutes differ in how they collect information regarding the management of resources. This was a significant obstacle to obtaining more precise results, and possibly biased the findings. An example of the latter concerns the practice of expensing 100% of personnel salaries against research budgets, when, according to the key informants, personnel also carry out teaching and clinical responsibilities. Human resources expenditures thus contribute to an overestimate of the level of expenditures on research.

The findings should, therefore, be viewed as preliminary and exploratory in nature. They provide a picture of the situation only of the participating institutions. While the general expenditure analysis gives insight into the overall INSALUD situation, conclusions from the case studies are limited to particular institutions. Likewise, the results do not necessarily reflect health research tendencies at the health sector level in Mexico. Better estimates of health research financial flows at a national level would involve a wider study that included universities, the Ministry of Health, the pharmaceutical industry and other private institutions.

With these limitations in mind, the study found:

• The total INSALUD expenditure for health research in 2004 was Mex$ 767 million, which increased to Mex$ 826 million in 2005. Research represented 10.6% and 11.4% of the total INSALUD expenditures for 2004 and 2005 respectively.

• With the exception of the INSP and INMEGEN, medical services represented the largest proportion of the institutes' expenditures. The institutes varied significantly in the percentage of their overall expenditures dedicated to

research. The HIM, INCAN, INCAR, INNN, INPED, INPER and INR all dedicated less than 10% of their expenditures to health research in both 2004 and 2005.

• The INSP, INCMNSZ and INER were the three most important health research institutes among the INSALUD. Together they accounted for 55% of all research expenditure in 2004 and 46% in 2005. The INSP alone contributed the greatest share to health research in 2005, accounting for 22% of all research expenditure in the INSALUD, followed by the INCMNSZ (15%) and the INER (9%). In 2005, the INMEGEN emerged as an important new research player in the INSALUD, accounting for 9% of INSALUD research funds.

• Personnel salaries and honoraria constituted the most significant expenditure category for research across all of the INSALUD, followed by materials and supplies.

• Strategies for financing health research also varied across the six INSALUD institutes that participated in the interviews. The majority of the INSALUD institutes relied on their federal core budget support to conduct research. The contribution of external, third-party financing to health research expenditure ranged from 5% in the INPER to 79% in the INSP. Support from CONACyT was an important financial resource for institutions.

• The INSALUD also varied in the way each institute approached and undertook research. While some institutions had developed their own priority lines of research, other INSALUD institutes lacked priorities in allocating core funding, and appeared instead to follow the personal interests of their researchers.

• The type of research carried out by the INSALUD institutes was predicated on the population they served. The perinatal and paediatric institutes (the HIM, INPED and INPER) dedicated a significant portion of their research effort to Group I diseases. The other institutions offering medical care concentrated their research efforts on Group II diseases and conditions. Finally, the INSP was found to have a more heterogeneous portfolio of research, as expected from a public health institution.

• Mexico lacks a consensus about what conditions/health needs are research priorities. While there have been nascent health research prioritization exercises in Mexico, including an effort by CONACyT and the Ministry of Health, these have been the result of academic exercises rather than consensus-building among different stakeholder groups. Civil society notably has been absent from this process, and has not participated in any prioritization activities.

Recommendations

Recommendations, in light of the findings and the experience of conducting the study, are as follows:

For INSALUD directors and administrators

• Establish general accounting guidelines that will permit easier tracking of the flow of both federal and external financial resources for research.

• Organize financial data (including source of funding, expenditure and products) so that they can be linked to individual research projects. This will permit a more complete evaluation of the costs per product and of research projects' short- and medium-term impact.

For researchers undertaking a similar analysis

• Triangulate data sources. CONACyT is an important funder of health research, and nearly every INSALUD institute had detailed information about projects funded by CONACyT. These data were used to validate the information collected in the interviews. In this way, data were gathered for institutes that had not participated in the study.

• Include other institutes that carry out health research to obtain a more complete and realistic picture of the state of national health research. Such a picture would better inform the process of defining health research priorities and strategies.

For policy-makers and other actors in the health research system

• Open a discussion among experts and other stakeholders on the subject of health and health research needs. A wide range of perspectives needs to be included in this discussion, beyond the traditional participation of health experts who have traditionally dominated agenda setting. In particular representatives from civil society organizations, representing marginalized population groups including indigenous, migrants, disabled and elderly persons, need to be at the table and contribute to these discussions. It is also important to include gender perspectives in defining priorities for health and health research needs. This is a fundamental step in the definition of future health research policy in Mexico.

• Disseminate results of this study to generate demand for better and more adequate data from each INSALUD.

• Carry out workshops with different sectors (local, state, federal and the executive and legislative branches of government), decision-makers, academics, health research professionals, civil society) to discuss the study results and involve a broader set of institutions in future research initiatives of this type.

Improving the process of estimating research expenditures, widening the number of participating institutes, and monitoring research expenditures over time comprise a useful set of strategies to help set health research policy and priorities and evaluate research concretely. With this study the authors hope to have raised awareness of the need for this type of analysis and to have contributed to the ongoing discussion of methodological and conceptual issues in monitoring financial flows for health research.

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promotes transparency by demonstrating how financial resources (national and international in source) are
spent. The study was reviewed and approved by the Research, Bio-safety and Ethical Committee of the
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Assessment of the health research system in Shanghai, People's Republic of China

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In 2006, the Key Lab of Health Technology of the Chinese Ministry of Health conducted a study to assess the performance of the core functions of the Shanghai Health Research System.

- *Health research production is plentiful in Shanghai province. Between 1999 and 2003, research-related publications totaled nearly 15 000. Shanghai has won many advanced technology prices, about 20% of them in the field of health research.*
- *In 2005, public sector funding represented 78.6% of the estimated 548.7 million yuan invested in health research. Funds internal to research institutions accounted for 9.9% and foreign funding 8.8%. Private sector (both for- and not-for-profit) funding together amounted to a mere 2.7% of research funding.*
- *Between 1999 and 2003, funding to medical schools and affiliated hospitals was higher than to independent research institutions. The former relied on government funding for more than three quarters of research funding, with government investment ranging from 73.9% of total investments in 2002 to 84.8% in 2001. In comparison, independent research institutions looked to non-government sources for roughly one half to two thirds of their funding for health research.*
- *Clinical research and basic medical research receive more attention as a health research priority than do preventive medicine and social health.*
- *While a high proportion of key informants (45.5%) perceived that health research was relevant to national health priorities, research results are being under-utilized. Only 3.5% to 4.1% of research is seen as being useful to health mangers and policy-makers.*
- *Resources are being wasted because of a lack of coordination among institutions and oversight on how funds are allocated. Needed are a mechanism for setting health research priorities, more rigorous evaluation of health research proposals and research ethics reviews, and an organization to monitor the allocation of funding.*

Assessment of the health research system in Shanghai, People's Republic of China

Profile of Shanghai

Shanghai is a municipality directly under China's Central Government. With a history of more than 700 years, Shanghai was once the financial centre of the Far East region. Since the reforms that began in the 1990s, great changes have taken place in the city. The municipal government is striving to build Shanghai into a modern metropolis and world economic, financial, trading and shipping centre by 2020.

The city is situated on the eastern fringe of the Yangtze River Delta, which is in the centre of China's north-south coastline. Located at the mouth of the Yangtze River, Shanghai enjoys a favourable geographical location with a good harbour and a vast hinterland encompassing part of the broad flat alluvial plain of the Yangtze River Delta.

Covering a land area of 6218.65 km^2 and a water area of 121.85 km^2, the city is about 100 km wide from east to west and 120 km long from north to south and is divided into 19 districts.

In 2005, Shanghai's population was 23.6 million. Nearly six million of these people were migrants.

Its birth rate was 6.08 births per 1000 population while the death and infant mortality rates were 7.54 deaths per 1000 population and 3.78 infant deaths per 1000 life births respectively.

The gross domestic product (GDP) was 915.42 billion yuan. Based on a resident population of 17.8 million (migrant population excluded), per capital GDP was 51 474 yuan.

The social insurance in Shanghai was composed of urban staff and workers' health insurance, urban residents' health insurance, town social insurance, individual businessman and professionals' health insurance, retired veteran cadres and retired staff and workers with medicare and rural social pension insurance.

Shanghai has a well-developed science and technology sector with 719 900 professional and technical personnel in state-owned companies and 145 500 scientists and engineers engaged in scientific and technological activities. Research and development expenditures are an estimated 21.377 billion yuan. R&D expenditure as a percentage of GDP is 2.34%.

The health research system in Shanghai

Health research plays a key role in improving human health. However, there is a large gap between health research and the resolution of major health problems. Lack of resources and wastage exist simultaneously.

The health research system includes all efforts directly linked to and having an effect on the way in which research is done and how it affects health. The core functions of national health research systems are: stewardship and governance, financing, capacity building, knowledge generation or translation and knowledge utilization.

As strengthening health research system capacity

is within the mandate and power of governments, the Key Lab of Health Technology of the Chinese Ministry of Health conducted a study in 2006 to assess the performance of these core functions of the Shanghai Health Research System (SHRS). Figure 3.1 shows the governance and administration structure of the SHRS.

Figure 3.1

Governance and administration structure of the Shanghai Health Research System
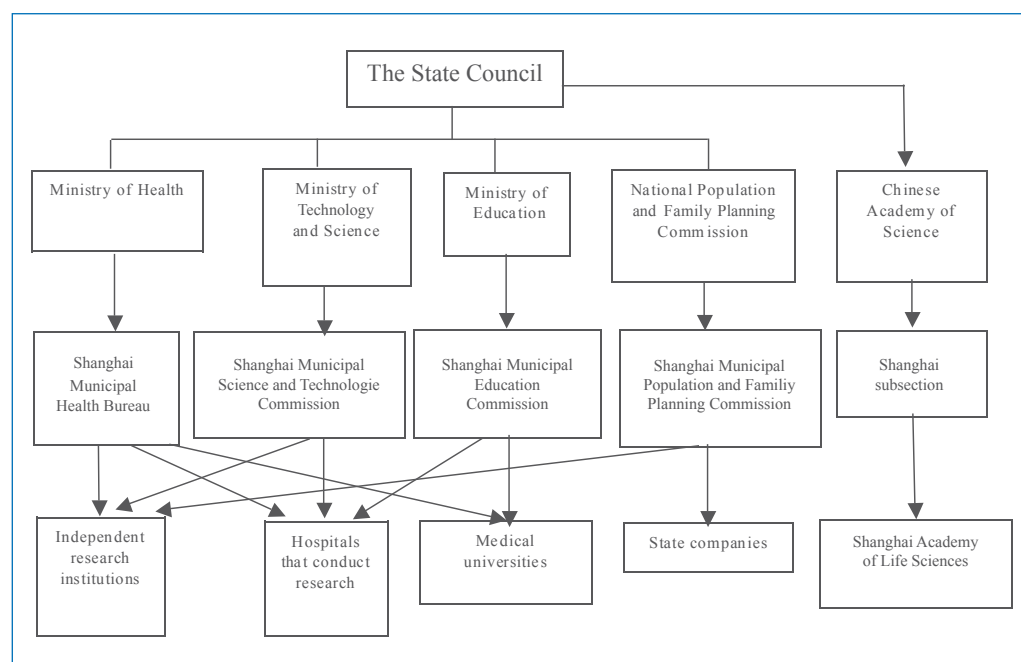
Health research production is plentiful in Shanghai province. In 2003, the total number of health-related papers published was more than 3830, including 134 published in foreign publications. Shanghai has won many advanced technology prices; about 20% of them in the field of health research – a much higher figure than that for other areas of R&D. Yet, the assessment study revealed problems and deficiencies within the SHRS. These included an incomplete management system; brain drain; inequity in funds allocation; insufficient translation of research results into knowledge; and insufficient knowledge utilization for improving policy,

programmes and service delivery affecting health. This chapter offers insight into the level and types of investment in health research and development (HR&D) in Shanghai province between 1999 and 2003, and compares these to research outputs over the same period. It also looks at research priorities. Based on these findings and the Key Lab's experience in conducting the assessment study, this chapter recommends a set of measures for improving the functions of the SHRS so that these functions lead to effective health action and consequently contribute to improving population health and reducing health inequities.

Expenditures on health research and development

To learn about expenditure for health research and related research outputs, the Key Lab used Chinese Science and Technology statistics obtained from the Ministry of Science and Technology and collected additional data from research and development institutions, medical schools and affiliated hospitals. In December 2006, the Key Lab undertook a survey of directors of departments of research and education in 55 health research organizations in Shanghai, including 11 medical universities and schools, 15 independent health research institutions, 25 tertiary hospitals and four health-related government departments. The departments included the National Science and Technology Commission, the Shanghai Municipal Science and Technology Commission, the Financial Bureau of Shanghai and the Educational Development Foundation in Shanghai.

According to the data obtained from the survey and government statistics (Chinese Science and Technology statistics), the four government agencies invested approximately 548.7 million yuan in HR&D (see Table 3.1) in 2005. Public sector funding represented 78.6% of that total, funds internal to institutions 9.9% and foreign funding 8.8%. Private sector (both for- and not-for-profit) funding together accounted for a mere 2.7% of research funding.

Table 3.1

Source of investment in HR&D in 2005

Funding source	Investment (million yuan)	Percentage of total funds (all research institutions)
Own funds	54.2	9.9
Public sector	431.4	78.6
Foreign funds	48	8.8
Private non-profit sector	6.7	1.2
Private for-profit sector	8.4	1.5
TOTAL	548.7	100

Levels of investment by category of research institution for the years 1999 to 2003 (Tables 3.2 and 3.3) reveal that the funding level was high and had increased over the 1999 to 2003 period. The funding sources included the above four funding agencies, some national foundations and organizations, such as Ministry of Technology and Science, Ministry of Health and Ministry of Education. Funding to medical schools and affiliated hospitals was higher than to independent research institutions in

each of the five years. The former institutions relied on government funding for more than three quarters of funding to health research, with government investment ranging from 73.9% of total investments in 2002 to 84.8% in 2001. In comparison, independent research institutions looked to non-government sources for roughly one half to two thirds of their funding for health research. Amounts from non-government sources ranged from 70.9 million yuan (48.5%) in 2000 to 112.1 million yuan (63.7%) in 2001

and 128.6 million yuan (59.7%) in 2003. This suggests that the government attaches more importance to investing in research conducted by medical schools and affiliated hospitals. Independent institutions needed to or were better able to access other sources of funding.

Table 3.2

Investment in health research conducted by medical schools and affiliated hospitals, 1999-2003

Year	Total investment (million yuan)	Government investment (million yuan)	Government investment (as % of total investment)	Non-government investment (million yuan)	Non-government investment (as % of total investment)
1999	70.7	56.1	79.3	14.7	20.7
2000	100.1	76.8	76.7	23.3	23.3
2001	120.3	102.0	84.8	18.3	15.2
2002	154.3	114.0	73.9	40.3	26.1
2003	187.8	151.8	80.8	36.0	19.2

Table 3.3

Investment in health research conducted by independent institutions, 1999-2003

Year	Total investment (million yuan)	Government investment (million yuan)	Government investment (as % of total investment)	Non-government investment (million yuan)	Non-government investment (as % of total investment)
1999	154.0	75.3	48.9	78.7	51.1
2000	146.1	75.2	51.5	70.9	48.5
2001	175.9	63.9	36.3	112.1	63.7
2002	200.3	86.2	43.0	114.1	57.0
2003	214.9	86.3	40.2	128.6	59.7

Figure 3.2 indicates that funding to medical schools and affiliated hospitals was much higher than to independent institutions. This is because the number of independent institutions is smaller than the number of medical schools and affiliated hospitals, and medical schools and affiliated hospitals have more researchers with higher levels of training so they tend to apply for more large projects than do independent institutions.

Figure 3.2

Comparison between independent research institutions and medical schools and affiliated hospitals
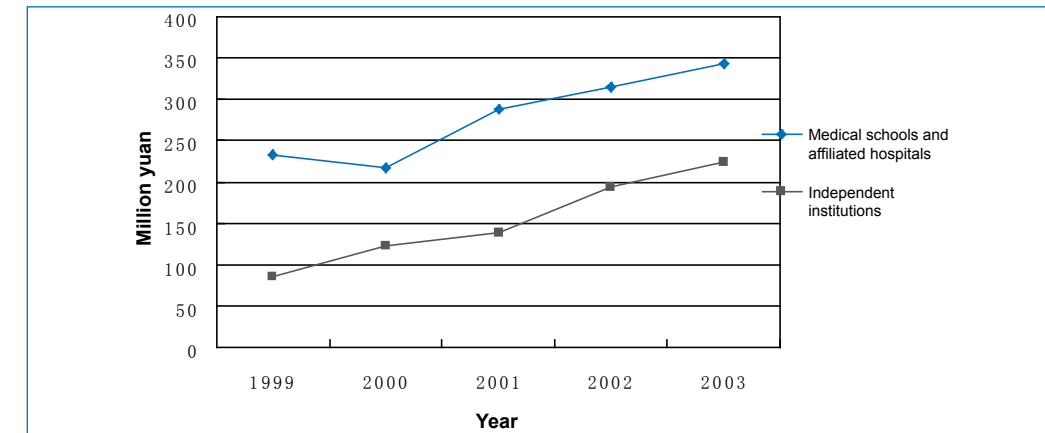
As Table 3.4 shows, public sector funds were invested heavily in basic medical research and basic science. Basic science research received 72.5% of government funding in 2005, and basic medicine 23.7%. Together health sciences, systems and policy research, and social science research received less than 1% of public funding. One of the reasons for this is that many health institutions give more attention to basic medical research and clinical therapies than to disease prevention. Another reason is that the process of translating health results into health policies is complex and needs a long time; the results of policies can be difficult to see and measure. A third reason is that basic medical research results in tangible success such as patents and bonuses for the researchers.

Table 3.4

Government investment in HR&D by type of research in 2005

Type of research	Investment (million yuan)	% of total
Basic science	150.0	72.5
Basic medicine	49.0	23.7
Clinical medicine	6.2	2.9
Health sciences, systems & policy	1.1	0.5
Social science	0.5	0.3
Other fields of science	0.2	0.1
TOTAL	207	100

Human resources working in health research

In both independent institutions and medical schools and affiliated hospitals, human resource costs represented a major part of HR&D expenditures. In 2003, human resources represented more than 30% of expenditures. As Table 5 shows, the total number of research staff has declined slightly in recent years. The study also showed that on the whole, research staff was mainly middle-aged (60.1% of them were between 30-50 years of age). Only a small proportion were younger researchers (20.1% were under 30 years of age). Research capability was perceived by staff to be insufficient. According to the survey results, the respondents believed that the ability to undertake proposal preparation and report writing and to develop new interventions needed improvement. Respondents also reported that the research environment and income levels of researchers needed improving; lab equipment needed to be replaced and updated; and cooperation among researchers needed to be strengthened.

Table 3.5

Number of research staff, 1999-2003

Year	Medical schools and affiliated hospitals	Independent R&D institutions	TOTAL
1999	10 363	1350	11 713
2000	9802	1520	11 322
2001	10 397	1287	11 684
2002	11 526	1262	12 788
2003	10 695	1150	11 845

Research output

The assessment study showed that research findings were disseminated primarily through the following channels:
- Department of Communication, Shanghai Health Bureau
- Information Centre, Shanghai Health Bureau
- Journal articles
- Hospital web sites
- Medical schools
- Forums and conferences.

Table 3.6

Health research outputs in 2005

Research outputs	National publications	Foreign publications	TOTAL
Research articles	14 077	888	14 965
Research articles in peer-reviewed journals	10 652	754	11 406
Other articles in peer-reviewed journals	1324	50	1374
Articles published in non-peer-reviewed journals	1243	0	1243
Grey literature	858	84	942
Registered patents	198	8	206

During the five-year study period, research output, as measured by numbers of publications was quite high with close to 15 000 publications (see Table 3.6). As Figure 3.3 indicates, research output remained steady in independent research institutions over the same period. These institutions published approximately 500 publications each year. Numbers of research publications by medical school and affiliated hospitals fluctuated somewhat, rising from over 2500 in 1999 to nearly 4000 the following year and then dropping to approximately 3200 in 2001. The numbers were obtained by asking the directors of research and education. Every director maintained records of the outputs of their institution.

Over the five-year period, the publication output by medical schools and affiliated hospitals increased and topped that of the independent research institutions. This is likely because there are fewer independent research institutions than medical schools and affiliated hospitals, employing fewer numbers of research personnel.

Figure 3.3

Comparison of research publications by independent research institutions and by medical schools and affiliated hospitals, 1999-2003
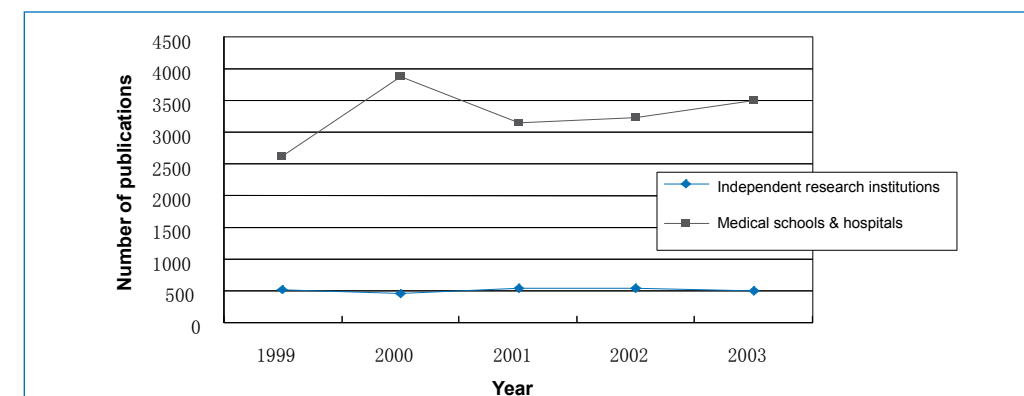
Figures 3.4 and 3.5 compare levels of funding over the study period to numbers of research publications. They demonstrate that there is very little relationship between funding and publication output.

Figure 3.4

Comparison of research funding to medical schools and affiliated hospitals and publications output, 1999-2003
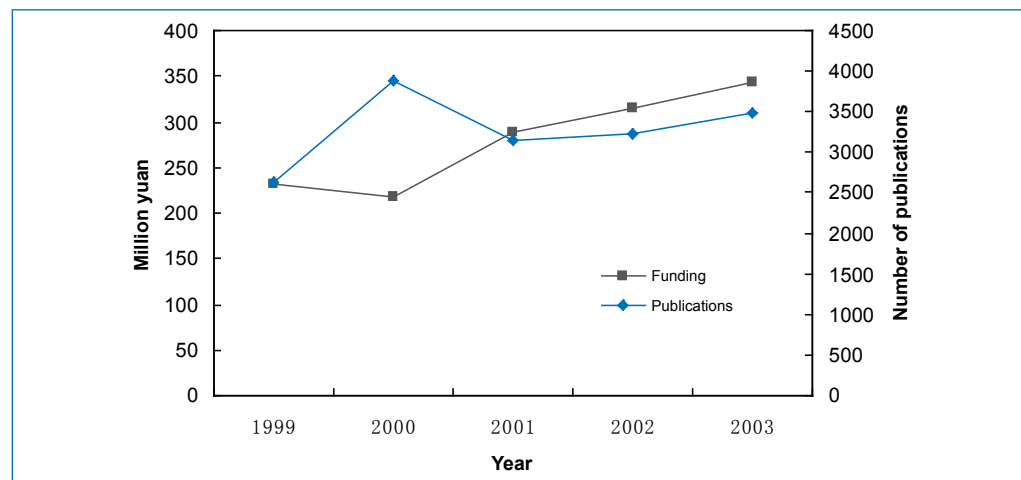
Figure 3.5

Comparison of funding to independent research institutions and publications output, 1999-2003
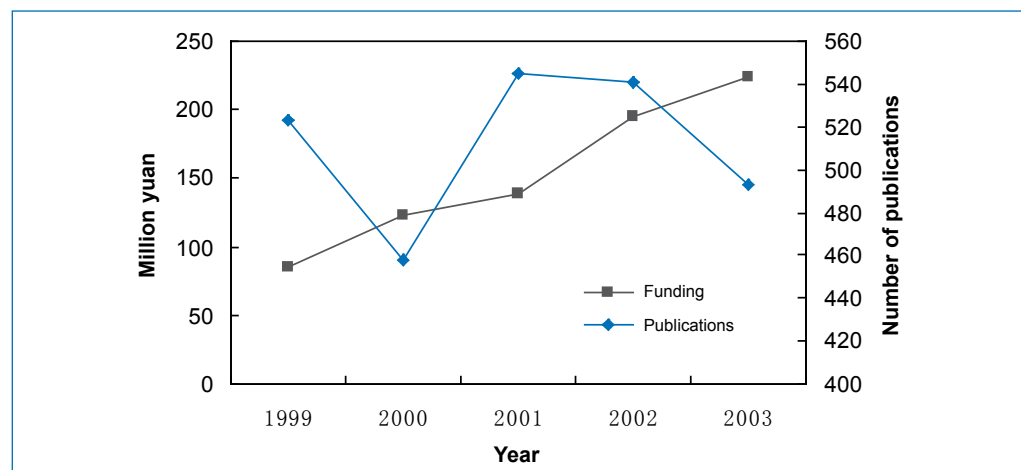
The Key Lab also attempted to explore the extent to which research results are being put to use. Four institutions (Shanghai Municipal Health Bureau, Shanghai Municipal Population and Family Planning Commission, Shanghai Municipal Education Commission and Shanghai Academy of Life Sciences) were asked to evaluate publications by their scientific merit, relevance of research topic to the institution's goals and mission, comprehensiveness of review of literature and reports, rigour of methodology, and policy relevance and implications.

Table 3.7 suggests that research results are underutilized. Particularly alarming is the opinion that only 4.1% and 3.5% of research is considered useful to health managers and policy-makers, respectively.

Table 3.7

Estimates of research results put to use

Research users	Research of potential use	%
Public	848	26.0
Medical service staff	746	22.8
Health managers	134	4.1
Policy-makers	113	3.5
Other researchers	276	8.4

Barriers to incorporating research results included: lack of high quality and timely research, deficit of well-trained research personnel, users' limited skills to use the results, lack of resources to transform the results into health policy or practice and lack of communication and coordination between researchers and users.

How well does health research correspond to defined priorities?

To answer this question, the Key Lab conducted key informant interviews with eight government leaders and experts, including the director of the research and education department of the Shanghai Municipal Health Bureau; the Shanghai Municipal Science and Technology Commission; the Shanghai Municipal Education Commission; the Shanghai Municipal Population and Family Planning Commission; and some experts from medical schools. It also studied the Shanghai Science and Technology Mid-term and Long-term Plan, which stipulates the following goals:
• Improve investment in public health.
• Strengthen the application of new clinical technology.
• Strengthen policy support, set up proper mechanisms to set research priorities.
• Support important disciplines, specialties and community programmes that can prevent and treat the most significant health problems.
• Modernize traditional Chinese medicine.
• Develop research on health policies.

Despite these goals, including one to establish a research priority-setting mechanism, such a system is not in place. Nor is there rigorous review of health research ethics and utilization of research results, or a mechanism for monitoring

the allocation of funding. Clinical research and basic medical research received more attention as a health research priority than did preventive medicine and social health.

A high proportion of key informants (45.5%) said that overall health research was very relevant to national health priorities. They also reported that wasting of resources and duplication of projects were serious problems among these organizations. Because of a lack of communication and proper planning, they usually fund similar projects. Key informants also indicated that the ethical review mechanism has not been built up well, either in funding organizations or research institutions. In addition, the ethics review process is not standardized and there is no comprehensive and complete health research database that records information about projects, funding and research results.

Recommendations

Based on the findings and experience in conducting the study, the Key Lab proposes the following recommendations related to HR&D priority setting, investments, human resources and research outputs.

HR&D investments
- Set up a uniform funding management system to improve the efficiency of funding allocation.
- At the same time, develop a variety of funding mechanisms for health research.
- Increase public funding for health research with the explicit goal of improving equity.
- Set up an organization to monitor funding for health research.

Human resources
- Increase the number of researchers and improve research staff skills through training.
- Develop incentives to attract and hold researchers in research institutions and avoid the brain-drain problem.
- Improve the health research environment by replacing and updating lab equipment, constructing an electronic library, improving communication and cooperation among researchers and setting up more supportive policies for research.

Research products
- Encourage researchers to work on results transformation.
- Introduce market incentives and competitiveness by reforming some independent research institutions into profit-making companies. Producing products for profit may inspire research institutions to attach more importance to transforming health research results.
- Set up a health research information system that would build a national health research database.
- Hold regular health research conferences so that researchers, policy-makers and consumers can get new health research information in a timely manner. Establish an effective communication platform to facilitate communication between researchers and users of research.
- Reinforce the connection between research results and health policies.

Priority setting
- Set up a formal system to improve communication between the health research funders, researchers and users. Organize a commission that includes key health policy-makers, experts from different research areas and health providers. The commission could hold a conference every year to discuss hot topics and difficult problems.
- Build a programme for the health research system as a whole.
- Establish research priorities through a scientific process.
- Develop comprehensive and sufficient health research review and ethical review systems.

Chapter 4

US investment in research to improve health

Mary Woolley, Emily T Connelly and Stacie M Propst

Mary Woolley is the President and CEO of Research!America, an elected member of the Institute of Medicine, and a fellow of the American Association for the Advancement of Science. A sought-after speaker and advisor to national and international organizations, she also serves on several advisory boards and committees, including the Board of Overseers of the Harvard School of Public Health.

Emily T Connelly is manager of science policy at Research!America. Prior to joining the organization, Emily earned her master of arts in science, technology and public policy from The George Washington University Elliott School of International Affairs and worked at the American Chemical Society. Her research interests include the investment in and economic impact of health research.

Stacie Propst is Vice-President of Science Policy and Outreach at Research!America. She develops and directs the alliance's education and advocacy efforts and manages outreach to policy-makers and other research stakeholders on behalf of Research!America's 500 member organizations. Before joining Research!America in 2001, she earned her doctorate in physiology and biophysics and completed a postdoctoral fellowship at the University of Alabama at Birmingham.

For a decade now, Research!America has reported on US investment in research to improve health.

- *In the United States, government investment in research is essential to stimulating increased private spending.*
- *Research!America estimates that in 2006, US$ 116 billion was spent on research to improve health in the United States. This amount is less than 6% of the US$ 2.1 trillion spent on health in the United States in the same year.*
- *This level of spending (approximately US$ 6700 per person annually) on health would certainly be worth it if the resulting health outcomes at least matched other industrialized nations which spend half as much.*
- *A mere 5.5 cents of the American health dollar is invested in research with the potential to solve costly, chronic conditions such as obesity, heart disease, cancer, diabetes and Alzheimer's.*
- *In recent years, US commitment to science and research has waned. Since 2003, the National Institutes of Health funding has leveled off and fallen below the rate of biomedical inflation, resulting in greater competition for shrinking research dollars. Industry investment has also flattened.*
- *Research!America estimates that in 2006, the United States spent approximately US$ 9.3 billion on global health research. This represents 8% of the total US investment (US$ 116 billion) made by private and public entities in health research overall.*

US investment in research to improve health

The endless frontier

A well-funded scientific research enterprise has fueled US innovation since the 1940s. The seeds of robust funding for science and technology were planted as Hitler rose to power in Europe and armed Germany's military with advanced weapons systems and technologies to invade its neighbours. Thus, World War II (WWII) and the looming Cold War with the Soviet Union cemented for President Franklin D. Roosevelt the necessity of a US commitment to invest in science and technology. In November of 1944, Roosevelt asked his director of the Office of Scientific Research and Development, Vannevar Bush, to submit recommendations for extending the scientific enterprise generated by the military during WWII into other aspects of American life. Specifically, Roosevelt called for a "war of science against disease":

> The fact that the annual deaths in this country from one or two diseases alone are far in excess of the total number of lives lost by us in battle during this war [WWII] should make us conscious of the duty we owe future generations.[1]

The framework devised by Vannevar Bush was presented to President Roosevelt in 1945. Entitled *Science – The Endless Frontier*,[2] the proposal deemed scientific progress a key to future security, better health, job creation, improved standard of living and even cultural progress. Vannevar Bush laid out the case for a "war against disease" by first acknowledging the progress that had already been made in reducing death rates in infants and children,

cutting death rates for all diseases among Army personnel by half and increasing the average lifespan of Americans to 65 years. He noted that striking advances made in medicine during the war were only possible because of a large body of scientific data accumulated through basic research in many scientific fields in the years prior to the war.

In language that resonates with current discussions about the need for more innovation in health, Bush wondered at lives cut short by diseases for which no prevention or cure was yet known. In his estimation, sources of support for basic research in medicine and the underlying sciences previously provided by university endowments, foundation grants and private donations were insufficient and must be bolstered by the federal government.

So began the investment of American tax dollars in basic research for the "common good". The National Science Foundation was established in 1950[3] and agencies across the government were allocated monies for research dedicated to improving health in the United States and worldwide. As one example of the government's new commitment to fighting disease through research, the budget of the National Institutes of Health (NIH) increased from under US$ 3 million annually in 1945 to more than US$ 50 million in 1950.[4] In addition to government support, business and industry generously invested in basic and applied research, and private funding through philanthropic giving continued to grow.

The funding landscape today

With so many streams of private and public funding for research, tracking US investment in health research and development (HR&D) is a challenge. As the largest non-profit, non-partisan alliance of organizations working to make research to improve health a higher national priority, Research!America has taken on the task of estimating the total US investment in health research. To better inform various audiences including elected officials, policy-makers, media, the scientific community and the American public at large, Research! America also tracks trends in the nation's overall commitment to scientific and technological research as it relates to spending on health and health care.

For a decade now, Research!America has reported on the overall investment in research to improve health while continuing to refine its knowledge of the funding landscape for research in the United States. As many leaders and observers of American innovation have noted in recent years, the US commitment to science and research is waning (see Figure 4.1).

Figure 4.1

US investment in HR&D by sector, 2001-2006
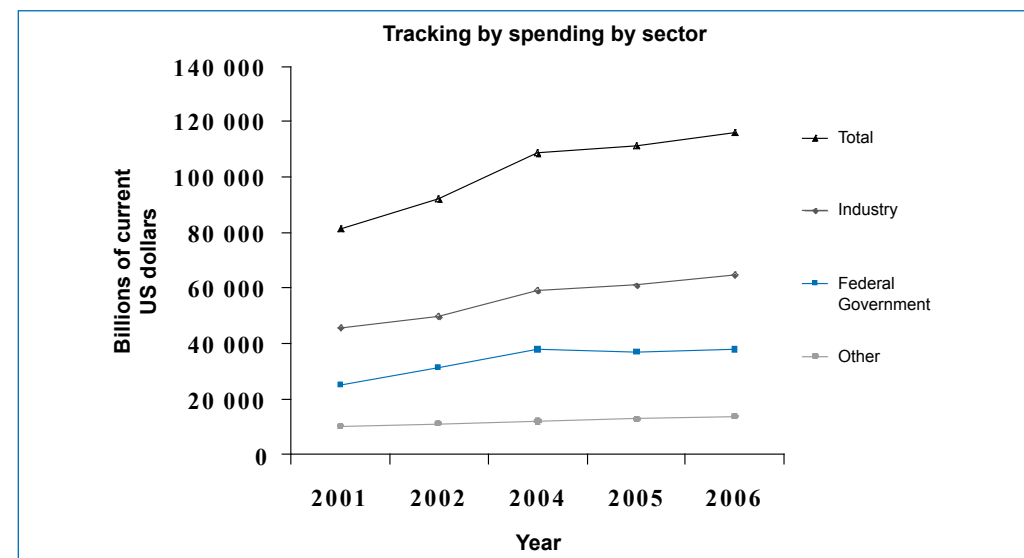
Source: Research!America. Investment in US Health Research 2001, 2002, 2004, 2005 and 2006.

Research that benefits human health is funded by many agencies across the federal government, but the NIH is the primary agency dedicated to medical and behavioural research. In the mid-1990s, political leadership, scientific leadership and patient advocates made a united call for substantially increased NIH funding.

Research!America's alliance of universities, independent research institutions, patient groups, scientific societies and industry played a critical role in mobilizing these various advocates to push for a doubling of the NIH budget from US$ 13.6 billion in 1998 to US$ 27.2 billion in 2003. However, what many viewed as a down payment on a long-term, more robust investment in research to prevent and cure disease and disability, has turned dramatically, resulting in a greater than 10% loss in purchasing power. Since 2003, NIH funding has leveled off and fallen below the rate of biomedical inflation, resulting in greater competition for shrinking research dollars.

As Figure 4.1 also shows, industry investment in research flattened as well. There are a number of likely reasons that include globalization and increased pressure on American businesses to compete. Substantial long-term research spending has given way to the need for companies to increasingly focus on short-term profits. There are also increasing incentives for American companies to move their manufacturing operations and even research facilities to other countries. Nations like India and China are appealing because they can provide cheaper labour costs, sufficient intellectual talent and more favourable tax and policy climates. Industry leaders in the United States say they are having difficulty recruiting scientists and engineers in the US for two reasons. The numbers of scientific degrees awarded to US citizens are declining while tightened immigration regulations and national security are making it harder for foreign students to train and work on US soil.

In the United States, government investment in research is essential to stimulate increased private spending. Businesses can then capitalize on those dollars. In a recent National Academies report titled *Rising Above the Gathering Storm*,[5] a cadre of academic and business experts illustrated in great detail the declining environment for investments in science, education and innovation in the United States. Similar reports have been published by organizations representing industry, such as the Council on Competitiveness, the Chamber of Commerce and the National Association of Manufacturers.

Although the United States still leads the world in science and research investment, the overall number of publications by US scientists has not increased for a decade and has recently fallen behind Europe.[6]

Investing in research to improve health

Half a century later, the societal problems cited by Vannevar Bush in *Science – The Endless Frontier* still exist or have been amplified, particularly in the "war against disease". Health-care spending in the United States has skyrocketed and now makes up 16% of its economy.[7] This level of spending (approximately US$ 7500 per person in 2007[8]) on health would certainly be worth it if the resulting health outcomes at least matched other industrialized nations that spend half as much. American citizens may pay more for their health care than anyone else, but they do not live as long or as well as many. People in more than 40 countries including Bosnia and Israel live longer on average than do Americans.[9] The United States has close to 50 million residents not covered by health insurance, two-thirds of Americans are overweight or obese, and the country is facing the retirement of the Baby Boom[10] generation that will draw in record numbers on the social safety-net programmes of Social Security and Medicare.

So what is the answer? Economists Kevin Murphy and Robert Topel make a compelling case that enhanced investment in research coupled with cost containment in health-care delivery could save the United States trillions in the

long run. By their calculations, gains in life expectancy from 1970 to 2000 in the United States added US$ 3.2 trillion each year to the nation's wealth. In a recent study, they suggest that even a modest 1% reduction in mortality from cancer would be worth nearly US$ 500 billion in social value.[11] The social value of improved health and longer lives is measured by what those health improvements and extra years are worth to people.

Research!America estimates the amount of money spent on research to improve health in 2006 to be US$ 116 billion (see Table 4.1). This amount is less than 6% of the US$ 2.1 trillion[12] spent on health in the United States in the same year.

Table 4.1

Estimated US HR&D expenditures, 2006

	US dollars (millions)
Industry	
Pharmaceutical industry (research and development)[a, b, c]	36 959
Biotechnology industry (research and development)[a, b, c]	18 241
Medical technology industry (research and development)[d] (2004)	9460
SUBTOTAL	64 660
Federal government	
National Institutes of Health[e]	28 516
National Science Foundation (biological sciences, bioengineering, chemistry, math, physics, behavioural sciences, computer and information science and engineering, polar health)[e]	1903
Department of Defense (medical research, chemical and biological defense)[e]	1614
Department of Agriculture[e]	1159
Department of Energy (biological and environmental research, advanced scientific computing research)[e]	792
Department of Veterans Affairs (medical and prosthetic research)[e]	769
Centers for Disease Control and Prevention[e]	546
Environmental Protection Agency (clean air, clean water, health & human ecosystems, pesticides & toxics)[e]	472
National Aeronautics and Space Administration (NASA) (Human Research Programme)[e]	415
Department of Homeland Security (chemical and biological)[e]	387
Agency for Health-Care Research and Quality[e]	346
Department of Commerce (National Institute of Standards and Technology)[e]	267
Department of the Interior (biological research)[e]	180
US Agency for International Development[f]	152
Food and Drug Administration[e]	148
Centers for Medicare and Medicaid Services[e]	28
Health Resources and Services Administration[e]	12
SUBTOTAL	37 706
Other	
Universities (institutional funds, 2005)[g]	8258
State and local government contributions (2005)[g]	2940
Independent research institutes (institutional funds)[h]	915
Voluntary health associations[i]	892
Philanthropic foundations (2005)[j]	708
SUBTOTAL	13 713
TOTAL	116 079

Sources: [a]Pharmaceutical Research and Manufacturers of America. *Pharmaceutical Industry Profile 2007* (www.phrma.org/files/Profile%202007.pdf); [b]Burrill & Company. Biotech 2006; [c]2006 annual reports of PhRMA member biotechnology companies; [d]AdvaMed (www.advamed.org); [e]American Association for the Advancement of Science. *Research & Development FY 2008* (www.aaas.org); [f]United States Agency for International Development. *Health-Related Research and Development Activities at USAID*, 2006 (pdf.usaid.gov/pdf_docs/PDACH111.pdf) and personal correspondence; [g]National Science Foundation. *Industrial Funding of Academic R&D Rebounds in FY 2005*; [h]Association of Independent Research Institutes. Survey of Members 2006 (www.airi.org); [i]2006 annual reports of selected voluntary health associations; and [j]The Foundation Center. *Distribution of Foundation Grants by Subject Categories* (www.fdncenter.org).
Compiled by: Emily Connelly and Stacie Propst, Research!America.

To put it in more telling terms, a mere 5.5 cents of the American health dollar is invested in research with the potential to solve costly, chronic conditions such as obesity, heart disease, cancer, diabetes and Alzheimer's (see Figure 4.2).

Figure 4.2

HR&D expenditures as a percentage of total health costs
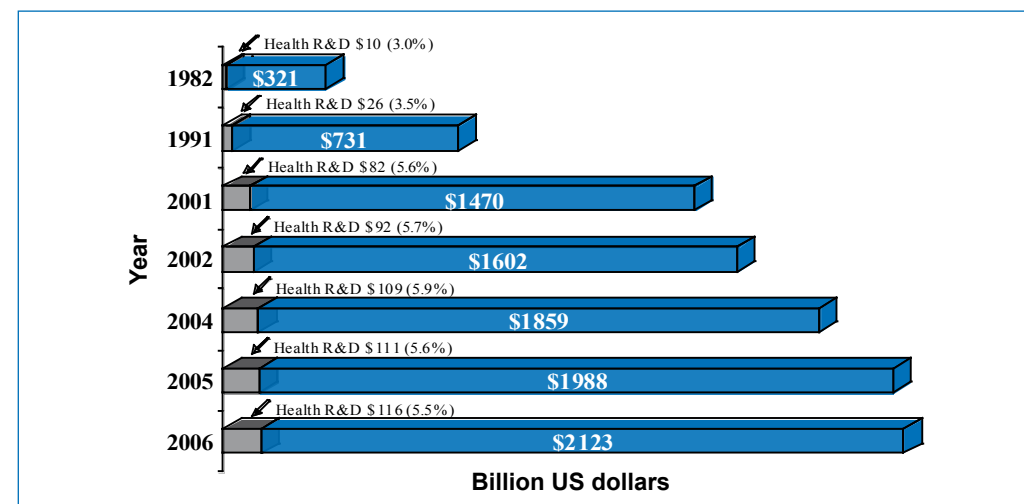
Sources: NIH Data Book; Research!America. Investment in US Health Research 2001, 2002, 2004, 2005, 2006; and Centers for Medicare and Medicaid. National Health Expenditure Amounts 2001-2006.

Going global

As the world's communities draw closer and borders become increasingly porous, global health has become a priority. The United States as the world's leading investor in science and research is also uniquely positioned to lead in research that can improve health in nations around the world.

With support from the Ellison Medical Foundation, in 2005, Research!America

published the first known estimate of US investment in global health research.[13] Based on 2003 data, the report captured private and public investment in research focused on diseases and conditions that disproportionately affect poor populations in low- and middle-income countries.

Research!America continues to track investment in global health research with support from the Bill & Melinda Gates Foundation. The organization estimates that the United States spent approximately US$ 9.3 billion on global health research in 2006 (see Table 4.2). This represents 8% of the total US investment (US$ 116 billion) made by private and public entities in health research.

Included in Research!America's estimate is research on diseases like HIV/AIDS, which affects millions of people worldwide, and parasitic diseases such as lymphatic filariasis, which are virtually unknown in the United States. Research!America also attempts to capture the full spectrum of research, including prevention research and assessments of which health interventions are most effective in the field. Challenges in compiling this data are significant because reporting varies among sectors and it can be difficult to isolate funds dedicated to global health research from overall health research investments.

Table 4.2

Estimated US investment in global HR&D, 2006

Source of funding	Global HR&D (million US dollars)
Pharmaceutical and biotechnology industries[a, b]	3478
National Institutes of Health[c, d]	4981
Centers for Disease Control and Prevention[e]	32
US Agency for International Development[f]	152
Department of Defense[g, h]	64
Department of State[i]	39
Foundations (2005)[j, k]	592
TOTAL	9338

Sources: [a]PhRMA New Medicines in Development Database; [b]PhRMA Industry Profile 2007 (www.phrma.org/files/ Profile%202007.pdf); [c]NIH Office of Aids Research FY 2008 Congressional Budget Justification (www.oar.nih.gov/public/pubs/fy2008/OAR08CJ.pdf); [d]NIH Estimates of Funding for Various Diseases, Conditions, Research Areas (www.nih.gov/news/fundingresearchareas.htm); [e]CDC Financial Management Office; [f]USAID Global Health Bureau; [g]Army RDTE Budgets FY 2007, Volumes I and II, Budget Activities 2, 3, 4, and 5 (www.asafm.army.mil/budget/fybm/archived/2000s/fybm-chart.asp); [h]Defense Health Programme FY2008/2009 Budget Estimates, Volume 2, Section 3-B (www.defenselink.mil/comptroller/defbudget/fy2008/budget_justification/index.html); [i]US Department of State. International Affairs Function 150 Summary and Highlights, FY 2008 Budget Request (www.state.gov/documents/organization/80151.pdf); [j]Bill & Melinda Gates Foundation 2005 Form 990-PF (www.gatesfoundation.org/nr/downloads/financialreports/2005_Attachments_A-L.pdf); [k]The Foundation Center. International Grantmaking Update. October 2006 (www.foundationcenter.org).
Compiled by Emily Connelly and Christine Hunt, October 2007.

Understanding the US investment in global health research is important in determining whether the United States is indeed taking on the challenge of developing solutions for

the world's most intractable but imminently preventable health problems. The American people expect such leadership. According to recent polling, eight in ten Americans think it is important for the United States to work to improve health globally. They would agree with former Congressman Paul G Rogers'[14] declaration that "[i]nvesting in global health research is the smart thing to do for America and the right thing to do for the world."

Recognizing the need for more voices to speak out on the importance of global health research, Research!America established the Paul G Rogers Society for Global Health Research. The Society is composed of scientific leaders representing a broad spectrum of research fields and public health. The Society's "ambassadors" as they are called receive the full benefit of Mr Roger's vast experience and skill at communicating the importance of making research, including global health research, a higher national priority.

With support from the Bill & Melinda Gates Foundation, Research!America enables the Society's ambassadors to engage policy-makers, thought leaders, the media and the public on the value and importance of investing in global health research.

What Americans want

If it were up to the American people, investment in research to improve health would not be leveling off. Research!America has been tracking public opinion about research and health-related topics for almost two decades. Measuring attitudes about research and health is a way of understanding better the value Americans place on investing their tax and consumer dollars in improved health.

While the vast majority of Americans (97%) think it is important for the United States to be a global leader in scientific research (see Figure 4.3), 65% believe that the US is losing its global competitive edge in innovation.

Figure 4.3

US public opinion on the importance of the United States being a global leader in scientific research
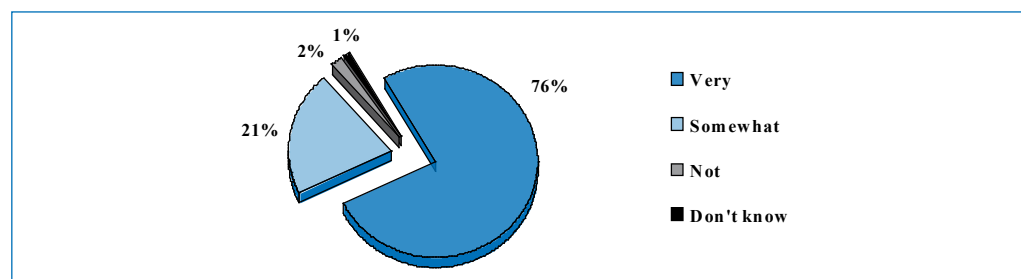
Source: Charlton Research Company for Research!America. Bridging the Sciences Survey, 2006.

Research!America's data clearly show that seven in ten Americans would be more likely to vote for a candidate for Congress if that candidate were a strong supporter of federal spending for medical, health and scientific research.

1 http://www.nsf.gov/about/history/nsf50/vbush1945_roosevelt_letter.jsp.
2 www.nsf.gov/od/lpa/nsf50/vbush1945.htm.
3 www.nsf.gov/about/history.
4 www.nih.gov/about/almanac/appropriations/index.htm.
5 www7.nationalacademies.org/ocga/testimony/Gathering_Storm_Energizing_and_ Employing_America2.asp.
6 Mervis, J. Scientific publishing - U.S. output flattens and NSF wonders why. Science, 2007, 317:582.
7 Centers for Medicare and Medicaid Services (CMS), Office of the Actuary.
8 www.kff.org/insurance/upload/7692.pdf.
9 www.census.gov/ipc/www/idb/.
10 Term is used to refer to persons born during the post-World War II surge in births in North America and the United Kingdom (1946-1964).
11 *The Value of Health and Longevity*, NBER (www.nber.org/digest/dec05/w11405.html).
12 Centers for Medicare and Medicaid Services (www.cms.hhs.gov/NationalHealthExpendData/downloads/proj2006.pdf).
13 Woolley M, Propst SM, Connelly ET. United States investment in global health research, *Global Forum Update on Research for Health. Vol. 2 Poverty, equity and health research*, Geneva, Pro-Book Publishing and Global Forum for Health Research, 2005:91-95.
14 The Honourable Paul G Rogers, former US Congressman from Florida (1955-1979), served as chair of the House Subcommittee on Health and the Environment from 1971-1979.

Chapter 5

Using bibliometrics to inform cancer research policy and spending

Richard Sullivan, Seth Eckhouse and Grant Lewison for the European Cancer Research Managers Forum

Richard Sullivan is chairman of the European Cancer Research Managers Forum (ECRMF) and UK Director of the Council for Emerging National Security Affairs (CENSA), a Washington-based think tank. He is also a professor at the London School of Economics and Political Science (Department of Social Policy - Health, Population and Society). He was previously with Cancer Research UK where he served on the charity's Executive Board as Director of Clinical Programmes and Centres and was responsible for the management of the clinical research portfolio, as well as clinical policy across a broad range of areas.

Seth Eckhouse is the administrative director of the ECRMF. He is a graduate of Boston University's School of Public Health (USA) and served four years with the United States Marine Corps.

Grant Lewison is co-founder of Evaluametrics Ltd, a consultancy company specializing in the evaluation of research through publication metrics. Prior to starting Evaluametrics Ltd in 2005 with Philip Roe, he worked with the Wellcome Trust in London and was Visiting Professor in the Information Science Department, City University.

- *Bibliometric analysis can provide important information that decision-makers can use in determining how funds for health research are most wisely spent.*
- *Comparisons of research outputs and DALYs can suggest areas of research that are unduly neglected in particular countries.*
- *Good research governance is essential, but bureaucracy is absorbing too much of the global investment in cancer research. There is an urgent need to reconsider the regulatory paradigms that have been built into a thriving industry around cancer research and reverse this trend.*

Using bibliometrics to inform cancer research policy and spending

The importance of surveying cancer research activity

Research into the causes, prevention, diagnosis and treatment of cancer is a US$ 17 billion global enterprise, encompassing basic research on genetics and cell science, epidemiology, research on diagnostic tools and procedures and on the three main treatment paths of surgery, chemotherapy and radiotherapy. Each year, about 40 000 papers relevant to cancer research are published in scientific journals, yet the toll from the disease does not diminish. The World Health Organization (WHO) estimates that each year nearly 7 million people worldwide lose their lives prematurely to cancer.[1] Indeed, one in eight deaths is from cancer. In industrial countries the figure is even more alarming at more than one in four. The undiminished death toll persists despite a decrease in smoking rates in many industrial countries and significant advances in cancer diagnosis and treatment over the last few decades. What is more, the impact of cancer on low- and middle-income countries is projected to increase over the next three decades, particularly given the growing rate of tobacco use.[2] For many of these countries affected by the double burden of both chronic and infectious diseases, research and health resource prioritization is of particular and paramount importance.

We need, therefore, assist decision-makers and managers who are responsible for administering cancer research funding by providing them with information about the landscape of current cancer research activity. Using publications of research findings as a proxy indicator, we can look at the geographical distribution of cancer research activity, its characteristics (which manifestations of cancer? which approaches to tackling the disease?

patient- or laboratory-based?), and whether these correlate with the burden of disease. Transnational comparisons may reveal that particular countries are under-researching cancer overall, or certain aspects of the disease.

The funding of research is not always top-down, driven by clear policy from government in response to a perceived need: it may also be bottom-up, especially where research projects are proposed by investigators and then selected for funding after a peer-review process. The motivation here may be intellectual, or it can be the personal experience of individual researchers whose family members or friends may have succumbed to a particular manifestation of the disease. That cancer research covers such a huge range of scientific endeavour, from the social to natural sciences, makes the task of developing realistic measures of the state of global cancer research complex.

Over the last six years, the European Cancer Research Managers Forum[3] (ECRMF) and others have complemented ongoing national work by collecting and disseminating high quality funding and activity data on global cancer research. ECRMF has developed a methodology that uses bibliometrics to iden-tify global cancer research funders (govern-mental, not-for-profit/charitable and industry), estimate health research expenditures and analyse research activity.[4] Such data, parti-cularly when subjected to trend analysis and aggregated at a sufficiently high level, provide important strategic intelligence. Bibliometric analysis involves the selective identification of cancer research papers in the Science Citation Index (SCI), by means of a "filter" based both on

specialist cancer journals and title keywords.[5] The title keywords are essential as about two thirds of cancer papers are published in non-specialist journals.[6] The selected papers' bibliographic details are then downloaded to spreadsheets, where they can be analysed. The papers themselves can be looked up online or in libraries to record the acknowledged sources of financial support, using methodology originally developed at the Wellcome Trust.[7]

This information can then be compared to data on burden of illness from cancer. In determining the latter, we have been helped greatly by the recent publication by WHO of estimated deaths and disability-adjusted life years (DALYs) lost from particular diseases and disorders[8] for all member countries for 2002. We are also aided by statistical compilations from Europe[9] – mostly through WHO's cancer control arm, the International Agency for Research on Cancer (IARC) – and from Surveillance, Epidemiology and End Results (SEER) and the Centers for Disease Control and Prevention (CDC) in the United States.[10] Estimates of deaths from named causes, by age category, are also available for recent years for many countries. With these data, estimates can be made of the differential life expectancy of people diagnosed with a specific disease compared with the general population, and of how life expectancy has changed over time.[11] Unfortunately, the latter data may be deficient for some countries, where cultural factors mitigate against truthful recording of causes of death.

Is there too much or too little cancer research?

Previous reports of the Global Forum for Health Research[12] have drawn attention to the "10/90 gap", the imbalance between the world's biomedical research portfolio and global burden of disease. Diseases of the rich receive far greater funding for research than diseases of the poor. The gap arises because countries are inclined to set their biomedical research agenda with reference to their local health needs. As the overwhelming majority of research is carried out in the richer countries whose health priorities are dominated by noncommunicable diseases, it is these diseases that receive the most attention. The imbalance is made worse because poor countries have much higher DALYs per capita than rich countries. Table 5.1 shows DALYS for several countries over the range of values estimated by WHO, where Iceland had the lowest DALY per capita (0.10) while Sierra Leone had the highest (0.95).

adults. If we compare the output of cancer research papers in the SCI with the total for all biomedical research (based on the selection of papers with one or more of a large number of biomedical address terms),[13] we find that cancer research papers (corrected for the calibration factor of the filter used to identify them, 1.06) account for about 13% of the biomedical total for the years 1999-2003. This suggests that the disease is over-researched, in line with other diseases now prevalent in industrial countries.[14] Ill-health and premature deaths in low- and middle-income countries often occur, not by a lack of knowledge of how to diagnose and treat a disease, but by a simple lack of clean drinking water and good sanitation and issues of violence within and between societies. The situation in industrial countries is radically different. For example, in the UK the disease burden from cancer was estimated at 1.17 million DALYs out of a total of 7.56 million, or 15.5%, but its output of cancer research papers was only 3115 out of 29 000 or 10.7%, barely two thirds of what might have been justifiable if – and only if – national priority setting does not take into account research efforts in other countries.

Even though one would not expect the biomedical research agenda to be slavishly dictated by disease burden statistics, and there are good scientific and humanitarian reasons for work on diseases that are not prevalent in industrial countries, such as malaria, this comparison does suggest that more money could justifiably be spent on cancer research in many low- and middle-income countries. As the population ages, more deaths, particularly among men, will be from cancer (see Figure 5.1 that shows rates for the UK over 20 years). This is an additional argument for more cancer research in Western Europe and other industrial countries, though a few of them (notably Greece and Italy) already do more than expected. Greece publishes just over 20% of its biomedical research papers in cancer, but its cancer burden in DALYs is only 15.4%. This is exceptional.

Table 5.1

WHO estimates of numbers of DALYs per capita (p.c.), selected countries, 2002.

Country	DALY p.c.	Country	DALY p.c.	Country	DALY p.c.
Sierra Leone	0.95	South Africa	0.46	Indonesia	0.21
Lesotho	0.75	Ghana	0.35	Poland	0.15
Chad	0.61	India	0.29	Iceland	0.10

Although cancer accounts for about 12% of deaths worldwide, its burden in DALYs is barely 5%, because most people die from the disease when they are middle-aged or older
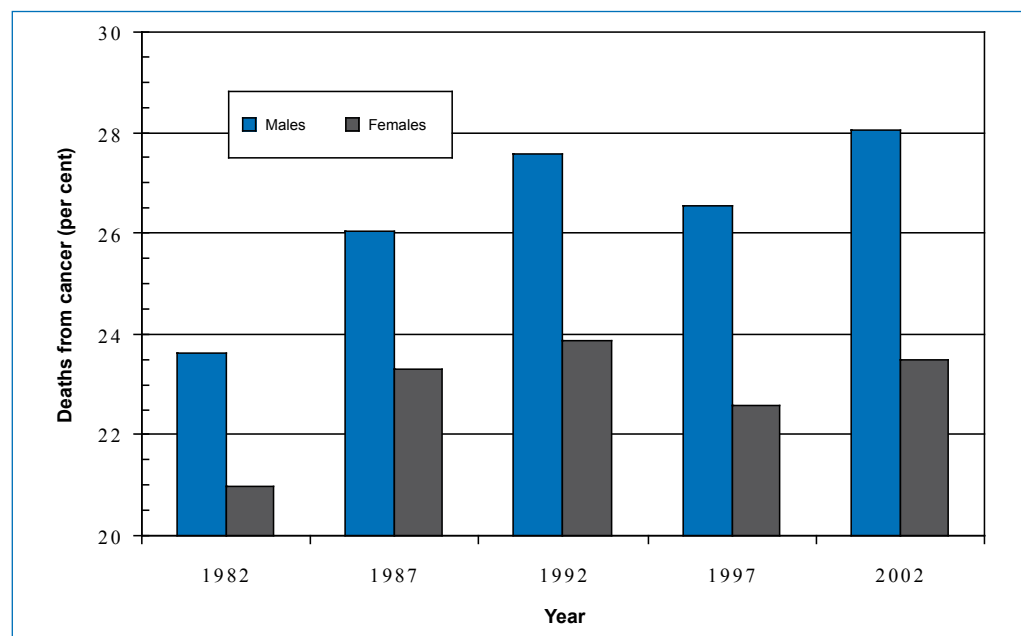
Figure 5.1

Percentages of all deaths that were recorded for malignant neoplasms, 1982-2002, in the UK

Source: UK National Statistics Annual Reports, UK Government Statistical Service.

If the amount of cancer research is less than might be justified, can we use the data on outputs to suggest areas of research that are being unduly neglected in particular countries (as the pattern of support is still largely national)? There are two possible approaches. The first is to compare one country's pattern of outputs with those of other countries. This is not necessarily logical, because the overall distribution of the cancer research portfolio may not be ideal, based, as it is, on a multiplicity of decisions in many countries, funding agencies and research institutions, each of which may have particular special interests. However it can show some clear and interesting patterns. For example, in comparison to other industrialized countries, Japan does relatively more research on stomach cancer and relatively less on breast cancer.[15] This appears to be appropriate as it reflects the burden of disease from these two cancer manifestations in Japan. Other countries

could compare their relative commitments to these two disease areas (and others) and see if they also reflect their relative burden.

An alternative approach is to look at the relationships between research outputs and improved treatment of patients or reductions in disease incidence to see if there are any obvious lacunae. This is clearly more difficult, although several studies have shown that research into new cancer drugs (chemotherapy) is relatively well supported, particularly by the big pharmaceutical and biotech companies, whereas research into improved surgery (which is currently the main means of effecting cancer cures) is relatively neglected, probably because of the lack of clear commercial incentives to exploit innovative techniques. Public health and preventive medicine are also neglected, especially the psychosocial work that could underpin campaigns to change

people's lifestyle choices and behaviour (see data in reference 18). So too is research on social inequalities and stress and their relationship to cancer incidence.

Determining funding for cancer research: two approaches

Over the last five years, a substantial database of funding sources and their direct spend on cancer research has been built up. In Europe, major governmental and charitable bodies[16] have been identified through the ECRMF. In the United States, data were obtained through a 1997 review by the Institute of Medicine and the RAND database of federally-funded research (RaDiUS).[17] Most of the direct expenditure identified came from self-declared submissions and was relatively low resolution – that is, it encompassed only aggregate financial data for each source. For those organizations that fund only cancer research, mostly in the charitable sector, these data were relatively easy to verify using published accounts. However for governmental funding sources, there were few clear-cut disease-specific data.

In addition to the activities of the ECRMF and RAND, an initiative has been started to provide high-resolution, uniformly coded data for cancer research funding and projects. The International Cancer Research Portfolio,[18] which uses the Common Scientific Outline method, was originally developed in the United States and has now been applied. It is now used extensively in the United Kingdom (since 2002)[19] and more recently in Canada.[20] These high-resolution studies provided comparable, high quality data on funding by both site and approach (prevention, basic research). Initiatives are under way to apply the Common Scientific Outline to other countries, in particular other European Union Member States and Australia.

Thus, while there are relatively good data for Europe and North America, few are available on cancer research funding in other countries, particularly those in the Far East[21] and South America. In addition, while surveys of cancer research funders capture direct expenditure,

they are unable to estimate indirect support through infrastructure funding of research activities in the university and national health-care systems – both of which tend to be supported by national (or regional) governments in Europe. A great deal of cancer research expenditure comes from the commercial sector. Indeed, Global Forum for Health Research analyses have indicated that about half of all biomedical research spending is from this sector, particularly from large pharmaceutical companies.[22]

Hence, this study pursued an alternative approach to estimating cancer research funding – one based on bibliometrics. The assumption was that it would be possible to establish a cost per paper, and then multiply this figure by the number of published papers to give an estimate of expenditure (this method is able to take into account a number of complex interactions, for example the non-linear relationship between funding input and publication output). The cost of a paper was estimated in two ways. The first was simply to divide the number of biomedical papers by the Global Forum for Health Research estimate of the public domain biomedical research expenditure (government and non-profit).[23] The second was to ask leading cancer researchers (identified from the cancer research paper files) for their annual research budgets, and divide these by their fractionated paper counts. It turned out that the two figures were fairly close. The mean public domain cost of cancer research papers was US$ 232 000 in 2001. In that year, the public domain expenditure of US$ 55 billion (US$ 106 billion less US$ 51 billion of commercial funding) led to the publication of about 287 000 biomedical papers in the SCI. Perhaps 18 000 of these papers would have been from research funded by the pharmaceutical, biotech and medical equipment companies (allowing also for the

papers funded by industry but without an industrial address, about 45% of the total). Thus, approximately 269 000 papers could be estimated to be funded by public domain sources. The average cost per paper would have been about US$ 205 000, somewhat less than the mean estimated cost of a cancer paper. However this global estimate would have included about 15% of papers from low- and middle-income countries, whose average cost per paper would have been much lower than the mean for industrial countries, so reducing the world average to below the estimate made based on researchers' responses to our enquiry. This estimate in turn would be expected to be higher in the United States than in Western Europe.

Use of bibliometrics to identify amounts of support for cancer research

During the years 1999-2003, there was an average of 38 830 cancer papers per annum in the SCI (after correction for the filter's lack of precision and recall), of which about 15% would have been supported by industry. So the 85% of papers supported by the public domain would have an estimated cost of about US$ 7.7 billion. To estimate the total budget for cancer research, the expenditure of the pharmaceutical industry was added. As much of this does not appear in the form of published papers, a slightly different avenue taken to estimate its contribution to global cancer research funding. For the 24 leading companies, which together represent about 90% of total pharmaceutical industry expenditure, their total R&D spends (as published in their annual reports and reproduced in the UK Department of Trade & Industry's "R&D Scoreboard") were fractioned by the percentage of their SCI papers within the cancer field. The somewhat heroic assumption that the proportion of published cancer research papers reflects the proportion of cancer research conducted gave an estimate of US$ 3.4 billion for the named companies (see Table 5.2). Scaling up to allow for the rest of industry (including medical device and services companies) would give an estimated commercial cancer R&D expenditure for 2001 of about US$ 4.7 billion. The total cost of cancer research in that year could therefore be estimated at US$ 12.4 billion, or just under 12% of world biomedical expenditure.

Table 5.2

Estimated expenditures on total and cancer-related R&D by 24 leading pharmaceutical companies for 1999-2003 (US dollars in millions)

Company		All	Cancer	Company		All	Cancer
Novartis	CH	2972	379	Schering-Plough	US	1120	129
Aventis	FR	3103	367	Wyeth	US	1577	123
Roche	CH	2779	335	Merck Sharp & Dohme	US	2118	115
Johnson & Johnson	US	2956	228	Sanofi-Synthelabo	FR	1138	114
GlaxoSmithKline	UK	3931	213	Merck	DE	594	66
Bristol-Myers Squibb	US	1742	212	Daiichi Pharma	JP	336	62
Pfizer	US	4056	209	Takeda Chemical	JP	729	59
AstraZeneca	UK	2515	186	Eisai	JP	396	46
Amgen	US	883	185	Sankyo	JP	581	30
Schering	DE	901	162	Fujisawa Pharma	JP	402	25
Eli Lilly	US	1754	156	Yamanouchi Ph.	JP	459	24
Boehringer Ingelheim	DE	1112	131	Novo Nordisk	DK	537	9

Country codes: CH = Switzerland, DE = Germany, DK = Denmark, FR = France, JP = Japan, UK = United Kingdom, US = United States.

Bibliometrics also can give information about the support provided by public sector and charitable sources. Funding acknowledgements were recorded from a large structured sample of cancer papers, with proportionately more papers included from the smaller countries in Europe. The numbers of acknowledgements to the leading national funding bodies, fractionated to allow for multiple funding of many of the papers, were scaled up to allow for the size of the samples of papers from each country, and then multiplied by the estimated cost of a cancer paper (US$ 232 000). The resulting estimates needed further correction to allow for higher salary costs in the United States compared with Western Europe, and for the observation (from many charities in the United Kingdom) that about one third of papers supported by disease-specific charities were outside their nominal field of research. As such, their actual expenditure was likely to have been about 50% higher than these estimates.

Table 5.3

Leading public sector and charitable sources of funding for cancer research in 2001 (US dollars in millions)

Name of funding source	Country	Category	Total funding[a]	Corrected funding[b]	Actual funding
National Cancer Institute (+ other National Institutes of Health)	US	GA	2443	2282	2640
MD Anderson Cancer Center, Houston TX	US	NP	636	332	258
Veterans Administration	US	GD	518	270	
Department of Defense	US	GD	422	220	
American Cancer Society	US	CH	313	163	131
Mayo Clinic and Foundation, Rochester MN	US	NP	272	142	
Cancer Research UK (Cancer Research Campaign)	UK	CH	383	123	216
Associazione Italiana per la Ricerca sul Cancro (AIRC)	IT	CH	323	103	39
Deutsche Forschungsgemeinschaft	DE	GA	268	86	
German Cancer Research Centre (DKFZ)	DE	NP	234	75	57
Institut National de la Santé et de la Recherche Médicale (INSERM)	FR	GA	210	67	
Ministry of Research and Universities (MURST)	IT	GD	207	66	
Deutsche Krebshilfe e.V.	DE	CH	195	62	75
Medical Research Council of Canada	CA	GA	178	62	
Italian Ministry of Health	IT	GD	189	61	
Dutch Cancer Society	NL	CH	178	57	52
Medical Research Council	UK	GA	170	55	
Association pour la Recherche sur le Cancer (ARC)	FR	CH	168	54	31
Centre Nationale de la Recherche Scientifique (CNRS)	FR	GA	99	32	

[a] Total = estimated number of annual papers, fractional counts.
[b] Estimates have been corrected for salary differences between countries, and for some expenditure being outside the cancer field as defined.
Country codes: CA = Canada, CH = Switzerland, DE = Germany, DK = Demark, FR = France, IT = Italy, JP = Japan, NL = Netherlands, UK = United Kingdom, US = United States.
Category codes: CH = collecting charity, GA = government agency, GD = government department, NP = other non-profit.

Table 5.3 also shows the actual expenditures of some of the funding sources where data were available from ECRMF surveys or other published data. Although there was a fair correlation between the estimated and actual expenditures, degrees of errors were due mostly to the sampling process, whereby some funding bodies' papers were either over- or under-represented.

Not all the papers had a financial acknowledgement and may have been supported by university funding (e.g. salaries paid to faculty members) or hospitals, where physicians and surgeons would (in Europe) normally be on contract to the health authority, or regional or national government. In papers where there are formal acknowledgements some of this "hidden" funding would also have occurred in the form of staff salaries and overheads. Overall, about one third of the cancer papers inspected had no specific funding acknowledgements, but there would have been a public sector contribution of up to US$ 2.9 billion to pay for this research. This was likely to be an over-estimate, however, as the papers entailed mostly clinical observation and would have cost less than the average for funded projects. This total would have been within the "public domain" total of US$ 7.7 billion, so the contribution of other funders would have been at least US$ 4.8 billion, and possibly more. The organizations listed in Table 5.3 have a calculated total expenditure of US$ 4.3 billion; they probably represent about 90% of all public sector funders, so "hidden" public sector cancer research support is estimated at roughly US$ 2.7 billion.

Table 5.4

Summary of public and not-for-profit sectors cancer research estimated expenditures by source for 2001 (US dollars in billions)

Source	Region	Funding
Government agencies and departments	US/CA	2.9
	EUR	0.5
	Other	0.1
Private non-profit sources	US/CA	0.7
	EUR	0.6
	Other	0.1
Industry		4.7
International		0.1
Background		2.7
TOTAL		12.4

Country codes: US = United States, CA = Canada, EUR = Europe.

Policy implications of the analysis

Despite large increases in cancer research expenditure by the leading source of funds (US National Cancer Institute)[24] and by some of the European non-profit organizations, notably Cancer Research UK, the world output of cancer research papers has grown only slowly, at about the same rate as that of biomedical research output overall. In part, this is because there have also been large funding increases in some far Eastern countries, notably China and the Republic of Korea[25], and the amount of space in medical journals is limited, which keeps acceleration of outputs under check – though it, too, is slowly expanding to accommodate demand. This slow growth rate in outputs despite increased funding has led to an inflationary

situation where the cost of a research paper has been rising steadily at about 6% per year. Consequently, the global estimate for cancer research expenditure in 2007 would be about US$ 17.6 billion.

Another factor hindering the growth in research outputs was the increasing regulation of research activity. The impact of regulatory policy on cancer research funding and productivity is now a critical issue for all countries. As Europe has recently discovered, changes to regulatory policy can have a dramatic effect on the cost of research.[26] Over the last decade the fashion for ever-increasing regulation across all domains – clinical trials, health-care data, human tissue – has led to an increase in the unit cost of research in the absence of any tangible social benefit from many of those regulations. A particularly pernicious example has been the impact of the Clinical Trials Directive on European non-commercial clinical trials.[27] With costs increasing by two to three times, the number of public benefit clinical trials has substantially decreased. Increases in public funding for cancer research can improve productivity only if regulatory and other management costs are kept in check. Good research governance is essential, but bureaucracy is absorbing too much of the global investment in cancer research. There is an urgent need to reconsider the regulatory paradigms that have been built into a thriving industry around cancer research, and reverse this trend.

As Table 5.4 demonstrates, the United States and Canada spent much more on cancer research in the public domain than did Europe, despite having a smaller population. The ratio of expenditures was more than three to one. However Europe published almost as many cancer research papers as these two countries (13 762 compared with 13 484 in 2000 and 15 516 compared with 15 957 in 2005), so it was clearly getting better value for money. European cancer research is also more clinical and therefore more likely to be put to use in the form of references that underpin clinical guidelines than publications from North

America.[28] These guidelines increasingly are being used to inform best practice and to determine whether new (and expensive) treatments are cost-effective, and so can be justified.

Not-for-profit European cancer research funding was split fairly evenly between the public and private non-profit sectors. This is a good situation as charitable organizations can be rigorous in their use of peer-review for awarding grants to the most meritorious proposals, free from short-term political objectives. In contrast, some state funding bodies still provided only long-term institutional support, which may not be sufficiently flexible to respond to new developments. The massive funding increases that were made available to the National Cancer Institute in the late 1990s may also have discouraged donations to US charities and foundations that played a far smaller part in cancer research there than they did in Europe. What is more, most of the funds raised were directed to cancer service support and outreach programmes where they fill gaps in cancer service provision left by the private health-care system.[29] In many parts of the world, notably Eastern Europe (the new accession countries to the European Union) and in Japan,[30] the tradition of charitable support of cancer research hardly exists. It is inevitably difficult to change long-held attitudes about reliance on state support for the funding of research. In several Eastern European countries, research expenditures were actually reduced in the early 2000s[31] so that their governments could meet the fiscal requirements for joining the European Union. Perhaps more could be done to encourage these countries to provide fiscal incentives for newly-rich entrepreneurs to set up endowed foundations and to allow small-scale collecting charities to develop. There can, however, be too many of these – in the United Kingdom there are over 200 charities established to support cancer research and some of them are so small that it is hard for them to use peer-review to allocate their funds.

Table 5.4 shows the important role played by industry, which contributed almost 38% of the total expenditure on cancer research. There is concern that too much of the overall cancer research expenditures is directed to just one type of research, such that the others – prevention, screening, histopathology, radiotherapy and surgery – are neglected. The latter are less glamorous, whereas the appearance of an expensive new "wonder drug" attracts media headlines and encourages the belief that development of such treatments is the best use of scarce resources. It is for public domain funders to take account of this imbalance and to restore it through increased emphasis on these other areas of research. Bibliometrics can be used to track these changes and to record progress in individual countries.

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Chapter 6

Donor funding priorities for communicable disease control in the developing world

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This chapter examines donor funding for 20 historically high-burden developing world communicable diseases for the years 1996 to 2003 and considers factors that may explain variance in priority levels among diseases.

- *Neither developing world need nor industrialized world interests explain all funding patterns. Donors may be imitating one another in ways that do not take into account problems in the developing world.*
- *Funding does not correspond closely with burden. For example, acute respiratory infections comprise more than a quarter of the burden among the 20 communicable diseases looked at in this chapter, but receive less than 3% of direct aid.*
- *Examining funding by disease is critical since diseases may be in competition with one another for priority and donors may be making allocation decisions in ways that do not correspond to developing world need.*
- *There is an urgent need for a major increase in funding for communicable disease control in the developing world, and for more balanced allocation of resources already provided.*
- *The dynamic between recipient need, provider interest and global policy diffusion makes continued research and monitoring of funding patterns essential to ensure that recipient needs are not crowded out.*

Donor funding priorities for communicable disease control in the developing world

Introduction

Which developing world communicable diseases do donors prioritize with funding and which do they neglect? What explains differential treatment? Are new funding patterns emerging that diverge from past donor practices?

The adoption by United Nations (UN) member states of the Millennium Declaration and Millennium Development Goals (MDGs) reflects a new commitment to address the burden of poverty in the developing world. This consensus includes a particular concern for improving the health conditions of the poor, and may have spurred increased donor funding for health. MDG goals four, five and six concern health explicitly, and lay out specific objectives for the control of a number of diseases, including HIV/AIDS, malaria, tuberculosis and measles. A new commitment to the health of the poor is also reflected in the proliferation over the past decade of initiatives and public-private partnerships dedicated to addressing health problems in the developing world, including the Global Fund to Fight AIDS, Tuberculosis and Malaria and the GAVI Alliance.

Despite increasing industrialized world attention to the health of the developing world's poor in recent years, these questions of donor allocations for communicable disease control deserve consideration for a number of reasons. First and foremost, the shortfall between needed and committed resources for health remains very large, and it is by no means certain that the MDG consensus will bridge the gap any time soon. As MacKellar has noted,[1] the final report of the World Health Organization (WHO) Commission on Macroeconomics and Health argues for a donor commitment of US$ 27 billion per year by 2007 to address the health needs of developing countries.[2] By 2003, at US$ 8 billion, actual donor commitments for health were less than a third of that amount.[3] A consequence of this persistent shortfall is that health initiatives, including efforts to control particular communicable diseases, find themselves in ongoing competition for scarce resources, a dynamic noted in several studies of donor health priorities.[4] Researchers developed the disability-adjusted life year (DALY) measure explicitly in recognition of resource scarcity to aid policy-makers in making difficult allocation decisions.[5]

A second reason these questions deserve attention is that factors other than developing world need may influence donor behaviour, including the interests of industrialized states. This dynamic has received confirmation from several decades of scholarship on aid provision generally and in particular policy sectors such as the environment.[6] However, it has attracted little explicit attention in analyses of aid for health. An exception is MacKellar whose work has highlighted the prominence of HIV/AIDS on the donor agenda to the neglect of nutrition and other basic health care issues, a phenomenon he notes may be a function of domestic politics in industrialized states.[7]

Third, in the developing world communicable diseases continue to pose the greatest burden among all disease categories, and the priority donors give to many may be insufficient. The burden of other conditions, including

noncommunicable diseases and injuries, is increasing in the developing world, particularly among lower-middle income states. However, in the poorest countries where aid is most needed and where the majority of donor funds are directed, communicable diseases continue to represent by far the greatest burden among all categories.[8] In sub-Saharan Africa these diseases alone are responsible for more than half of all deaths.[9]

There are several other reasons analysis of communicable disease control funding allocations is critical. Such funding may constitute a significant portion of donor spending on health and reflect their overall priorities. Also, new initiatives directed towards particular diseases may be altering funding allocations in favour of these diseases and to the neglect of others, including the Global Fund to Fight AIDS, Tuberculosis and Malaria, President Bush's Emergency Plan for AIDS Relief, and the MDGs, which mention HIV/AIDS, tuberculosis, malaria and measles directly. Finally, vertical disease control initiatives may be in tension with horizontal reform initiatives intended to enhance the effectiveness of national health sectors, a subject of ongoing analysis among scholars and observers investigating the most effective means of enhancing health systems capacities in developing countries.[10]

Several studies have considered patterns of funding for developing world health by recipient and donor country.[11] With the exception of a decade old inquiry that touched on the issue in passing[12] and a more recent study that examines allocations for research alone and only for a limited number of conditions,[13] none has done so comprehensively by disease. In this paper the author calculates and examines recent donor funding and initiatives for 20 historically high-burden developing world communicable diseases. He considers explanations for variance in priority and explores whether funding patterns for the communicable disease sector as a whole have shifted in recent years. By examining only donors he does not mean to de-emphasize the critical role in health of other actors such as

nongovernmental development organizations and developing world governments; his aim, rather, is to narrow the focus so as to better understand this particular, highly influential group of actors.

Analysts of foreign aid have developed a number of frameworks to explain donor behaviour, and these may be applied to disease control.[14] A *recipient need* framework presumes that donors respond to the seriousness of problems in a considered way, taking into account humanitarian concerns and the most pressing problems of people in developing nations. With respect to disease control, this framework would posit that factors such as a disease's burden and speed of spread should influence funding levels, as donors target and seek solutions for those diseases that pose the greatest threat to the health of the poor in the developing world.

A *provider interest* framework presumes that the interests of constituencies in industrialized states are paramount. Donors may prioritize a disease because political elites perceive a disease to be a national threat. For instance, in 2000 the Clinton administration labeled the global spread of HIV/AIDS a national security threat, arguing that it had the potential to cause political instability in the developing world. In consequence for the first time the United States Security Council became involved in the fight against an infectious disease. Also, in the late 1980s and early 1990s the United States and Western European governments detected a rise in domestic tuberculosis incidence after decades of decline. It was only thereafter that the United States Congress authorized significant funding for the control of tuberculosis both domestically and overseas, and that the disease received major attention from international organizations such as the World Health Organization.[15] A disease also may be prioritized because it offers profit potential for pharmaceutical companies in drug and vaccine sales,[16] another dynamic consistent with a provider interest framework.

Recent scholarship in political science suggests yet another logic that may underpin the provision

of aid. Scholars working from a constructivist international relations paradigm have argued that the interests of individual nation-states cannot be understood by considering domestically oriented concerns alone.[17] Rather, states, like individuals, exist in an international society, where they are subject to socialization processes. They may not initially know what they want but come to hold particular preferences as a result of socialization by other state and non-state actors into commonly held norms. For instance, a state originally may not prioritize a health cause such as polio eradication, but comes to adopt the cause because domestic health officials learn at international gatherings that other countries are pursuing this goal and they are likely to be left behind. Thus, we may identify a *global policy* framework that presumes a cross-national diffusion of ideas and preferences as state and non-state actors learn from and

influence one another. In line with this dynamic, the agendas of particular individuals and organizations may be crucial. For instance, if influential donors such as the World Bank or the Bill & Melinda Gates Foundation agree that a particular disease should be targeted for global control, dozens of other donors may follow. While recipient need or provider interest may shape initial donor choices, subsequent behaviour may be based less on deliberation than on precedent, resulting in simultaneous global shifts in priorities not always in accordance with developing world need.[18]

In the sections that follow the author examines evidence for these explanatory frameworks by comparing recent funding data across diseases and by considering emerging donor practices.

Methods

The author calculated funding for 20 communicable diseases (see Table 6.1) from 42 donor organizations (see Table 6.2) for the years 1996 to 2003 (in deflated US dollars using 2002 as a base year). He included diseases that historically have afflicted large numbers of people in the developing world, and whose burden has been calculated by

the Global Burden of Disease (GBD) project. He analyzed the years 1996 to 2003 since his primary concern was recent rather than historical priorities, and since records for these but not earlier or later years were relatively comprehensive for each of the donors considered, facilitating reliable comparisons across diseases.

Table 6.1

Communicable diseases considered

Disease	DALYs in developing world*
Acute respiratory infections	71 302 314
Chagas disease	91 473
Dengue fever	378 650
Hepatitis	1 749 484
HIV/AIDS	85 428 359
Intestinal nematode infections	2 068 962
Japanese encephalitis	67 304
Leishmaniasis	1 732 239
Leprosy	111 229
Lymphatic filariasis	4 896 775
Malaria	39 253 040
Measles	24 863 534
Meningitis	3 788 112
Onchocerciasis	950 541
Polio	101 803
Schistosomiasis	1 536 102
Tetanus	8 983 423
Trachoma	601 985
Trypanosomiasis	1 584 036
Tuberculosis	24 973 890

Countries classified by the World Health Organization as having very high or high child and adult mortality.
Source: World Health Report 2001.

Table 6.2

Donor organizations considered

Bilateral donors	Italy
Australia	Japan
Austria	Luxembourg
Belgium	Netherlands
Canada	New Zealand
Denmark	Norway
European Community (grouping of states)	Portugal
Finland	Spain
France	Sweden
Germany	Switzerland
Greece	United Kingdom
Ireland	United States

International financial institutions
African Development Bank
Asian Development Bank
European Bank for Reconstruction and
Inter-American Development Bank
World Bank

Multinational pharmaceutical companies
Aventis
BristolMyersSquibb
GlaxoSmithKline
Merck
Novartis
Pfizer

Philanthropic foundations
Burroughs Wellcome
Edna McDonnell Clark Foundation
Ford Foundation
Bill & Melinda Gates Foundation
MacArthur Foundation
Nippon Foundation
Rockefeller Foundation
Wellcome Trust

The author considered donors of four types: bilateral development agencies of industrialized states; international financial institutions; philanthropic foundations; and multinational pharmaceutical companies. He included each bilateral donor of the Organisation for Economic Co-operation and Development (OECD), an institution that groups the world's industrialized powers. He also considered five international financial institutions offering concessionary loans and grants to developing countries, including the World Bank (loans from these institutions that were not concessionary – including loans by the International Bank for Reconstruction and Development (IBRD) – were excluded). Among the hundreds of philanthropic foundations that fund communicable disease control in the developing world, the author focused on a handful that dominate funding. Many pharmaceutical companies have been involved in drug or vaccine donations: the author considered a number with major roles.

Several agencies of the UN system also are involved in communicable disease control. The author examined their records but ultimately did not include their funding since most UN agencies do not have budgeting or grants collection systems that enable comprehensive classification of grants by diseases targeted for all the years considered in this study. It is possible to estimate disbursements from some of the UN agencies for a small group of diseases. However, to include certain diseases for which data are available and exclude others for which data are not would bias results. The exclusion does not likely influence results significantly as aggregate UN funding for communicable disease control is small compared to that coming from other categories of donors. The World Health Organization's own estimates of planned resources in 2000-2001 for HIV/AIDS, for instance, was US$ 55 million, only 0.40% of the total funding for AIDS control from direct grants calculated in this study. Also, UN priorities do not diverge likely so significantly from the rest of the donor community as to require a modification in conclusions.

The author reviewed approximately 15 000 health-oriented grant records from the 42 donors. He identified 6104 as direct grants targeted towards the control of a clearly specified communicable disease or set of communicable diseases for the years 1996-2003. He excluded a number of other direct grants for communicable disease control, since records did not provide sufficient information to determine the diseases targeted. For this and other reasons, the figures the author calculated should not be used as global totals of funding spent on specific diseases.

The author created a grants database and derived funding totals for each disease year by year. For multi-disease grants he divided funding equally across diseases. There was one exception: the Global Fund pools resources for HIV/AIDS, tuberculosis and malaria control. Its records indicate that 56% of funds have gone towards AIDS programmes, 31% towards malaria and 13% towards tuberculosis. The author divided funding accordingly for those grants made to the Global Fund by donors considered in this study. The Global Fund, the GAVI Alliance and other public-private partnerships were treated as intermediate rather than original sources of funding: he included in the database only grants coming directly from the 42 donors considered, not disbursements from these intermediate entities to recipients.

For the bilateral development agencies the author utilized a database of grants to developing countries compiled by the OECD.[19] A study has noted limitations of this database, including the classification of grants with multiple purposes into single categories, and missing data[20]; however, it is sufficiently complete to facilitate comparative inferences across diseases. For international financial institutions, philanthropic foundations and pharmaceutical companies he consulted annual reports and grants databases of individual organizations. Also, the author cross-checked philanthropic foundation records with those from an organization

that independently tracks US grants.[21] In addition, for all four donor categories he consulted reports from global health initiatives. Some of the data come from grant agreements while others come from final grant reports. Disease incidence data are from the Global Burden of Disease project.[22] Project researchers have developed the disability-adjusted life year (DALY), an indicator that integrates mortality and morbidity information and allows for comparison across diseases of the number of healthy life-years lost due to individual conditions.

Some diseases neglected by direct grants may be prioritized by integrated, non-disease specific indirect grants oriented towards health sector strengthening, and vice versa. To examine this possibility, the author considered a sample of 100 such grants, randomly selected from nine donors: the Asian Development Bank, Australia, the Bill & Melinda Gates Foundation, the Inter-American Development Bank, the Rockefeller Foundation, Sweden, the United Kingdom, the United States and the World Bank. The author's initial aim was to parse spending by individual disease. This proved impossible, as the very nature of these horizontal grants, predominantly for comprehensive health sector development, meant that few (less than 5%) included separate budget line items for the control of particular diseases. The author therefore decided on an alternative means of approaching the issue. While few grants delineated disease-specific funds, each grant included sufficient information to determine whether the control of one or more of the 20 diseases considered in this study were a major objective. The author used this information to calculate the percentage of grants in the sample for each disease that included their control as an objective. He then placed the percentages in rank order by disease and compared this ranking with rankings of direct spending, using Spearman's correlation.

Results

Aggregate spending

Spending on communicable disease control constitutes a considerable and rising proportion of total donor funding for health and population (see Figure 6.1), making analysis of how this money is distributed crucial. Such funding comprised 12% of total spending on health and population for 1996, rising to 37% of total spending on health and population by the year 2003.

Figure 6.1

Funding for communicable disease control as a percentage of total donor spending on health and population*
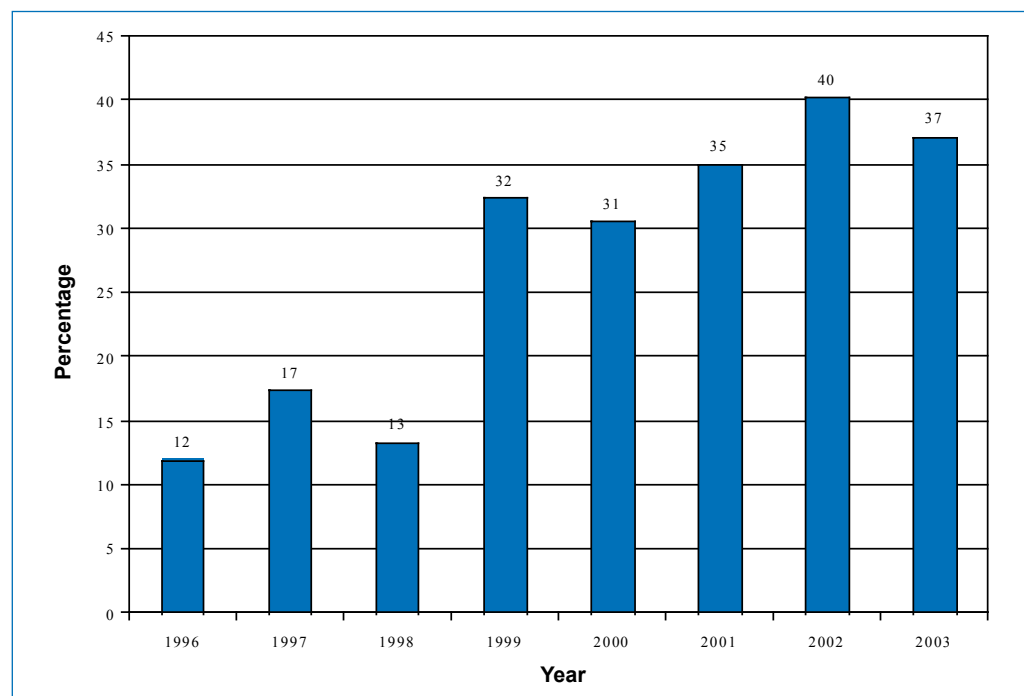
*Calculations are aggregates of the OECD states and agencies as reported in the OECD's credit reporting system, combined with Bill & Melinda Gates Foundation figures as calculated from the Foundation's grant records.

Recipient need

Concern for recipient need does not imply a linear relationship between disease burden and donor funding since factors such as projected change in disease incidence, health systems capacities, the costs of interventions and expenses associated with final stages of eradication should also influence funding levels. However, a recipient need framework would predict a measure of correspondence, on the presumption that donors are responding to the scale of the problem in the developing world.

Figure 6.2 compares burden and funding shares for direct grants for a selected group of diseases, and Table 6.3 lists figures for all 20.

Direct grant levels correspond little to burden. An indicator is that the annual donor dollars per healthy life year lost (see Table 6.3, column 2) vary widely across diseases. Acute respiratory infections represent more than a quarter of the total developing world burden among this group of diseases – second among the 20 diseases and nearly as high as AIDS – yet receive less than 2.5% of direct funding. AIDS is favoured relative to burden, comprising just over 30% of the burden but receiving nearly half of all direct donor funds. Measles and onchocerciasis also present an interesting contrast: measles comprises more than 9% of the burden but receives only 1.7% of direct funding,

while onchocerciasis shows the reverse pattern. Trachoma, leprosy, polio and Chagas disease also are favoured relative to burden, a reflection of the fact that, like onchocerciasis, donors have targeted each disease for elimination.
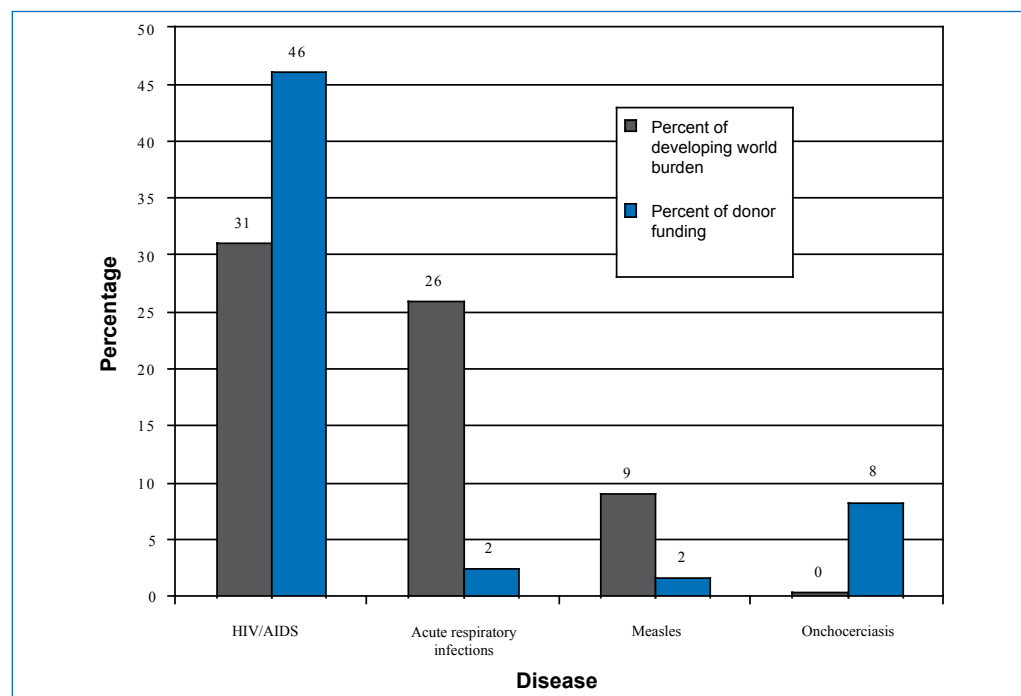
Table 6.3

Disease burden in the developing world versus share of donor funding, direct grants only*

Disease	Annual donor US dollars per DALY, direct funding	Percentage of burden among 20 diseases	Percentage of direct funding among 20 diseases	Total direct funding 1996-2003 (thousands of US dollars)
Polio	2453.79	0.04	14.61	1 998 425
Onchocerciasis	146.96	0.35	8.17	1 117 553
Leprosy	138.07	0.04	0.90	122 858
Trachoma	54.79	0.22	1.93	263 851
Chagas disease	54.49	0.03	0.29	39 877
Japanese encephalitis	51.51	0.02	0.20	27 736
Hepatitis	21.27	0.64	2.18	297 667
Dengue fever	20.37	0.14	0.45	61 704
HIV/AIDS	9.25	31.13	46.21	6 320 599
Trypanosomiasis	7.94	0.58	0.74	100 594
Lymphatic filariasis	5.11	1.78	1.46	200 059
Tuberculosis	4.69	9.10	6.85	936 423
Meningitis	4.58	1.38	1.01	138 751
Malaria	3.92	14.30	9.00	1 230 574
Schistosomiasis	3.90	0.56	0.35	47 935
Leishmaniasis	3.33	0.63	0.34	46 148
Intestinal nematode	3.30	0.75	0.40	54 539
Tetanus	1.65	3.27	0.87	118 415
Measles	1.14	9.06	1.66	227 338
Acute respiratory infections	0.58	25.98	2.40	328 357

* For Table 6.3, donor funding is considered for the years 1996-2003 in deflated dollars, with 2002 as the base year. Burdens are measured in DALYs for the year 2000 for developing countries. Percentages are of the total for the 20 diseases considered, not of all developing world diseases.

Figure 6.2

Percentage of developing world burden and donor funding for selected communicable diseases*

Legend:
- Percent of developing world burden
- Percent of donor funding

*For the period 1996-2003, direct grants only. Sources same as Table 6.3.

On the other hand, GBD data indicate that the increase in burden of AIDS in the developing world from 1990 to 2000 – nearly 57 million DALYs – far exceeded that of the other 19 diseases. The next highest increase was for lymphatic filariasis at 4.05 million. Donors therefore have prioritized a very high burden disease, rapidly growing out of control, a funding pattern in accordance with recipient need.

Provider interest

A strong correspondence between industrialized world disease burden and donor funding for control of developing world diseases may indicate the influence of provider interests, as donors may be targeting diseases that industrialized world political elites believe to be threats to their own citizens or that pharmaceutical companies perceive to be sources of potential drug sales profit.

Table 6.4 presents an indicator of donor direct funding for three high burden developing world diseases alongside burden in the industrialized world. A correspondence exists between the two. The communicable disease with a very high industrialized world burden, HIV/AIDS, is also the one that receives by far the greatest donor attention. HIV/AIDS is unique among developing world communicable diseases in

that it is the only one that is a major threat in both developing and industrialized countries, and one of the few diseases for which drug and vaccine discovery and sales offer potentially large pharmaceutical company profits. Thus provider interest offers an alternative explanation to recipient need for donor prioritization of HIV/AIDS.

Funding priority for tuberculosis compared to malaria control may also indicate provider interest (see Table 6.4). In developing countries the burden of tuberculosis is 57% lower than that of malaria. In industrialized states, however, tuberculosis has a burden more than 25 times greater, emerging as a threat in the 1980s when multi-drug resistant strains appeared.

Table 6.4

Industrialized and developing world burden for selected diseases, and funding for their control*

Disease	Industrialized world burden (thousands of DALYs)	Annual donor US dollars per disability-adjusted life year	Developing world burden (thousands of DALYs)
HIV/AIDS	822	9.25	85 428
Tuberculosis	136	4.69	24 974
Malaria	5	3.92	39 253

*Burden for year 2000; annual donor US dollars per disability adjusted life-year is annual average for the years 1996 to 2003, and considers direct grants only.

On the other hand, provider interests do not explain funding patterns for trachoma, onchocerciasis, leprosy, polio and Chagas disease, each of which, relative to burden, receives considerable donor funding (see Table 6.3 above). These diseases do not threaten industrialized states; nor do they offer pharmaceutical companies significant profit potential.
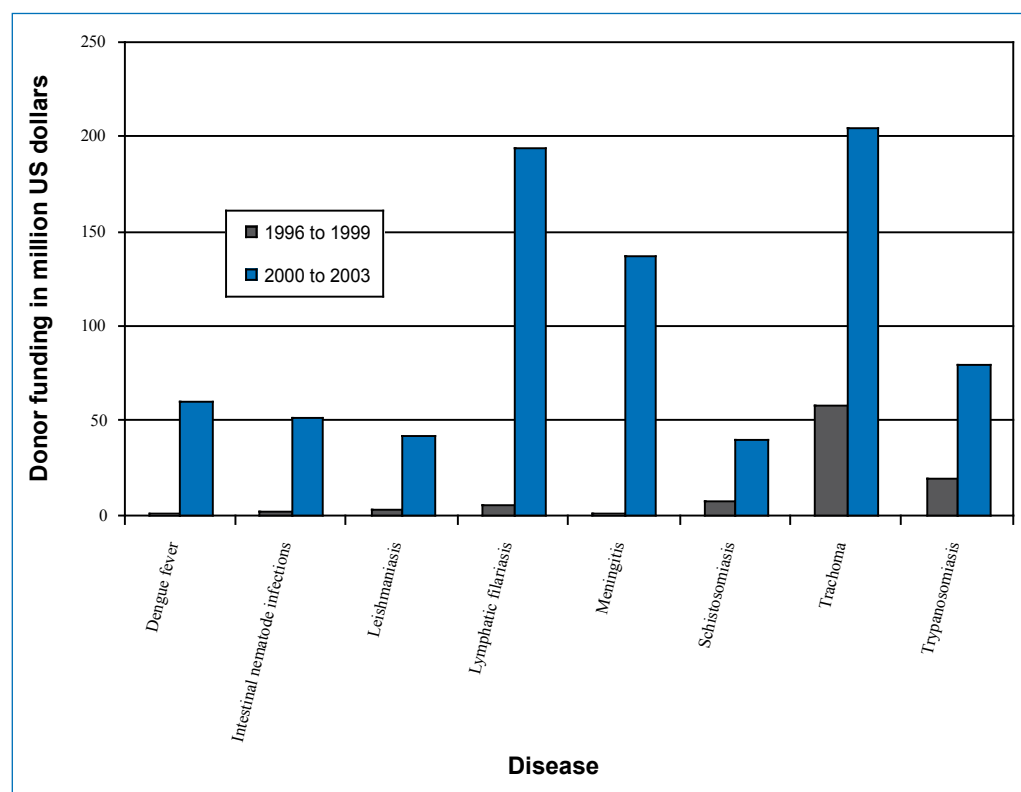
Global policy

Parallel shifts in priority during concentrated time periods may indicate the influence of global policy diffusion. Such shifts may occur because actors are imitating one another or because particular organizations are encouraging them to adopt certain practices.

Several trends indicate the presence of such effects. In the late 1990s direct aid for communicable disease control as a percentage

of total funding for health rose markedly (see Figure 6.1). Also, donors suddenly and dramatically increased funding for a number of long-neglected diseases (see Figure 6.3). Other communicable diseases also experienced significant increases across two time periods (1996-1999 and 2000-2003): HIV/AIDS funding rising 464%, malaria funding 197% and tuberculosis funding 163%.

Figure 6.3

Donor funding in direct grants across two time periods for selected diseases*

Y-axis: Donor funding in million US dollars (0 to 250)

Legend:
- 1996 to 1999
- 2000 to 2003

X-axis (Disease): Dengue fever, Intestinal nematode infections, Leishmaniasis, Lymphatic filariasis, Meningitis, Schistosomiasis, Trachoma, Trypanosomiasis

*Figures from author's calculations based on compiled donor grants database.

Collected grant records indicate that a proliferation of new communicable disease control alliances stood behind these increases, bringing together donors in public-private partnerships, disease control campaigns and global funds focused on specific sets of diseases (see Table 6.5). Many of these well-known initiatives had an investment imperative: donors used a venture capital approach to develop products and strategies – vaccines, drugs and other tools – that might address pressing health concerns. The Medicines for Malaria Venture (MMV), for instance, was formed to discover and deliver affordable anti-malarial drugs. The International AIDS Vaccine Initiative (IAVI) was created to develop effective HIV vaccines for use throughout the world. The Global Alliance to Eliminate Lymphatic Filariasis formed in 2000, bringing together GlaxoSmithKline, Merck, the World Health Organization, the Bill & Melinda Gates Foundation, ministries of health and many other organizations in a public-private partnership.

Table 6.5

Partial list of new communicable disease control initiatives and public-private partnerships since late 1990s

Year	Disease	Purpose	Major donors
1997	Meningitis	Coordinating group for epidemic response	Denmark, Netherlands, Norway, United States, United Kingdom, World Bank, Bill & Melinda Gates Foundation, GlaxoSmithKline, sanofi-aventis
1998	Malaria	Roll Back Malaria alliance to halve world's malaria burden by 2010	Multiple OECD states, World Bank, Bill & Melinda Gates Foundation, Rockefeller Foundation, Wellcome Trust, Burroughs Wellcome, WHO, UNICEF, UNDP
1998	Tuberculosis	Stop TB partnership to control disease	Multiple OECD states, World Bank, sanofi-aventis, GlaxoSmithKline, Bill & Melinda Gates Foundation, Rockefeller Foundation, Wellcome Trust
1998	Trachoma	International Trachoma Initiative to eliminate disease	Clark, Pfizer, Bill & Melinda Gates Foundation, WHO
1999	Hepatitis, acute respiratory infections and others	Global Alliance for Vaccines and Immunization (the GAVI Alliance) - fund for new vaccines and infrastructure strengthening	Bill & Melinda Gates Foundation primary donor, plus donations from multiple OECD states
1999	Tetanus	Campaign to eliminate disease by 2005	Bill & Melinda Gates Foundation, Japan, WHO, UNICEF, UNFPA
1999	Leprosy	Global Alliance to Eliminate Leprosy (GAEL)	WHO, Novartis, Nippon, Denmark, World Bank
2000	Lymphatic filariasis	Alliance to eliminate disease	GlaxoSmithKline, Merck, Bill & Melinda Gates Foundation, United Kingdom, Japan
2001	Measles	Campaign to halve measles deaths worldwide by 2005	United States, Bill & Melinda Gates Foundation, WHO, UNICEF
2001	Trypanosomiasis	Public-private partnership and funding for drug/vaccine development	sanofi-aventis, WHO, Bill & Melinda Gates Foundation, Wellcome Trust, Belgium, France
2002	HIV/AIDS, tuberculosis, malaria	Global Fund to Fight AIDS, Tuberculosis and Malaria	Contributions from most OECD states and many other donors

Acronyms: OECD = Organisation for Economic Co-operation and Development, TB = Tuberculosis, UNDP = United Nations Development Programme, UNFPA = United Nations Population Fund, UNICEF = United Nations Children's Fund.

The Bill & Melinda Gates Foundation was centrally involved in developing and supporting many of these initiatives, in this period giving individual grants of US$ 10 million or more for 18 of the 20 diseases (only leprosy and onchocerciasis were not given grants of this size).

Many of these grants were oriented towards investment in research. Among its most significant awards were US$ 750 million to the GAVI Alliance, US$ 100 million to the Global Fund, US$ 50 million to support polio eradication in India and sub-Saharan Africa, US$ 18 million to the Albert B. Sabine Vaccine Institute for hookworm vaccine development and US$ 20 million for programme development for the Global Alliance for the Elimination of Lymphatic Filariasis. It also gave US$ 20 million to the International Trachoma Initiative to improve tools for fighting this disease, US$ 40 million to the Medicines for Malaria Venture, US$ 27 million to PATH to support the development of a Japanese Encephalitis vaccine, US$ 70 million also to PATH to support the elimination of epidemic meningitis in sub-Saharan Africa, US$ 55 million to the International Vaccine Initiative to fund dengue fever vaccines for children, US$ 27.8 million to support schistosomiasis control in Africa and US$ 17.8 million to the University of North Carolina for the development of drugs for leishmaniasis and trypanosomiasis.

There were precedents to these initiatives and partnerships from the 1970s to the mid-1990s, including: smallpox eradication; Chagas disease control initiatives; onchocerciasis control programmes; dracunculiasis, leprosy and polio campaigns that continue to the present; and multiple public-private partnerships that appeared in the 1990s. What is distinct about recent developments is the number of initiatives that emerged in a concentrated period of time. This proliferation cannot be traced to any new needs from developing countries: most of the targeted diseases had long been endemic in that part of the world. Nor are there any obvious new provider interests that appeared. What seems to have occurred is a process of policy diffusion, driven by interactions among donors.

Indirect grants

Indirect grant data (see Figure 6.4) present a mixed picture on the degree to which these resources compensate for disproportionate allocation of direct grants across diseases. On the one hand, some diseases de-prioritized by direct funding are prioritized in indirect grants and vice versa. Acute respiratory infections, highly neglected in direct funding, fare somewhat better in indirect grants as 29% of the sample target them for control, fifth highest among the 20 diseases. Measles and tetanus, also neglected in direct funding, rank fourth and tied for first, respectively, in indirect grants. Onchocerciasis, prioritized in direct grants with 8.17% of direct funding but only 0.35% of the burden, is de-prioritized in indirect grants, targeted by only 2%. Trachoma and Chagas disease also are prioritized in direct funding and de-prioritized in indirect grants.

On the other hand, the priority that several diseases receive among direct grants is reinforced in indirect grants. HIV/AIDS, which ranks first in total direct grant funding, ranks third in indirect grant prioritization. Poliomyelitis, which at US$ 2454 receives more donor dollars per disability-adjusted life year from direct grants than any other disease, a function of the present global eradication campaign nearing its final stages, is also prioritized in indirect grants, ranking sixth among the 20 diseases. In addition, several diseases relatively neglected by direct funding also are neglected in indirect grants. These include intestinal nematode infections, lymphatic filariasis, schistosomiasis, meningitis and trypanosomiasis, none of which are targeted by more than 4% of indirect grants. Beyond this, Spearman's rank correlation for the 20 diseases for total direct funding and the percentage of indirect grants that target a disease is 0.52 and significant at the 0.05 level (significance level = 0.020), suggesting that indirect grants may reinforce rather than compensate for donor direct grant imbalances.

Figure 6.4

*Percentage of indirect grants targeting diseases**
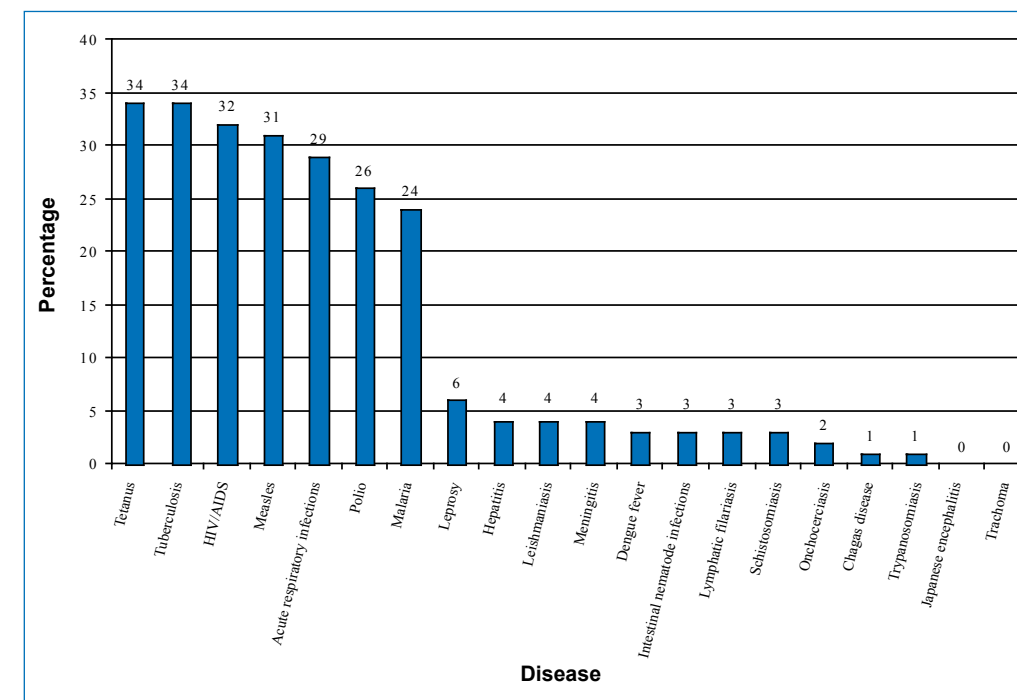
Data from sample of 100 indirect grants randomly selected from nine donors.

Discussion

Donor funding in direct grants varies significantly across diseases, ranging from US$ 2454 annually per DALY for polio to only US$ 0.58 for acute respiratory infections. Many factors may stand behind this variance, including the targeting of particular diseases for global elimination, the high costs associated with the final stages of disease elimination, efforts to control diseases that are spreading rapidly, a focus on diseases for which cost-effective interventions exist, a new "return on investment" dynamic among certain donors, the emergence of disease-specific focused public-private partnerships, the fear by political elites in industrialized states that particular diseases will threaten national security, and interest group mobilization within these richer countries to address certain diseases. In other words, a combination of recipient need, provider interest and global policy effects appear to interact to shape disease funding priorities, rather than factors from any individual framework alone.

High levels of funding for polio, onchocerciasis and leprosy, for instance, are likely connected to the fact that each is the target of a global elimination campaign nearing its final stage, raising costs per person. Prioritization of trachoma and Chagas disease may also be connected to global elimination efforts. Large increases in funding in recent years for Japanese encephalitis, dengue fever, trypanosomiasis and several other diseases may be connected with a new investment dynamic spurred on by the Bill & Melinda Gates Foundation and a number of public-private partnerships. The high share of funding for HIV/AIDS compared with burden may be due both to its rapid spread and to dynamics inside industrialized countries, including perceptions by political elites that the disease poses a national security threat, and interest group mobilization in rich countries. The neglect of diseases such as malaria, schistosomiasis, leishmaniasis and intestinal nematode infections may be connected to the fact that these diseases do not pose any major threat to rich countries and therefore no powerful interest groups have mobilized surrounding them. Similarly, most acute respiratory infections, while prevalent in industrialized states, are readily treatable and political elites therefore may not consider them to be significant public health threats emanating from abroad (the recent attention to SARS and avian flu is an exception that provides evidence for the broader point: when a disease is perceived to be a threat to the peoples of rich countries donors are more likely to pay attention).

Donor priorities for developing world health have moved in waves,[25] including vertical disease control in the 1950s and 1960s, primary health care in the 1970s and health sector reform and sector-wide approaches (SWAps) in the 1980s and 1990s. Observers have commented on tensions between approaches, as concentrated campaigns may effectively address one disease but divert scarce resources away from other needs[26] and may place pressure on over-burdened health systems that lack the capacity to address multiple causes effectively.[27] The creators of a number of disease-specific initiatives are cognizant of this tension and have designed their initiatives to be consistent with health sector strengthening efforts. For instance, the Global Fund to Fight AIDS, Tuberculosis and Malaria has created country coordinating mechanisms composed of local stakeholders to ensure projects initiated are consistent with national priorities. Also, the High Level Forum on the Health Millennium Development Goals has brought together donors and government officials from developing countries to focus on aid harmonization, among other issues.[28] This being said, vertical-horizontal tensions persist, even in these more carefully designed efforts,[29] and these initiatives give the issue ongoing relevance.

It would be inaccurate to conclude from the data calculated in this study that certain communicable diseases of the developing world are over-funded. Even diseases that appear to be prioritized receive amounts that are far from adequate. From 1996 to 2003 total direct grants considered in this study amounted to merely US$ 9.25 annually for each year of healthy life lost in the developing world due to HIV/AIDS, and only US$ 1.71 billion annually for control of all 20 diseases. By comparison, a recent study estimated that in 1999 health administrative costs in the United States amounted to US$ 1059 per capita and at least US$ 294.3 billion in total – nearly 175 times this funding figure for developing world communicable disease control.[30] Also, the same study estimated savings of US$ 209 billion annually if the United States were to reduce health administrative costs to per capita levels in Canada. As the World Health Organization's Commission on Macroeconomics and Health has noted,[31] there is an urgent need for a significant increase in public and private sector industrialized world funding for the control of communicable diseases in the developing world, an investment that the governments and citizens of wealthy countries can easily afford.

A major increase in spending may be a long time in coming, however, and with wealthy countries unwilling to provide adequate resources, donors will undoubtedly continue to make many funding decisions based on the disease targeted, influenced by industrialized world interests and priorities of the moment. The result will be ongoing competition among diseases for attention. This dynamic makes continued research and monitoring of funding patterns essential, since recipient needs may be crowded out in the process.

Acknowledgements

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