Chapter 5

Progress in measuring the 10/90 gap

Section 1

Measuring financial flows: review of ongoing efforts

1. Background

The Commission on Health Research for Development drew attention to the importance of health research as the "essential link to equity in development."[1] It proposed that low- and middle-income countries should review and strengthen the management of health research so as to meet their national needs as well as contribute to the global fund of knowledge. The Commission also recommended that governments in low- and middle-income countries should allocate at least 2% of national health expenditures for research and that 5% of the foreign aid budget in the health sector be assigned to health research and capacity strengthening. The Commission hoped that these financial arrangements would provide a secure foundation for funding the priority research needs in low- and middle-income countries, based on the new concept of Essential National Health Research (ENHR).[2]

However, with few exceptions, neither the low- and middle-income countries nor the donor community enthusiastically followed up the Commission's recommendations. Furthermore, since most low- and middle-income countries were not actively tracking the pattern of spending on health research, it was difficult to know how close they were to the target and what trends were occurring over time. One major obstacle was the lack of tested methodologies for monitoring spending on health research at the country level.

In an attempt to fill this gap, the Global Forum and its partners have tackled the problem through their support of a network of investigators. This chapter summarizes the main points of the most recently published report measuring financial flows for health research[3] and ongoing efforts in this area. The tentative results from a few countries should stimulate others to follow the example and provide data from many more countries. Ideally, other studies will adopt the core definitions in order to facilitate comparisons among countries and also to examine trends over time.

Why measure resource flows?

Knowledge of resource flows for health research is an important input into priority setting. Although funding agencies and companies in the public and private sectors may have internal mechanisms to track health R&D expenditures, the available data is very fragmented. The Organization for Economic Cooperation and Development (OECD) is the only institution with a mandate to regularly collect and disseminate standardized national statistics on aggregated health-

[1] Commission on Health Research for Development. *Health Research: Essential Link to Equity in Development*, New York, Oxford University Press, 1990.

[2] Task Force on Health Research for Development. *Essential National Health Research. A Strategy for Action in Health and Human Development*, Geneva, UNDP, 1991.

[3] Global Forum for Health Research. *Monitoring Financial Flows for Health Research*, October 2001.

related R&D for its Member States. R&D funds are reported as part of science and technology (S&T) information. While no equivalent institutional mechanism exists in low- and middle-income countries, information on resource flows has recently begun to emerge, as described below.

The challenge now is to institutionalize health R&D indicators which can be collected in low- and middle-income countries, countries in transition and high-income countries. Wherever possible, such indicators should draw on existing international statistical standards. Consistency will facilitate comparisons between countries while also meeting national and regional needs.

A detailed mapping of resource flows will help decision-makers in both high-income and low- and middle-income countries to target, and therefore better allocate, funds supporting health R&D. Mapping will also help monitor shifts in R&D funding allocations towards the most important health conditions and determinants, identify the areas which do not attract enough funding, and avoid unnecessary duplication of research efforts. These measures, in turn, are expected to have a significant impact on reduction of the burden of disease and injury in low- and middle-income countries, particularly among the poor.

Following on from the 1990 Report of the Commission on Health Research and Development, the 1996 Report of the WHO Ad Hoc Committee on Health Research reiterated the importance of establishing an institutional mechanism for the systematic tracking of investments in health R&D.[4] Although the Ad Hoc Committee Report provided summary data on public and private investments in health research and estimated global health research investments at US$ 56 billion, the authors acknowledged the complexity of developing a reliable system to monitor resource flows. The report also confirmed the earlier finding that less than 10% of health research funding worldwide was allocated to the diseases and conditions that account for 90% of global disease burden.

A number of initiatives are under way to measure financial flows. The major challenges are to standardize the methodologies used for data collection, gather high quality information, and present this in a way which is relevant and useful for policy-makers.

The following are examples of ongoing efforts to measure financial flows.

2. Global Forum for Health Research

The Global Forum and other institutions embarked on a project to collect information with the goal of improving priority setting through developing a database of internationally comparable statistics on global resource flows for health research. The results from the first phase of this project were reported in *Monitoring Financial Flows for Health Research*[5] which tracked resources for the year 1998. The report estimated that in 1998 global funding for health research had risen to US$ 73.5 billion and that 21 developing countries (15 from Latin America, four from South East Asia, plus Turkey and India) financed 3% of this total. The report noted that where data was available, health research expenditure from middle-income countries was considerably higher than that estimated for the 1996 Ad Hoc

[4] Ad Hoc Committee on Health Research. *Investing in Health Research and Development*, Geneva, WHO, September 1996.
[5] Global Forum for Health Research. op. cit.

Committee Report. The extent to which this funding addressed the priority health needs of developing countries was not assessed. However, the need for disaggregated data on health research expenditure to be collected and disseminated was re-emphasized, as was the need for this data to include both the public and private sectors.

In addition to producing global results, the project was based on the following four strategies:

Strategy 1: Measure resource flows in additional developing and transition countries using the methodology developed in this study.

Strategy 2: Encourage the entities already compiling health statistics (e.g. OECD, UNESCO) to pay greater and more detailed attention to the monitoring of health research investments.

Strategy 3: Periodically obtain disaggregated data from large investors in advanced countries including ODA agencies, foundations and pharmaceutical companies.

Strategy 4: Influence partners with established interests and expertise in specific disease areas to do periodic studies of resource flows for the conditions representing the highest burden of disease in the world (e.g. International Union Against TB and Lung Disease, Wellcome Trust, WHO/TDR, WHO).

The Global Forum and other institutions are currently updating the information of the 2001 report on financial flows for health research and the results are expected to be available at the World Summit on Health Research and Forum 8 in November 2004 in Mexico.

3. World Health Organization

As part of the Health Research Systems Analysis initiative, WHO plans to conduct national surveys to collect resource flows data.[6] A framework for conducting these studies was outlined in a background paper presented at Forum 7[7] including data on sources of funds, burden of disease and type of research activities conducted. The paper highlighted the importance of gaining data in a disaggregated format on sources of funds, diseases addressed and type of research conducted.

4. Council on Health Research for Development

COHRED's approach to measuring resource flows lies in the principle of strengthening in-country capacity to measure investments in health research. It produced original information for three Asian countries[8] and has currently completed the measurement of six other countries (see section 2, part 3 below).

5. National R&D surveys (OECD, UNESCO)

In many countries, the process of data collection has been institutionalized within the framework of S&T indicators, on the basis of relatively standardized methods. The OECD book *Measuring Expenditure on Health-Related R&D*, edited by Alison Young,[9] gives an excellent description of the complexities of these datasets and their strengths and weaknesses. In addition to the OECD, routine R&D data are collected on an international basis by the Ibero American

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[6] Pang T *et al.* "Knowledge for better health - A conceptual framework and foundation for health research systems" *in Bulletin of the World Health Organization*, 2003.

[7] Kennedy A *et al.* Paper presented in Forum 7, December 2003.

[8] Alano B and Almeira S. *Tracking country resources for health research*, Manila, Centre for Economic Policy Research, 2000.

[9] OECD. *Measuring Expenditure on Health-Related R&D*. Paris, 2001.

Network of Science and Technology Indicators (RICYT)[10] (see below) and UNESCO. These routine data collection methods, whilst well established and producing stable reliable estimates of overall national funding for R&D, have some limitations when used to measure health-related R&D. UNESCO is currently revising the recommended system of S&T indicators for developing countries.

• *OECD R&D information*
The OECD R&D database includes data for 39 countries (of which 24 are advanced countries, seven transition countries and eight middle-income with two more, India and South Africa, on the verge of inclusion). This coverage goes beyond OECD membership to include countries which are formal or informal members of the OECD Committee for Scientific and Technological Policy or because they are included in the outreach exercise of the Directorate concerned.

The main data series are published twice yearly in *Main Science and Technology Indicators*. The more detailed series needed to estimate national expenditure on health-related R&D are mostly included in *Basic R&D Statistics* which is published annually on CD-ROM and every two years in printed format.

Between 1999 and 2001, groups led by individual countries reviewed various areas of national and R&D survey methodology and practice with a view to making proposals for changes in the underlying methodology for R&D surveys known as the *Frascati Manual*. Statistics Canada led a group to review the problems of measuring health-related R&D.[11]

• *OECD R&D in national health accounts*
The principal goal for developing national health accounts (NHA) is to support health systems governance and decision-making by providing a fully coherent set of tables which give a complete account of all expenditure for health regardless of its origin, destination or the objective of the actors involved and which can be used for ongoing analysis (as opposed to one-time study).

The OECD published *A System of Health Accounts* in 2000. It has recently been followed by the *Guide to Producing National Health Accounts with special applications for low- and middle-income countries* promoted by the World Bank, WHO and USAID (WHO, 2003).[12]

6. The Ibero American Network of Science and Technology Indicators (RICYT)

The Ibero American Network of Science and Technology Indicators (Red Iberoamericana de Indicadores de Ciencia y Tecnología – RICYT) was created in 1995. Its general aim is to promote the development of instruments for the measurement and analysis of science and technology in Latin America, within a framework of international cooperation, with a view to increasing their use as a political instrument for decision-making.

RICYT organizes workshops on the methodological problems of science and technology indicators in Latin America (one result has been the publication of a Latin American manual of indicators on technological innovation, the *Bogotá Manual*), collects and publishes indicators for the region, creates mechanisms of mutual

[10] RICYT (Red Iberoamericana de Ciencia y Tecnología). *El estado de la ciencia: principales indicadores de ciencia y tecnologia Iberoamericanos/Interamericanos*, Quilmes, RICYT, 2000.
[11] OECD. op. cit.
[12] WHO, World Bank, WHO and USAID. *Guide to Producing National Health Accounts with special applications for low-income and middle-income countries*, Geneva, 2003.

assistance in Latin America and diffuses information about its activities via *Indicios*, a news and opinion bulletin and web page (www.ricyt.org).

RICYT manages a database for 28 countries, covering financial and human resources for R&D and S&T (also including education and other scientific activities), bibliometrics, patenting and innovation activities. The data, sources and methods for each country can be consulted online and are published annually in *Main Ibero and Inter-American Science and Technology Indicators* (*Principales Indicadores de Ciencia y Tecnología*). RICYT's work on health research has been predominantly in the area of bibliometrics.[13]

7. Approaches regarding disease-specific investments

To measure the 10/90 gap, it is essential to obtain information on disease-specific investments (see below). The Wellcome Trust and Médecins Sans Frontières Access to Essential Medicines Campaign[14,15] have undertaken studies to estimate investments in specific tropical diseases research. In addition, research is currently under way to track disease-specific investments, in particular using bibliometric approaches.[16]

Section 2

Measuring financial flows: results to date

The main results of the work undertaken by the Global Forum and its partners in the past three years can be summarized as follows:[17]

1. Global estimates

Based on partial estimates, public and private sources worldwide invested a minimum of US$ 73.5 billion in health R&D in 1998 (i.e. about 2.7% of total health expenditures worldwide). Governments in high-income countries, countries in transition and low- and middle-income countries invested at least US$ 37 billion (50% of the total) and the pharmaceutical industry US$ 30.5 billion (42%). Private, non-profit and university funds provided the remaining US$ 6 billion (8%) (see Insert 5.1).

[13] Munoz TF et al. *Análisis de la Producción Científica en Ciencias de la Salud de los países de América Latina y el Caribe (Período 1999-2000)*, Madrid, RICYT, 2003.

[14] *PRISM Report No. 7. Malaria Research, an audit of international activity*, London, Wellcome Trust, September 1996; and Paper presented by Catherine Davies in Forum 7, Geneva, December 2003.

[15] Médecins Sans Frontières Access to Essential Medicines Campaign. *Fatal Imbalance: The Crisis in Research and Development for Drugs for Neglected Diseases,* Geneva, 2001; and Paper presented by MSF in Forum 5, Geneva, October 2001.

[16] Lewison G, Lipworth S and de Francisco A. "Input indicators from output measures: a bibliometric approach to the estimation of malaria research funding" in *Research Evaluation*, 2002. Vol 11, (3):155-163; and paper presented in Forum 6, Arusha, November 2002.

[17] Global Forum for Health Research. op. cit.

Insert 5.1

Estimated global health R&D funding 1998 (in billion of current US$)

Sources of financing	Total (billion US$)	Per cent of total
Public funding: high-income and transition countries	34.5	47
Public funding: low- and middle-income countries	2.5	3
Private funding: pharmaceutical industry	30.5	42
Private non-profit funding (foundations and universities)	6.0	8
Total	73.5	100

Source: Global Forum for Health Research, *Monitoring Financial Flows for Health Research*, 2001.

Overall investments in health R&D from public, industrial and non-profit sources increased in real terms in high-income countries during the 1990s, in contrast to a general decrease in the countries in transition. The figure of US$ 73.5 billion contrasts with that of US$ 56 billion in 1992. It is estimated that up to one third of the increase between 1992 and 1998 is in real terms. Data from low- and middle-income countries, when available, indicate considerably larger R&D investments in health from national sources than earlier studies had estimated.[18] While this increase reflects real growth in overall investments in health R&D, it probably also reflects better reporting for these countries.

2. Funding of health R&D in high-income and transition countries

(a) Public funding of health R&D in high-income countries

Governments in high-income countries invested US$ 34.2 billion in health R&D in 1998. The United States provided over half of this amount, investing US$ 19.5 billion. Japan contributed US$ 2.9 billion, Germany US$ 2.4 billion, France US$ 2.2 billion, the United Kingdom US$ 1.8 billion and Canada US$ 0.75 billion. Together, the G7 countries (including a rough estimate for Italy) accounted for about 90% of total publicly funded health R&D in the high-income countries. All other high-income country governments together contributed an estimated US$ 3.5 billion. These data were drawn from OECD and Eurostat R&D databases and reports of national R&D surveys and budgets.

For the United States, public funds spent for health R&D are estimated at about 0.22% of GDP, the highest figure among high-income countries. This is followed by Austria, Finland, France, the Netherlands and Sweden. The National Institutes of Health (NIH/USA) are by far the largest institutions

[18] Michaud C and Murray CJL. *Resources for health research and development, 1992: a global overview.* Annex 5 *of Investing in Health Research and Development. Report of the Ad Hoc Committee on Health Research relating to future intervention options*, Geneva, WHO, 1996.

funding health research worldwide. The NIH has doubled its budget over the last five years, to US$ 27.3 billion in 2004 (see chapter 4).[19]

Funding of global health issues by members of the European Medical Research Council

At its Plenary Meeting in April 2002, the European Medical Research Council (EMRC)[20] identified the need to standardize and collect information on financial flows and the 10/90 gap. The group initiated a survey to test a methodology with a view to its implementation by all Member Organizations. The questionnaire was tested for the year 2001 in the following countries: Denmark, Finland, France, the Netherlands, Norway, Portugal and Sweden. The results of this pilot test indicated that the percentage of their total research budget allocated to global health issues was below 6% in all cases and was highest for the Netherlands Organization for Health Research and Development closely followed by Denmark. The remaining Member Organizations allocated less than 4% of their resources to global health research initiatives. The group suggested extending the survey to all countries represented in the EMRC Standing Committee, reiterated its commitment to research work addressing the 10/90 gap and established a working group for this purpose.

(b) Public funding of health R&D in transition countries

In 1998, the Czech Republic, Hungary, Poland, Romania, the Russian Federation, the Slovak Republic and Slovenia spent the equivalent of approximately US$ 360 million on health R&D, of which government financing accounted for just over US$ 200 million. However, the magnitude of R&D efforts is not adequately reflected in these dollar figures as a result of these countries' weak currencies. Comparisons of purchasing power parities reflecting the average cost of goods and services in each country, raises total health R&D funding to US$ 800 million, of which an estimated US$ 450 million was financed by public sources.

(c) Funding of health R&D by foundations

Private foundations and other not-for-profit organizations spent an estimated US$ 3.4 billion on health research in 1998 of which US$ 1.9 billion came from the United States, US$ 700 million from the United Kingdom, US$ 240 million from Japan, US$ 200 million from Canada and US$ 120 million from France. An estimated US$ 200 million came from all other high-income countries combined.

The Bill and Melinda Gates Foundation contributed an amount of US$ 189 million to health research in 2001. Other large private sponsors of research in 1998 were the Wellcome Trust in the United Kingdom and the Howard Hughes Medical Institute in the United States.[21] The Wellcome Trust aims to both extend the international knowledge base in tropical medicine and foster a productive research environment in developing countries so that these countries are better equipped to combat their own health problems.

The Howard Hughes Medical Institute is a biomedical research organization that supports biomedical research and education through geographically and topically defined competitive research grants. It currently has

[19] *The Lancet*, Vol 363 (9406) 31 January 2004.
[20] Paper presented by Ragna Valen, Research Council of Norway, in Forum 7, Geneva, December 2003.
[21] Global Forum for Health Research. op. cit.

programme grantees in 29 countries and is increasingly focusing on governments and scholars in low- and middle- income countries. It is involved in developing modular programmes that can improve science education and provides students with research opportunities in the laboratory.[22] The Institute invested around US$ 389 million in 1998.[23]

The Nuffield Trust for Research and Policy Studies in Health Services was established in 1940 to help coordinate hospital and associated medical services throughout the United Kingdom.[24] Over the years, through its research grants, seminars, fellowships, publications, and national and international partnerships, in addition to funding health services research, the Trust has contributed significantly to the development of policy thinking on health services research.

(d) Funding of health R&D by universities

In addition to these sources, at least US$ 2.5 billion was contributed to health research through the private funds of universities and colleges in Canada, Japan and the United States.

(e) Funding of health R&D by the private pharmaceutical sector

The pharmaceutical industry, including biotechnology companies, spent an estimated US$ 30.5 billion in 1998, corresponding to 42% of all health R&D funding (Insert 5.2). Reported investment in R&D as a share of sales in the pharmaceutical industry ranged from 12% to 21% of turnover in the 15 companies with the largest R&D investment. The share was higher still in the 10 biotechnology companies making the largest R&D investments, corresponding to allocations of 26%-67% of revenues to R&D (Insert 5.2).[25]

It is estimated that in 1998, US-based pharmaceutical companies invested US$ 20.3 billion in R&D in pharmaceuticals for human use, of which US$ 16.9 billion was spent in the United States and US$ 3.4 billion abroad.[26] Information on the cost of research and clinical trials for the discovery and development of medicines was not considered in this study.

[22] Paper presented in Forum 7 by Jill Conley, Howard Hughes Medical Institute, USA.
[23] Global Forum for Health Research. op. cit.
[24] Paper presented in Forum 7 by John Wyn Owen, Secretary, Nuffield Trust, United Kingdom.
[25] Global Forum for Health Research. op. cit.
[26] Pharmaceutical Research and Manufacturers of America. PMA *Annual Survey 2000*.

Insert 5.2

R&D expenditures by major pharmaceutical and biotechnology companies, 1998 (in millions of US dollars)

15 leading pharmaceutical companies with largest R&D	R&D expenditures	As % of total pharmaceutical sales
AstraZeneca	2,183	17
Glaxo Wellcome	1,927	15
Roche	1,893	19
Merck & Co	1,821	12
Novartis	1,801	16
Bristol-Myers Squibb	1,559	12
Hoechst Marion Roussel	1,426	18
Johnson and Johnson	1,400	16
SmithKline Beecham	1,394	18
American Home Products	1,389	16
Rhone-Poulenc Rorer	1,010	17
Boehringer Ingelheim	866	19
Bayer	852	18
Novo Nordisk	420	21
Yamanouchi	415	17
10 biotechnology companies with largest R&D		
Amgen	663	26
Chiron	108	NA
Genentech	396	55
Biogen	177	45
Alza	156	67
Immunex	92	NA
Genzyme	63	NA
British Biotech	20	NA
Chiroscience	51	NA
Genset	10	NA

Source: SCRIPS 1999, Pharmaceutical Company League Tables; Ernst and Young: European Life Sciences 99, Sixth Annual Report.

3. Funding of health R&D in low- and middle-income countries

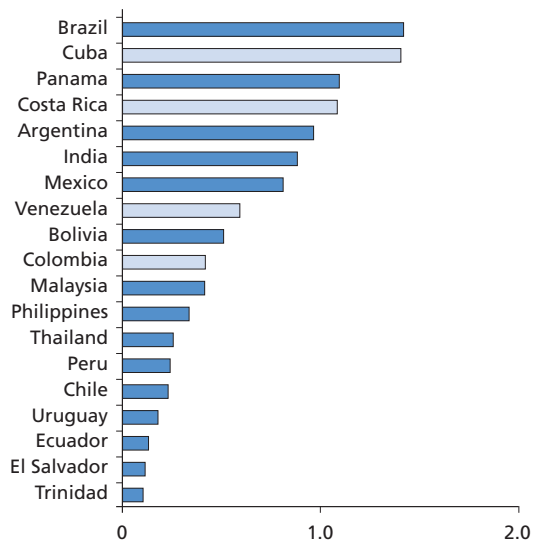
The study supported by the Global Forum and partners did not attempt to be a comprehensive review of all low- and middle-income countries investing in health research. It focused both on countries for which published information was available and on a few selected countries in which teams conducted special surveys on health R&D. A summary of the available information is provided below.

It is estimated that Argentina, Brazil, India, Malaysia, Mexico, Panama, Peru, the Philippines, Thailand and Turkey spent a minimum of US$ 2.3 billion in 1998 on health R&D. Data for other low- and middle-income countries, among them countries which spend considerable amounts on health research such as the People's Republic of China, are not available at this stage and will be explored in the future.

The Commission on Health Research for Development recommended that at least 2% of national health expenditures in low- and middle-income countries should be allocated to health research and capacity building. Of the countries included in this study, Brazil and Cuba approached the 2% mark (Insert 5.3). Turkey was not included in Insert 5.3 as higher education subsidies in that country, particularly in state universities for medical education, influenced the high percentage reported.

Insert 5.3

Estimated health R&D in selected low- and middle-income countries as percentage of total health expenditures*



Sources: Health R&D data supplied by specific country surveys; GDP: World Bank (2000) and RICYT (2000); Health expenditure: WHO (2000) and OECD (2000).

** Pale countries are particularly rough estimates.*

A three-country study supported by COHRED in Malaysia, the Philippines and Thailand traced investments in health R&D from the funding sources to the performers of the research projects concerned.[27] The survey concluded that these three countries spent over US$ 33 million in 1997 and US$ 30 million in 1998 (total expenditures by public and private sectors), with Thailand spending about 50% of the total.

Following the three Asian studies described above, a comparative report and manual were

[27] Alano and Almeira. op. cit.

designed and used to undertake studies in the following countries: Burkina Faso, Cameroon, Cuba, Kazakhstan and Hungary. In addition, studies are currently under way in Uzbekistan and Brazil.

The results of recent studies supported by COHRED were presented in Forum 7.[28] In summary, the main results and conclusions of the country studies reflected the following:[29]

- Hungary has by far the largest expenditure of the group of countries. The Hungarian government has committed to increase the ratio of gross expenditures on R&D to 1.9% of GNP after its accession to the European Union.
- In Burkina Faso and Cameroon foreign funds make up the majority of health R&D funds, whereas in Kazakhstan, Malaysia, Philippines and Thailand, the government sector is the largest contributor. The dependency on foreign funds for health research projects has a large influence on the possibility of re-allocating funds towards the country's health and health research priorities.
- In Cuba all but 4% of funds were allocated to priority topics. But in Kazakhstan, less than 20% of total health R&D funds were allocated to health research priorities, despite the fact that government funds make up 90% of the national total and the Ministry of Health controls 95% of these funds. This difference may be attributed to the strength of the links between the national priority setting and fund allocation mechanisms.
- In both Kazakhstan and Indonesia[30] attempts are being made to institutionalize the tracking of resource flows. This will facilitate the improved linkage between health research priorities and resources.

Section 3

Measuring financial flows: difficulties encountered

Obtaining information on financial flows is time consuming, expensive and difficult due to the following factors:

- definitions are normally not standardized
- organizations surveyed do not systematically track or monitor health research in comparable ways
- staff are normally too busy to provide information beyond the scope of their records and sometimes do not see the value in conducting these exercises
- questionnaires sent to funders in high-income countries are frequently not returned
- decentralization of management in ODA and multilateral organizations contributes

[28] Paper presented by Bing Alano in Forum 7, Geneva, December 2003.
[29] Details of the studies and further results can be accessed at www.cohred.ch.
[30] Indonesia has conducted resource flows studies on a regular basis since 1998.

to problems in obtaining data on financial resources
- the importance and the relevance of the data on resource flows for investor organizations is often unclear when compared to other priorities
- fluctuations in exchange rates complicate the interpretation of data, especially long-term funding trends
- double counting is a problem which needs special attention
- obtaining data from funders in advanced countries on research funds actually spent in low- and middle-income countries is difficult
- lack of information, in particular on:
  - the global allocation of funds to R&D for specific diseases
  - public funding by advanced countries for northern institutions conducting R&D on problems important to low- and middle-income countries
  - pharmaceutical industry funding in low- and middle-income countries
  - disaggregated information from the pharmaceutical industry
  - cost of R&D to develop drugs and vaccines, including the costs of clinical trials
  - regular budget allocations by UN agencies such as WHO to health research (as differentiated from earmarked contributions)
  - link between health priorities identified by low- and middle-income countries and projects funded by national and international sources
  - share of public funds invested in fundamental research which eventually led to a marketed drug
  - funding for social science and health economics research.

Section 4

Measuring financial flows: an attempt to standardize the methodology by the Global Forum and its partners

There is a need to standardize the methodology for measuring health R&D financial flows. Improving the data available requires national 'champions` who will build an informed constituency bringing together producers and users of such data. In their efforts to improve the information on R&D investments in health research and tackle some of the problems mentioned above, the Global Forum and its partners have attempted to standardize the methodology in the following ways:

1. Definition of health research and development

The OECD and UNESCO definitions were adopted for this study:[31]

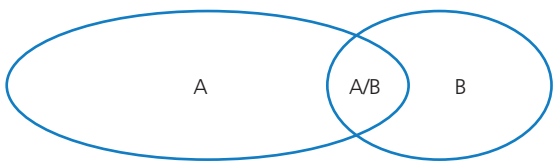
"Research and experimental development comprises creative work undertaken on a systematic basis in order to increase the stock of knowledge, including knowledge of man, culture and society, and the use of this knowledge to devise new applications."

[31] OECD *The Measurement of Scientific and Technological Activities, Proposed Standard Practice for Surveys of Research and Experimental Development, Frascati Manual 1993,* Paris, 1994.

Insert 5.4

Representation of health research funding

A = R&D by high-income countries
B = R&D by low- and middle-income countries
A/B = R&D efforts converge or overlap (see text for details)



Source: Global Forum for Health Research, *Monitoring Financial Flows for Health Research*, 2001.

Under this definition, health research is a process for generating systematic knowledge and testing hypotheses, within the domain of medical and natural sciences as well as social sciences including economics and behavioural science. The information resulting from this process can be used to improve the health of individuals or groups.

2. Representation of health research funding

One objective of tracking financial flows in the project supported by the Global Forum was to measure total funding for health R&D worldwide, with a particular emphasis on R&D for or by low- and middle-income countries. Insert 5.4 illustrates the main components:

- "Area A" corresponds to the health R&D efforts of high-income countries.
- "Area B" represents the health R&D efforts of low- and middle-income countries.
- The overlapping "Area A/B" depicts where these efforts converge or overlap.

These three areas could be further defined in several ways. For the purpose of financial flows in the present study, "Area A" describes all health R&D *funded by* high-income countries; and "Area B" describes all health R&D *financed by and carried out in* low- and middle-income countries. The "Area A/B" corresponds to R&D funded by high-income countries and carried out in and for the primary benefit of low- and middle-income countries. The area also incorporates R&D carried out in high-income countries which is for, or relevant to, the needs of low- and middle-income countries; and R&D carried out in low- and middle-income countries which is for, or relevant to, the needs of high-income countries. The three areas constitute the framework for project data collection.

Data on health R&D expenditures can be collected from the unit providing the funds ("the funder") or from the unit actually carrying out the research ("the performer"). The data compiled within areas "A" and "A/B" were generally collected from funders, whereas the data for area "B" were collected from both performers and funders. Because the three categories of data were compiled using different approaches and from different sources, it was challenging to aggregate them into the global total, and especially to avoid double counting of area A/B.

The countries undergoing transition from centralized to market economies do not fit easily into the model. They are examined in a separate section but are also treated in the discussion of area A/B, as they are eligible for some of the types of support for health R&D traditionally oriented towards low- and middle-income countries.

3. Research classification framework

The main research categories used in the project supported by the Global Forum and its partners are presented in Insert 5.5. The aim was to produce a set of categories that would be useful for decision-makers, especially in low- and middle-income countries. It would, in addition, serve as a framework for special surveys and for documenting data compiled from other sources.

4. An institutional classification

There are other dimensions by which R&D resource flows are commonly classified. These may include activity, discipline, topic, location, beneficiary and development outcome. Insert 5.6 represents an institutional classification of the main types of health R&D funders and performers.[32]

The user/performer classification was developed during the experimental health R&D surveys in selected low- and middle-income countries (Area B in Insert 5.4 above).

Insert 5.5

Classification of resource flows for health research

Levels of aggregation of R&D funds

1. Basic research: non-oriented, fundamental research

2. Health conditions, diseases or injuries
   – Group I (communicable, maternal, perinatal, nutritional conditions)*
   – Group II (noncommunicable diseases)*
   – Group III (injuries)*

3. Exposures, risk factors that impact on health (determinants)
   – Risk factors within the health system
   – Risk factors outside the health system

4. Health systems research
   – Policy and planning research
   – Health services delivery research
   – Surveillance

5. Research capacity building
   – Recurrent expenses
   – Capital expenditures

Source: Global Forum for Health Research, *Monitoring Financial Flows for Health Research*, 2001.
* Follows the Global Burden of Disease classification (Murray CJL et al, 1996).

[32] Alano and Almeira. op. cit.

Insert 5.6

Classification of funders and performers

Sectors	Funders	Performers in low- and middle-income countries
Public sector	Government departments (national aid agencies)	Government departments Research institutes and universities Hospitals Others
Private sector	Pharmaceutical firms Private non-profit organizations	Pharmaceutical firms Academic/research institutes Hospitals/laboratories NGOs Others
International	Multilateral Bilateral	Foreign institutions Government departments Others

Source: Alano B and Almeira S, *Tracking country resources for health research*, Centre for Economic Policy Research, Manila, 2000.

5. Diversification of data sources

Previous global resource flow studies have mainly focused on data from existing databases and estimated the data from low- and middle-income countries. The Global Forum-supported project extends that work by developing special surveys based on the new classification by making more extensive use of recently published datasets and by undertaking institution-specific case studies involving personal contacts with funding agencies and low- and middle-income country institutions,[33] including:

- Funder questionnaires
- Special surveys for low- and middle-income countries
- Funder surveys/databases
- Government S&T surveys
- Evaluations, annual reports, websites
- Interviews/personal contacts.

[33] Global Forum for Health Research. op. cit.

Section 5

Measuring the 10/90 gap: comparing disease burden with investment in health research

The ultimate objective of measuring resource flows in health research is to make a judgement as to whether the limited research resources are allocated in the most efficient and effective way, as compared to the major health problems affecting a country. As shown in chapter 4, resource flows broken down by disease and risk factors are a crucial input in the CAM for priority setting in health research (Insert 4.2) which enables the measurement of overall progress in the 10/90 gap.

1. Relating disease burden to investments in health research

Many diseases and risk factors accounting for a high level of burden in terms of morbidity and mortality[34] suffer from very low levels of funding for research. These include, in particular, acute respiratory infections, diarrhoeal diseases, TB, tropical diseases, perinatal conditions and HIV/AIDS.

Although there has been no comprehensive review of financing flows relating to disease burden for all diseases, available evidence indicates that there are marked differences in the magnitude of research expenditures in comparison to the magnitude of the current or projected burden of disease.

Insert 5.7

Investment in health research for selected conditions

Condition	Global disease burden (% total 1990 DALYs)	Investment in US$ per DALY	Percentage of total investment in health research
Malaria	2.80%	1.89	0.10%
Acute lower respiratory infections	8.20%	0.51	0.10%
Diarrhoea	7.20%	0.32	0.06%
Road traffic injuries	2.50%	0.83	0.05%
TB	2.80%	0.68	0.05%

Source: Based on Murray CJ and Lopez A, *Global Burden of Diseases and Injuries*, WHO, 1996 and Report of the Ad Hoc Committee on Health Reseach and Development, 1996

[34] Murray CJ and Lopez A. *Global Burden of Diseases and Injuries. Volume 1*, WHO, 1996.

A study in 2000 indicated that in that year total expenditures for research on selected tropical diseases (leishmaniasis, malaria, trypanosomiasis and TB) which together accounted for about 5% of the total global disease burden (or 75 million DALYs), amounted to US$ 383 million.[35] Of this, approximately US$ 85 million was for drug R&D (0.11% of total global investment in health research) and a mere US$ 1.13 per DALY. Investment in research into malaria,[36] for example, a disease which accounted for 3% of the global disease burden in 2002, mainly in poor countries, is estimated to be US$ 100 million a year or US$ 2.2 per DALY – less than one twentieth of the average investments in health research per DALY as calculated by the Global Forum (US$ 52 per DALY).

The table below illustrates the global research effort on specific diseases and the persistence of the 10/90 gap in health research financing. Funding for research on conditions occurring overwhelmingly or exclusively in low- and middle-income countries is extremely low.

Insert 5.8

Global research effort for three classes of diseases

Disease type and category	Global research effort	Epidemiology	Examples	Notes
(I) Not neglected diseases	High	• Occurring in both rich and poor countries • Large vulnerable populations worldwide	• Hepatitis B • *Haemophilus influenzae* type b (Hib) • Diabetes • CVD	• High incentives for R&D • Not widely applicable, nor accessible or sustainable for low- and middle-income countries
(II) Neglected diseases	Low	• Occurring in both rich and poor countries • Substantial proportion of burden in poor countries	• HIV/AIDS • Tuberculosis	• Substantial research ongoing in rich countries • Level of R&D spending not commensurate with disease burden on a global basis • Low accessibility for poor countries
(III) Very neglected diseases	Very low	• Overwhelming or exclusive incidence in poor countries	• Malaria* • Chagas disease • Schistosomiasis • Leishmaniasis • Trypanosomiasis • Onchocerciasis • Lymphatic filariasis	• Extremely little R&D funding • No commercially-based R&D in rich countries

Source: Global Forum for Health Research, *The 10/90 Report on Health Research 2001-2002.*
* belongs also to category II, according to the Commission on Macroeconomics and Health.

[35] Médecins Sans Frontières Access to Essential Medicines Campaign. *Fatal Imbalance: The Crisis in Research and Development for Drugs for Neglected Diseases,* Geneva, 2001; and paper presented by MSF in Forum 5, Geneva, October 2001.
[36] Wellcome Trust. op. cit.

2. Bibliometric approaches

A review of papers published in the Science Citation Index between 1996 and 2001 presented in Forum 6[37] reflected the intensity of publications on research by disease. The study explored over 1.6 million papers published during this six-year period.

Of these published papers, research on diseases occurring predominantly or exclusively in low- and middle-income countries was low. For example, the total number of papers on pneumonia, diarrhoeal diseases, malaria and dengue accounted for less than 2% of the total, whereas the burden of these four diseases was over 13% worldwide in 2002 (as measured by DALYs). In the field of noncommunicable diseases (e.g. cardiovascular, mental and neurological diseases), which affect developing and developed countries almost equally, a very limited number of papers was devoted to the detection and management of these diseases at the primary health care level in low- and middle-income countries.

3. Challenges

(a) Basic research and the 10/90 gap

A large proportion of public health research funds is invested in 'basic research', i.e. research which cannot be identified with a particular disease or risk factor and which opens new avenues for finding solutions to a large variety of known and unknown problems affecting all countries. Therefore, when ascertaining the 10/90 gap, the question arises whether these investments should be considered (i) as part of the research undertaken to attack diseases prevalent in low- and middle-income countries; (ii) as part of the research undertaken to attack diseases prevalent in high-income countries; or (iii) taken out of the calculation of the health research gap altogether.

Based on the fact that, between 1975 and 1997, only 13 out of the 1233 drugs that reached the global market were for tropical infectious diseases that primarily affect the poor, investments in basic science have been categorized as part of the 90% of health research allocated to less than 10% of the global disease burden.

This draws attention to the fact that a determined effort by the public sector should be undertaken in the coming years to better link the results of basic research to the development of remedies for high-burden diseases. The private sector itself may also be attracted by the transformation of basic research results into products for high-burden diseases, given the growing market potential for these diseases.

(b) Transferability of benefits of research from high- to low-income countries in general, and from rich to poor societies in particular

As a result of the demographic and epidemiological transitions experienced in low- and middle-income countries, these countries are likely to increasingly benefit from the research findings undertaken in high-income countries. However, the direct transferability of findings from high-income countries to low- and middle-income countries in general, and from rich to poor societies in particular, is limited by the following factors:

- communicable diseases not prevalent and not researched in high-income countries or richer societies continue to account for

[37] Lewison, Lipworth and de Francisco op. cit. and Lewison G Personal communication, 2002.

a large share of disease burden in low- and middle-income countries and poor societies
- vaccines developed for industrialized country markets may not be effective against the different types of viruses and bacteria prevalent in low- and middle-income countries
- determinants of ill health vary greatly between and within countries
- the level of development and performance of health systems and services vary greatly between and within countries
- access to treatment, medicines and other research results are very different between and within countries
- interventions for NCDs available in more advanced countries and richer societies may not be directly adaptable, appropriate or cost effective in low- and middle-income countries and poorer societies due to costs and infrastructure requirements.

The communicable disease burden (as measured by the number of DALYs per 100 000 persons) is 13 times higher in low- and middle-income countries than in high-income countries.[38] For injuries, the burden in DALYs per 100 000 people is three times higher in low- and middle-income countries than in high-income countries, whereas NCDs have the same prevalence in both groups of countries. These differences are important in view of the fact that 85% of the world's population live in low- and middle-income countries.

Section 6

Conclusions and future steps

- Although a crucial input for setting priorities in health research, there is very limited information about resource flows for health research and little awareness about their usefulness.
- Major obstacles are the lack of financial and human resources as well as the lack of tested methodologies for monitoring spending on health research at the country level.
- In an attempt to fill this gap, the Global Forum and its partners have tackled the problem through their support of a network of investigators and the development of methodologies which should facilitate comparisons among countries and permit identification of trends over time.
- The most recent (1998) figure available for

[38] Global Forum for Health Research. *The 10/90 Report on Health Research 2001-2002*. 2002.

total global resource flows for health R&D is US$ 73.5 billion, of which 50% is invested by governments, 42% by the private commercial sector and 8% by private non-profit institutions. These figures are currently being updated.

- None of the low- and middle-income countries funded health research to the level of 2% of national health expenditures as recommended by the Commission on Health Research for Development in 1990, with the large majority of them below 1%.
- Although substantial progress has been made in the understanding of the 10/90 gap and a number of strategies have been developed to tackle it since 1990 (see also chaper 3), the 10/90 gap in health research largely remains. Very determined efforts by all governments will be needed in the coming years to correct it in the following ways: (a) systematically link investments in health research to the burden of disease, both at the national and global levels; (b) establish strong links between basic research and the development of remedies for high-burden diseases and risk factors; and (c) invest research funds in improving the functioning of health systems and services.
- The establishment of an International Health Statistics Institute would be well placed to:
  - provide standardized methodologies and working definitions across the various institutions and countries
  - collect and collate received information on a routine basis
  - produce reports and disseminate information, allowing both global and local monitoring of trends and of the impact of policies and initiatives
  - act as a partner for capacity building at national and international levels.