Original Articles

Mapping of health research funding in India

LALIT DANDONA, RAKHI DANDONA, G. ANIL KUMAR, KRYCIA COWLING, PRITTY TITUS, VISHWA MOHAN KATOCH, SOUMYA SWAMINATHAN

ABSTRACT

Background. We aimed to estimate the total annual funding available for health research in India. We also examined the trends of funding for health research since 2001 by major national and international agencies.

Methods. We did a retrospective survey of 1150 health research institutions in India to estimate the quantum of funding over 5 years. We explored the Prowess database for industry spending on health research and development and gathered data from key funding agencies. All amounts were converted to 2015 constant US$.

Results. The total health research funding available in India in 2011–12 was US$ 1.42 billion, 0.09% of the gross domestic product (GDP) including only 0.02% from public sources. The average annual increase of funding over the previous 5 years (2007–08 to 2011–12) was 8.8%. 95% of this funding was from Indian sources, including 79% by the Indian pharmaceutical industry. Of the total funding, only 3.2% was available for public health research. From 2006–10 to 2011–15 the funding for health research in India by the three major international agencies cumulatively decreased by 40.8%. The non-industry funding for non-communicable diseases doubled from 2007–08 to 2011–12, but the funding for some of the leading causes of disease burden, including neonatal disorders, cardiovascular disease, chronic respiratory disease, mental health, musculoskeletal disorders and injuries was substantially lower than their contribution to the disease burden.

Conclusion. The total funding available for health research in India is lower than previous estimates, and only a miniscule proportion is available for public health research. The non-industry funding for health research in India, which is predominantly from public resources, is extremely small, and had considerable mismatches with the major causes of disease burden. The magnitude of public funding for health research and its appropriate allocation should be addressed at the highest policy level.

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INTRODUCTION

Research is essential to guide improvements in population health, but developing countries have since long faced under-investment in health research in relation to their health needs.[1,2] Better estimates of trends in global and national expenditures on health research are needed to formulate informed health policies.[2–8] Expenditure data on research on specific diseases highlight the gaps in investment in less-developed settings.[9,10]

India's National Health Policy 2017 and other analyses have noted that the modest public expenditure on health research has resulted in limited progress for an informed policy action to improve population health.[4,7,8,11–13] In India, there is limited information of how much is spent on health- and disease-related research and where it is coming from. To address this gap, we aimed to map health research funding through a survey of health research institutions across India on funding over a 5-year period, estimate of funding by the industry, and assess health research funding trends in India 2001 onwards by major funding agencies to get an improved understanding of total health research funding in India.

METHODS

We defined health research using a previously described definition as studies in basic science, clinical science and public health including social sciences, which aim to describe human health, understand the impact of factors on health ranging from the biological to societal or environmental levels, or investigate ways to improve human health.[14] Experimental investigations to advance knowledge of human health with or without a specific application were considered basic science research, studies in clinical settings on humans were considered clinical research, and studies of health or disease at the population or health system level were considered public health research. A variety of data were collected for this study as described below.

Survey of funding for health research done in India

We estimated health research funds spent by institutions across India from April 2007 to March 2012, which corresponded to the

Eleventh Five-Year Plan of the Government of India. Ethics approval for this study was obtained from the Ethics Committee of the Public Health Foundation of India, New Delhi.

We compiled a list of all potential institutions in India engaged in health research from a variety of sources including a previously available database on health research output from India,[14] the Indian Council of Medical Research (ICMR) directory of health research institutions in India,[15] and the list of medical colleges available on the Medical Council of India website.[16] The contribution of institutions that had five or less publications in PubMed during 2007–12 was considered 'minor' and they were excluded from the study. As a result, 1150 institutions were considered eligible for the study. We sent a survey questionnaire to the institutions requesting information about their research projects during the 5-year study period, duration and amount of funding for each project, and the name of the funder or whether the project was funded by internal funds of the institutions. Data were collected from November 2012 to March 2015, which required many repeat emails and phone calls. Data were entered in a Microsoft-Access database for classification.

We used the above definitions[14] to classify each health research project as basic, clinical or public health research, and the Global Burden of Disease (GBD) classification[17] for the disease condition(s). The classification was done initially based on the title of the project. If this information was inadequate, web searches on that project were conducted and/or the institution was contacted for details that could assist with classification. The classification was done by four trained researchers, using a standardized protocol, under the supervision of senior investigators. Several trial runs were done to achieve consistency, and re-training done until the reliability of classification was found suitable. A randomly selected subset of grants was given to more than one person for classification, and the discrepancies were discussed to standardize the classification. Ambiguities in classification were resolved through discussion in team meetings. The projects that did not address specific disease condition(s) were termed 'cross-cutting'.

For our analysis, we considered only direct funding for health research and excluded funding for education, training, capacity building and infrastructure. If required, the funding amount was apportioned between the components based on the available information, and only the funding amount for health research was considered. If a project covered more than one disease, the funding amount was apportioned equally between the diseases. For projects extending over more than one fiscal year, the funding amount was proportionately distributed over the years. We compared the proportion of funding for diseases with their respective contribution to the disease burden in India measured as disability-adjusted life years (DALYs) in the year 2010 as computed by GBD 2015.[18]

Industry funding for health research in India

We obtained the Prowess database for the years 2005 to 2014 from the Centre for Monitoring Indian Economy to identify industry funding for pharmaceutical and medical devices research.[19] This database provides financial data for over 27 000 companies, which includes all companies traded on the Indian national stock exchange and many unlisted public and private companies. Data on research and development expenditure by the industry in India on pharmaceutical and medical devices research was obtained from 620 companies listed in this database under the categories 'drugs, medicines and allied products' and 'medical devices'.

Major agencies funding health research in India

The major Indian agencies funding health research were identified from a database compiled by the National Science and Technology Management Information System (NSTMIS),[20] according to which 91% of the health research funding in India from fiscal years 2000–01 to 2011–12 was provided by the ICMR, Department of Biotechnology (DBT) and Department of Science and Technology (DST), all of which are agencies of the Government of India. We used data on health research funding given by them for the years 2001 onwards that was provided to us, or from the NSTMIS database for the years for which data were missing. The total health research funding data of DBT was separated for eight domains: (i) human developmental and disease biology, (ii) human genetics and genome, (iii) infectious diseases, (iv) non-infectious diseases, (v) stem cell biology, (vi) vaccine research and diagnoses, (vii) public health food and nutrition, and (viii) translational research on medicinal and aromatic plants products.

Through the survey mentioned above, previous publications on health research overview and trends, and annual reports and websites of funding agencies, we identified that the US National Institutes of Health (NIH), the Bill and Melinda Gates Foundation (BMGF) and the Wellcome Trust were the prominent international agencies funding health research in India. The funding provided by NIH and Wellcome Trust for health research in India was compiled from their databases from 2001 to the latest available year 2014.[21,22] Furthermore, we obtained data on the scientific costs reported by the Wellcome Trust DBT India Alliance for 2010 to 2015 from their annual reports and estimated the portion spent on health research, which we divided equally between the Wellcome Trust and DBT as the source of funding.[23] BMGF provided data on funding of projects in India from 2009 to 2015 on request, from which we identified the health research component.

We report trends in total funding by these Indian and international funding agencies from 2001 to 2015.

Total health research funding in India

The total health research funding includes expenditure on health research training, capacity building and infrastructure in addition to health research projects. As these were not documented in the survey, we estimated the total health research funding available in India from 2007 to 2012 using different kinds of data. First, from the total health research funding reported in the survey, we excluded all the industry funding, and inflated these amounts pro-rata to adjust for the 76.5% participation rate in the survey. Second, we determined the proportion of total health research funding spent on health research training, capacity building and infrastructure from the funding data of the major Indian and international research funding agencies, and added these proportions to the amounts reported in the survey for each funding agency to estimate their total funding for health research in India for the years 2007 to 2012. For the agencies for which these data were not available, we made the following assumptions informed by agencies for which data were available: of the total research funding, 25% by Indian governmental agencies and 10% by Indian non-governmental agencies and international agencies was for health research training, capacity building and infrastructure. Third, we applied these proportions to the amount reported in the survey for each funding agency to estimate their total funding for health research in India, which included health research projects, training, capacity building and infrastructure. This was considered the total non-industry funding for health research in India.

The total industry health research funding was estimated by adding the industry funding from the Prowess database for 2007–12 and the international industry funding from the survey. We assumed that the Indian industry funding reported in the survey was already included in the industry amount reported in the Prowess database. The estimate of the total funding available for health research in India per year was the sum of the non-industry and industry funding.

The amount in Rupees (₹) for each fiscal year was converted to 2015 constant ₹ using the International Monetary Fund gross domestic product deflator for India.[24] These ₹ figures were then converted to US$, using the average exchange rate of ₹65.46 for the fiscal year 2015–16.[25]

RESULTS

Survey of funding for health research in India

Of the 1150 eligible institutions in the survey data, 880 (76.5%) responded, reporting funding data for 15 568 health research projects. Categories of institutions that had total reported health research funding of over US$ 1 million from 2007–08 to 2011–12 fiscal years had a higher participation rate (94.6%) than those that had total reported funding up to US$ 1 million (75.3%). Of the total health research projects, 12 447 (80%) were on specific disease(s) and accounted for 71.7% of the reported total research funding. The reported funding doubled for non-communicable diseases, increased 2.5 times for injuries but still remained small, and increased slightly for communicable diseases category over 5 years (Fig. 1). The public health research component was 34.2% for communicable diseases, 9.8% for non-communicable diseases and 21.7% for injuries.

For the 12 447 projects that were for specific disease(s), the funding reported over the 5 years of the survey period for communicable diseases was somewhat higher than their contribution to the disease burden (54.9% *v.* 42.7%), for non-communicable diseases almost equivalent to their disease burden (43.4% *v.* 47.6%), and for injuries grossly lower than their disease burden (1.7% *v.* 9.7%) (Table I). Tuberculosis, HIV/AIDS and neglected tropical diseases including malaria accounted for higher funding as compared with their contribution to the disease burden, but neonatal disorders with 13.6% of the disease burden accounted for <5% of the research funding. Among non-communicable diseases, neoplasms accounted for reasonable funding whereas cardiovascular disease, chronic respiratory disease, mental health and musculoskeletal disorder accounted for relatively lower funding as compared with their contribution to the disease burden. Injuries were grossly under-funded. For the research projects reported in the survey, 72.9% funding was from Indian sources and 27.1% from international sources (Table II). Among the Indian sources, the Central government was the predominant funding source, accounting for 87.9% of the Indian funding. Of the total Central government funding, the Ministry of Health and its agencies provided 26.3% and the Ministry of Science and Technology provided 50.7%. The largest Central government individual agencies that provided funding were DBT, DST, ICMR, and Council of Scientific and Industrial Research. Funding by Indian state governments was very small, making up only 1.6% of the total Indian funding. Of the total international funding, 53.9% was provided by stand-alone agencies, 15.5% by bilateral aid agencies, and 8.1% by multilateral agencies. Among the individual international agencies, the NIH, US Agency for International Development (USAID) and BMGF were the major contributors to the reported funding.

The largest proportion of international funding was for public health research (48.7%), whereas the largest proportion of Indian funding was for basic research (63.1%) and only 7.7% for public research (Fig. 2). The Central Ministry of Health and its agencies funded public health research more than the other Central government sources (19.5% *v.* 2.2%). Among the funding reported for disease-specific projects, 55.9% of the funding by Indian agencies was for non-communicable diseases, whereas only 20.5% of the funding by international agencies was for non-communicable diseases (Fig. 2).

The total reported funding, including the pro-rata adjustment for non-participation, increased from US$ 163.4 million in the first year of survey (2007–08) to US$ 248.8 million in the last year (2011–12), an average annual increase of 13.1%. The average

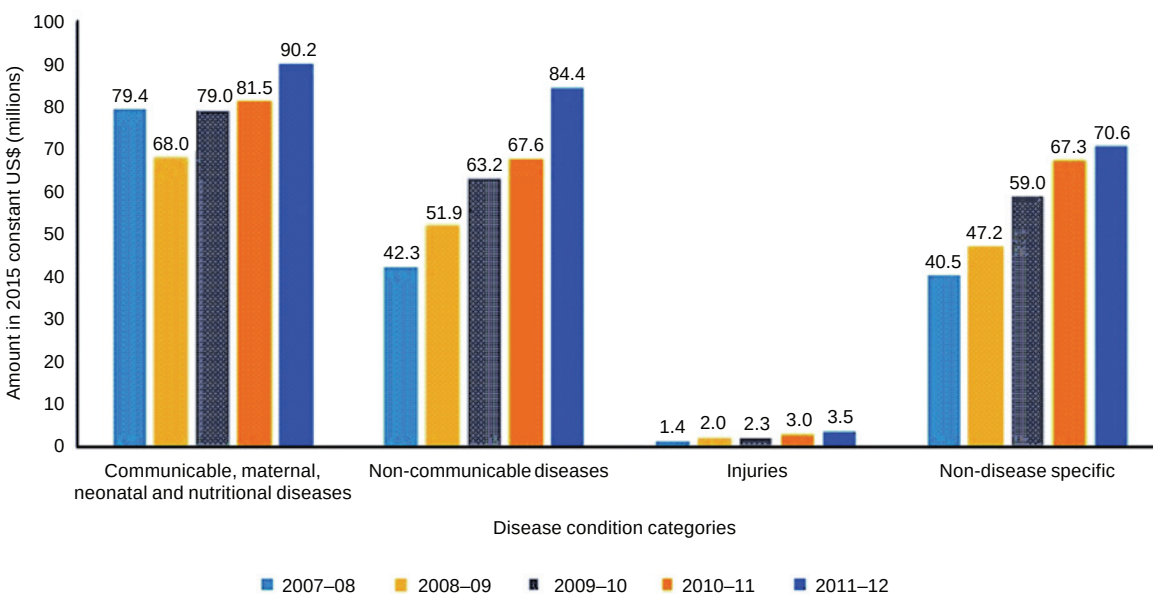

FIG 1. Annual health research funding by disease conditions in India from the survey data, 2007–12

TABLE I. Proportion of health research funding reported in the survey for India during 2007–12 for the Global Burden of Disease (GBD) Study disease categories

Disease condition	Per cent of total DALYs in 2010*	Per cent of total funding during 2007–12†
Communicable, maternal, neonatal and nutritional diseases	42.7	54.9
HIV/AIDS and tuberculosis	5.3	16.4
Tuberculosis	3.6	10.0
HIV/AIDS	1.7	6.3
Diarrhoea, lower respiratory, and other common infectious diseases	15.5	11.9
Diarrhoeal diseases	5.0	4.1
Lower respiratory infections	5.1	3.5
Meningitis and other common infectious diseases	5.5	4.3
Neglected tropical diseases and malaria	1.8	7.9
Malaria	0.9	2.8
Neglected tropical disease	0.9	5.1
Maternal disorders	1.0	1.9
Neonatal disorders	13.6	4.2
Nutritional deficiencies	4.4	3.0
Other communicable, maternal, neonatal and nutritional diseases	1.1	4.9
Maternal and child health, unspecified‡	—	0.7
Child health, unspecified‡	—	0.2
Maternal/reproductive health unspecified‡	—	0.4
Sub-classification not possible	—	3.4
Non-communicable diseases	47.6	43.4
Neoplasms	3.2	10.9
Cardiovascular diseases	11.8	5.6
Chronic respiratory diseases	5.7	1.9
Cirrhosis	1.5	0.4
Digestive diseases	2.5	1.4
Neurological disorders	2.6	3.7
Mental and substance use disorders	4.7	2.6
Diabetes, urogenital, blood and endocrine diseases	5.3	7.9
Diabetes	2.0	3.1
Musculoskeletal disorders	4.3	2.4
Other non-communicable diseases	6.1	6.4
Sub-classification not possible	—	0.1
Injuries	9.7	1.7
Transport injuries	2.8	0.02
Unintentional injuries	4.6	1.5
Self-harm and interpersonal violence	2.2	0.1
Forces of nature, war and legal intervention	0.04	0.1
Sub-classification not possible	—	0.04
Total	100	100

* Disability-adjusted life years (DALYs) for 2010 from GBD 2015 estimation
† Total amount used as a denominator for this excluded the amount for health research projects that were not specific for any disease condition
‡ Categories not present in GBD classification

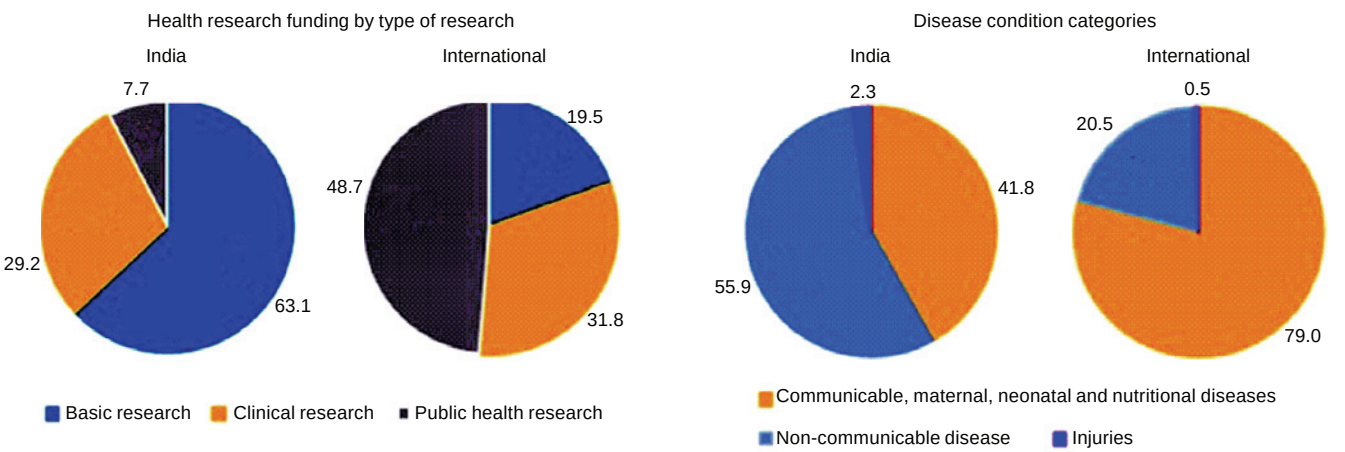

FIG 2. Distribution of Indian and international funding by type of research and for disease/condition categories in India from the survey data, 2007–12

TABLE II. Sources of health research funding reported in the survey during 2007–12 for India

Funding agency	Funding* from 2007–08 to 2011–12 in 2015 constant US$ (millions)	Per cent of total funding (%)
Indian	*701.5*	*72.9*
Central government	616.9	64.1
Central Ministry of Health and its agencies	162.5	16.9
Indian Council of Medical Research	79.3	8.2
Other†	83.2	8.6
Central Ministry of Science and Technology and its agencies	313.4	32.6
Council of Scientific and Industrial Research	70.1	7.3
Department of Biotechnology	163.8	17.0
Department of Science and Technology	79.5	8.3
Other ministries and their agencies‡	140.9	14.6
State government	11.0	1.1
State ministry of health and its agencies	2.7	0.3
State ministries other than health and their agencies	8.3	0.9
Non-governmental agencies	18.9	2.0
Pharmaceutical industry	29.6	3.1
Other§	25.1	2.6
International	*261.3*	*27.1*
Stand-alone agencies	140.3	14.6
US National Institutes of Health	53.4	5.5
Bill and Melinda Gates Foundation	23.7	2.5
Wellcome Trust	8.1	0.8
Other	55.2	5.7
Bilateral aid agencies	40.7	4.2
US Agency for International Development	26.5	2.8
European Union	9.5	1.0
Other	4.6	0.5
Multilateral agencies	21.3	2.2
World Health Organization	15.8	1.6
Other	5.5	0.6
Pharmaceutical industry	34.2	3.6
Universities	24.7	2.6
Total	962.7	100.0

* This excludes US$ 41.5 million for which data were missing † Includes other Central health ministry agencies ‡ Includes All India Council for Technical Education, Defence Research and Development Organization, Department of Atomic Energy, University Grants Commission, and other Central government agencies § Includes any other Indian agencies not included above and the intramural funding by research institutions

annual increase was substantially more for Indian (19.5%) as compared with international funding (3.2%).

TABLE III. Broader health research funding in India by major individual agencies, 2001–15

Funding agency	Average annual funding* in 2015 in constant US$ (millions)		
	2001–05	2006–10	2011–15
Indian			
Indian Council of Medical Research	10.3	28.0	51.9
Department of Biotechnology	8.9	25.5	25.5
Department of Science and Technology†	17.3	24.4	11.8
International			
US National Institutes of Health‡	17.5	35.3	16.8
Bill and Melinda Gates Foundation §	—	37.3	22.4
Wellcome Trust	5.0	4.6	6.5

* This funding is for health research and does not include administrative and institutional costs; for the April to March fiscal year reporting by Indian agencies, the initial year used in this table for direct comparison with the calendar year reporting by international agencies, e.g. Indian agencies fiscal data for April 2015 to March 2016 shown as 2015 data in this table † Data available for years 2001 to 2011; the single year data for 2011–15 may make this estimate erratic ‡ Data available for years 2001 to 2014 § Data available for years 2009 to 2015; the two years data for 2006–2010 may make this estimate erratic

Industry funding

The health research and development expenditure reported in the Prowess database of Indian companies was predominantly by the pharmaceutical industry. This amount increased from US$ 739.2 million in 2005 to US$ 1193 million in 2014, an average annual increase of 6.8%. We assumed that these reported amounts included the Indian pharmaceutical industry funding reported in the survey, which averaged US$ 5.9 million annually over the 2007–08 to 2011–12 survey period. The additional international pharmaceutical industry funding reported in the survey was an average of US$ 6.8 million annually.

Trends of funding by major individual agencies

The trends of funding for broader health research by some of the leading Indian and international agencies from 2001 to 2015 are shown in Table III. This broader funding includes research projects, disease registries, research training and capacity building, and research infrastructure, which is different from the funding reported in the survey data above, which included only research projects. It is important to note that these amounts do not include administrative and institutional costs, and therefore, do not indicate the entire health budgets of these agencies. This health research funding by the ICMR and the DBT increased substantially over

TABLE IV. Total estimated health research funding in India

Funding agencies	Annual funding in 2015 constant US$ (millions)		
	2007–08	2011–12	Average annual per cent increase
Indian	981.6	1342.5	9.2
Non-industry	138.1	248.8	20.0
Pharmaceutical industry	843.5	1093.7	7.4
International	62.0	70.6	3.5
Non-industry	51.9	59.6	3.7
Pharmaceutical industry	10.0	11.0	2.3
Total*	1053.3	1422.7	8.8

* Total funding includes the amount for which the funding source was missing, US$ 9.7 million in 2007–08 and US$ 9.6 million in 2011–12

the 15-year period. In contrast, funding by the two leading international agencies—NIH and BMGF—reduced substantially in the most recent 5-year period (2011–15). Comparing the funding provided by these agencies for research projects as reported by research institutions in the survey of 2007–08 to 2011–12 (Table II) with the broader research funding by the agencies (Table III), ICMR and all of the three international agencies in Table III provided significant health research funding for disease registries, research training and capacity building, and research infrastructure in addition to research projects.

Total health research funding in India

The total estimated health research funding available in India increased from US$ 1053 million in the year 2007–08 to US$ 1423 million in 2011–12, an average annual increase of 8.8% (Table IV). Considering the industry and non-industry funding for health research together for the period from 2007–08 to 2011–12, the vast majority of funding was from Indian sources (95%). Of the total, 79.8% of the health research funding was by the industry, almost all of which was by the Indian pharmaceutical industry. The average annual increase of funding over this period by Indian non-industry sources was close to three times as much as that by the Indian industry. As the industry funding was for basic and clinical research, of the total health research funding only 3.2% was for public health research.

The total estimated health research funding available in India in 2011–12 was 0.09% of the GDP,[26] of which the non-industry funding predominantly from public funds was only 0.02%.

DISCUSSION

The total estimated health research funding in India in 2011–12 was US$ 1.42 billion. This had increased at an average of 8.8% annually over the previous 5 years. Our total estimated health research funding is lower than a recently reported estimate for biomedical research and development expenditure in India,[6] which was US$ 1.9 billion in 2012 at the 2015 constant price. This was a broad estimate, whereas we adopted a more detailed approach, including data from a survey of health research institutions across India. Health research has been defined in varied ways which can make global comparisons and understanding trends over time difficult.[5,7,27] We estimated health research funding in India to be 0.09% of the GDP, of which only 0.02% was from public sources. This estimated proportion of per capita GDP spent on health research in India is about five times lower than that in South Korea and the UK.[5,8]

The dominant non-industry Indian source of health research funding was the Central government, and it is interesting that funding of health research by the Ministry of Science and Technology was more than that by the Ministry of Health. Funding by the Ministry of Science and Technology is predominantly for basic research. From 2008 to 2017, 2.3%–2.6% of the Central Health Ministry expenditure was on research.[28] Boosting of research funding by the Central Health Ministry is particularly important as it funds relatively more public health research, which is very inadequate. Public health research funding accounted for a meagre 3.2% of total health research funding, which corroborates with the low public health research output from India.[14] Enhancing the Central Health Ministry expenditure on research to 5% of the total health budget may be a reasonable expectation. This enhancement could be usefully targeted to conditions that are under-funded relative to their contribution to the disease burden and for greater public health research for strengthening the health system. Strategic planning to address the continuing deficits in public funding for health research, and enhancing the overall proportion for public health research, is needed urgently to reduce the large disease burden in India and to make universal healthcare possible.[4,8,29] The need for alignment of research funding by funding agencies with the health needs of the country has been emphasized previously,[3] but specific action is needed to make this happen.

A majority of the total health research funding was from Indian sources, and an increase in funding over recent years was documented more for Indian than for international sources. Two prominent international sources, i.e. NIH and BMGF, provided a substantially less funding for health research in India during 2011–15 as compared with the previous 5-year period. Among the bilateral funding agencies, USAID was the major funding source reported in the survey. An interesting finding of the survey was that a much larger proportion of international funding was for public health research as compared with Indian funding, highlighting the need for reinforcing the latter.

During 2007–12, the reported funding for research on non-communicable diseases increased substantially, reflecting the increasing focus on chronic diseases which are the leading cause of disease burden in India, but the neglect of injuries continued.[14,18,30] However, the reported funding was substantially less for some of the leading causes of non-communicable disease burden such as cardiovascular disease, chronic respiratory disease, mental health and musculoskeletal disorders in comparison with their contribution to the disease burden, indicating that within the overall low research funding levels relatively larger portions were being spent on diseases with lower burden. Tuberculosis, HIV/AIDS, and neglected tropical diseases including malaria accounted for higher funding as compared with their contribution to the disease burden. High concentration of funding for these diseases has been documented previously,[9,10] and these are also prioritized in the national vertical disease control programmes with neglect of other infectious diseases.[31] With India still dealing with a major burden of neonatal disorders,[32,33] the reported funding for these conditions was low. An interesting finding was that the international funding was predominantly reported for communicable diseases, whereas the Indian funding was more balanced between the communicable and non-communicable diseases. These findings highlight that the challenge of appropriate targeting of health research funding for more effective population health improvement is yet to be addressed effectively in India. It is important to note that while the magnitude of burden by a disease is a useful guide for research funding, there would be other reasons as well to prioritize funding for certain diseases that are of special interest

to India, e.g. those that are targeted for elimination or those that occur specifically in India. Also, several findings from health research in other countries may be applicable to this country for which research may not need to be prioritized in India. In addition, research being done in non-health sectors on diseases and risks that are influenced by other sectors has to be taken into account while assessing the need for health research on such conditions.

There are several limitations within which these findings should be interpreted. First, there is no comprehensive listing of institutions doing health research in India. We compiled this list from various sources, but could have still missed some institutions. Second, to make the effort efficient, we excluded from the survey smaller institutions that had less than one publication per year in PubMed, which could have potentially led to an underestimation of health research funding. On the other hand, our pro-rata adjustment approach for non-participating institutions could have led to an overestimation, as the larger institutions with higher funding had a higher participation rate. These two opposing influences could have potentially cancelled each other, though the extent of this cannot be ascertained. Third, with limited information available on some projects, their classification could have been erroneous. We gathered all possible information and used a standardized approach to classification to minimize this impact. Fourth, we had access only to broad industry funding data for health research based on which it was not possible to classify the funding for various disease conditions. We could only ascertain that almost all of this funding was for basic and clinical research. Fifth, the methods of data compilation and reporting by various agencies funding health research are different, with some agencies having no methodical compilation, which could have led to inaccurate estimates and comparisons. Also, the data available from funding agencies did not allow matching with the data obtained from research institutions. Finally, the data reported from health research institutions is some years old as it took a long time to obtain information through repeat contacts. However, combined with more recent data from the industry and the funding agencies, this package of findings seems to be a useful aid to the understanding of various aspects and trends of health research funding in India. The reasonably high response rate in our survey is a strength of this assessment, which was made possible by perseverance in follow-up over an extended period.

There have been previous attempts to assess health research output from India in relation to the distribution of disease burden,[14,34,35] but a detailed assessment of health research funding in India has not been available. This report is the first detailed effort to examine the nature of health research funding available to institutions across the country, what it is spent on, and the sources of funding. This, along with the estimation of industry research expenditure, provides a more comprehensive understanding of health research funding in India than has been possible so far. The gaps and mismatches reported in this paper could help better steering of research funding in India to under-funded diseases with higher burden, and health system priorities.[11,12,36] For regular tracking of health research funding and its use, India needs a robust and comprehensive system of maintaining data on trends of health research funding, which could be developed on the basis of the mapping reported in this paper. With considerable heterogeneity in the causes of disease burden and risk factors between the states of India reported recently,[37] it would be useful in the future to steer research funding to address major health inequalities between the states of India, many of which are as large as some countries in the world.

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CONTRIBUTIONS

LD, RD, and VMK conceptualized the study. LD, RD, GAK and KC contributed to the study design. VMK and SS facilitated data access across institutions and agencies. GAK and PT carried out the data analysis under the oversight of LD and RD, and KC contributed to the data analysis. LD, RD, GAK and SS interpreted the findings initially and drafted the manuscript. All authors reviewed and approved the final manuscript.

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Conflicts of interest. VMK and SS were both formerly Secretary to the Government of India, Department of Health Research and Director-General of the Indian Council of Medical Research. None of the other authors have any competing interests. The contents of this paper are solely the responsibility of the authors and do not necessarily represent the official views of the Government of India.

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