Development assistance for health: past trends, associations, and the future of international financial flows for health

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Summary

Background Disbursements of development assistance for health (DAH) have risen substantially during the past several decades. More recently, the international community's attention has turned to other international challenges, introducing uncertainty about the future of disbursements for DAH.

Methods We collected audited budget statements, annual reports, and project-level records from the main international agencies that disbursed DAH from 1990 to the end of 2015. We standardised and combined records to provide a comprehensive set of annual disbursements. We tracked each dollar of DAH back to the source and forward to the recipient. We removed transfers between agencies to avoid double-counting and adjusted for inflation. We classified assistance into nine primary health focus areas: HIV/AIDS, tuberculosis, malaria, maternal health, newborn and child health, other infectious diseases, non-communicable diseases, Ebola, and sector-wide approaches and health system strengthening. For our statistical analysis, we grouped these health focus areas into two categories: MDG-related focus areas (HIV/AIDS, tuberculosis, malaria, child and newborn health, and maternal health) and non-MDG-related focus areas (other infectious diseases, non-communicable diseases, sector-wide approaches, and other). We used linear regression to test for structural shifts in disbursement patterns at the onset of the Millennium Development Goals (MDGs; ie, from 2000) and the global financial crisis (impact estimated to occur in 2010). We built on past trends and associations with an ensemble model to estimate DAH through the end of 2040.

Findings In 2015, US$36·4 billion of DAH was disbursed, marking the fifth consecutive year of little change in the amount of resources provided by global health development partners. Between 2000 and 2009, DAH increased at 11·3% per year, whereas between 2010 and 2015, annual growth was just 1·2%. In 2015, 29·7% of DAH was for HIV/AIDS, 17·9% was for child and newborn health, and 9·8% was for maternal health. Linear regression identifies three distinct periods of growth in DAH. Between 2000 and 2009, MDG-related DAH increased by $290·4 million (95% uncertainty interval [UI] 174·3 million to 406·5 million) per year. These increases were significantly greater than were increases in non-MDG DAH during the same period (p=0·009), and were also significantly greater than increases in the previous period (p<0·0001). Between 2000 and 2009, growth in DAH was highest for HIV/AIDS, malaria, and tuberculosis. Since 2010, DAH for maternal health and newborn and child health has continued to climb, although DAH for HIV/AIDS and most other health focus areas has remained flat or decreased. Our estimates of future DAH based on past trends and associations present a wide range of potential futures, although our mean estimate of $64·1 billion (95% UI $30·4 billion to $161·8 billion) shows an increase between now and 2040, although with a large uncertainty interval.

Interpretation Our results provide evidence of two substantial shifts in DAH growth during the past 26 years. DAH disbursements increased faster in the first decade of the 2000s than in the 1990s, but DAH associated with the MDGs increased the most out of all focus areas. Since 2010, limited growth has characterised DAH and we expect this pattern to persist. Despite the fact that DAH is still growing, albeit minimally, DAH is shifting among the major health focus areas, with relatively little growth for HIV/AIDS, malaria, and tuberculosis. These changes in the growth and focus of DAH will have critical effects on health services in some low-income countries. Coordination and collaboration between donors and domestic governments is more important than ever because they have a great opportunity and responsibility to ensure robust health systems and service provision for those most in need.

Funding Bill & Melinda Gates Foundation.

Introduction

During the past decade, substantial growth in health financing has contributed to progress toward global health goals. At the turn of the millennium, 129·0 of every 1000 children died before the age of 5 years, 499·5 of every 100 000 women died due to complications from childbirth, and HIV/AIDS mortality was climbing 9·4% each year in low-income countries.[1–4] In an unprecedented response, world leaders came together to create the Millennium Development Goals (MDGs) in 2001.[5] Three of the eight goals aimed to improve health. MDG 4 called for a two-thirds reduction in under-5 mortality; MDG 5 called for the reduction of maternal mortality by three-quarters; and MDG 6 called for the

Research in context

Evidence before this study

Much research has sought to describe the disbursement of development assistance for health (DAH). Previous research articles and reports by the Institute for Health Metrics and Evaluation have tracked DAH from 1990 onward, disaggregating spending by the source of funding, intermediary channel, recipient country, and health focus area. Other studies have concentrated on specific health focus areas, such as the estimates produced by Countdown to 2015, which focused on maternal, child, and newborn health. In addition to resource tracking, separate, relatively contentious lines of research have aimed to measure the effectiveness of DAH, and the practice in which development assistance displaces government spending. These studies vary in scope and conclusion, with some focusing on cross-country longitudinal analyses, and others concentrating on a single country or programme. Finally, there is a substantial body of research that aims to connect governance and DAH, and explores how DAH is allocated across recipient countries and health focus areas. Conclusions from these studies have been quite mixed.

Added value of this study

To our knowledge, this is the first study to track DAH up to the end of 2015, the first to statistically evaluate changes in DAH disbursement over time, and the first to use past trends and associations to estimate the amount of development assistance expected to be provided in the future. Our results show that the past 26 years were characterised by three distinct periods, with moderate growth in the 1990s, accelerated growth in the first decade of the 2000s, and stagnation since 2010. Additionally, these varying historic trends show that there is a great deal of uncertainty about the total amount of DAH that will be provided in the future, with mean estimates showing substantially slower growth in the future than in previous years. Finally, this study makes use of improved methods and more detailed tracking than has been previously employed.

Implications of all the available evidence

The era of major growth in DAH has, at least temporarily, ended. This is crucial for poor people who live in countries where domestic resources fall short of the minimum needed to cover health needs. Still, substantial uncertainty exists in our predictions, showing the enormous potential for donors and international policy makers to contribute to health gains through the allocation of more resources. Such gains could be achieved by use of innovative health financing measures to encourage domestic spending and by increasing efficiency of existing resources.

reversal of the spread of HIV/AIDS, malaria, tuberculosis, and other major infectious diseases.[6]

Since the adoption of the MDGs by the UN General Assembly, development partners worldwide have increased in size and number, with some focused exclusively on the specific diseases targeted by the MDGs. Some of the now-largest global health organisations did not exist or had been recently created in 2000, including the Bill & Melinda Gates Foundation (the Gates Foundation); Gavi, the Vaccine Alliance (Gavi); The Global Fund to Fight AIDS, Tuberculosis and Malaria (the Global Fund); The US President's Emergency Plan for AIDS Relief (PEPFAR); and the President's Malaria Initiative (PMI).

Whereas the MDG era saw tremendous success in improving international resources for health, other global issues—including the continued financial insecurity provoked by the global financial crisis, the unprecedented number of migrants seeking asylum in Europe and elsewhere, and issues related to climate change—are now capturing the international community's attention. These issues mark a potential shift away from the traditional global health landscape that has characterised the past several decades.

To better understand past and future trends in global health, this paper presents health focus area-specific estimates of development assistance for health (DAH) from 1990 to the end of 2015, with predictions of total DAH up to 2040. With these estimates of DAH, we explore the associations between the establishment of the MDGs, the scale-up in terms of funding and global health actors, the composition of DAH across key health focus areas, and the recent stagnation in DAH.

Methods

Data

DAH refers to the in-kind and financial resources transferred from primary development channels to low-income and middle-income countries for the purpose of maintaining or improving health.[7,8] We tracked DAH from 1990 to the end of 2015 using methods developed by the Institute for Health Metrics and Evaluation. We collected audited budget statements, annual reports, and project-level records from the main international agencies that disbursed DAH from 1990 to the end of 2015. We collected data from all publicly available sources of development assistance and obtained additional data through correspondence to augment any gaps in these data. We standardised and combined records to provide a comprehensive set of annual disbursements. In some cases, disbursements are modelled based on past trends, commitment data, and budget data. In-depth information about our methods for tracking primary sources of DAH and dealing with lags in data reporting and the removal of funds that are counted multiple times when agencies transfer funds

See Online for appendix

between each other have been published previously[9–13] and are shown in the appendix.

We divide DAH into nine primary, mutually exclusive focus areas: HIV/AIDS, tuberculosis, malaria, maternal health, newborn and child health, other infectious diseases, non-communicable diseases, Ebola, and sector-wide approaches and strengthening of health systems. Two additional health focus areas exist: resources defined as other are projects that do not fit into one of our primary health focus areas; and resources defined as unallocable are projects for which we do not have sufficient information to identify the health focus area of a particular grant or loan.

For our statistical analysis, we grouped the health focus areas into two categories: MDG-related (HIV/AIDS, tuberculosis, malaria, child and newborn health, and maternal health) and non-MDG-related (other infectious diseases, non-communicable diseases, sector-wide approaches, and other) focus areas. We removed unallocable and Ebola funding because we did not have

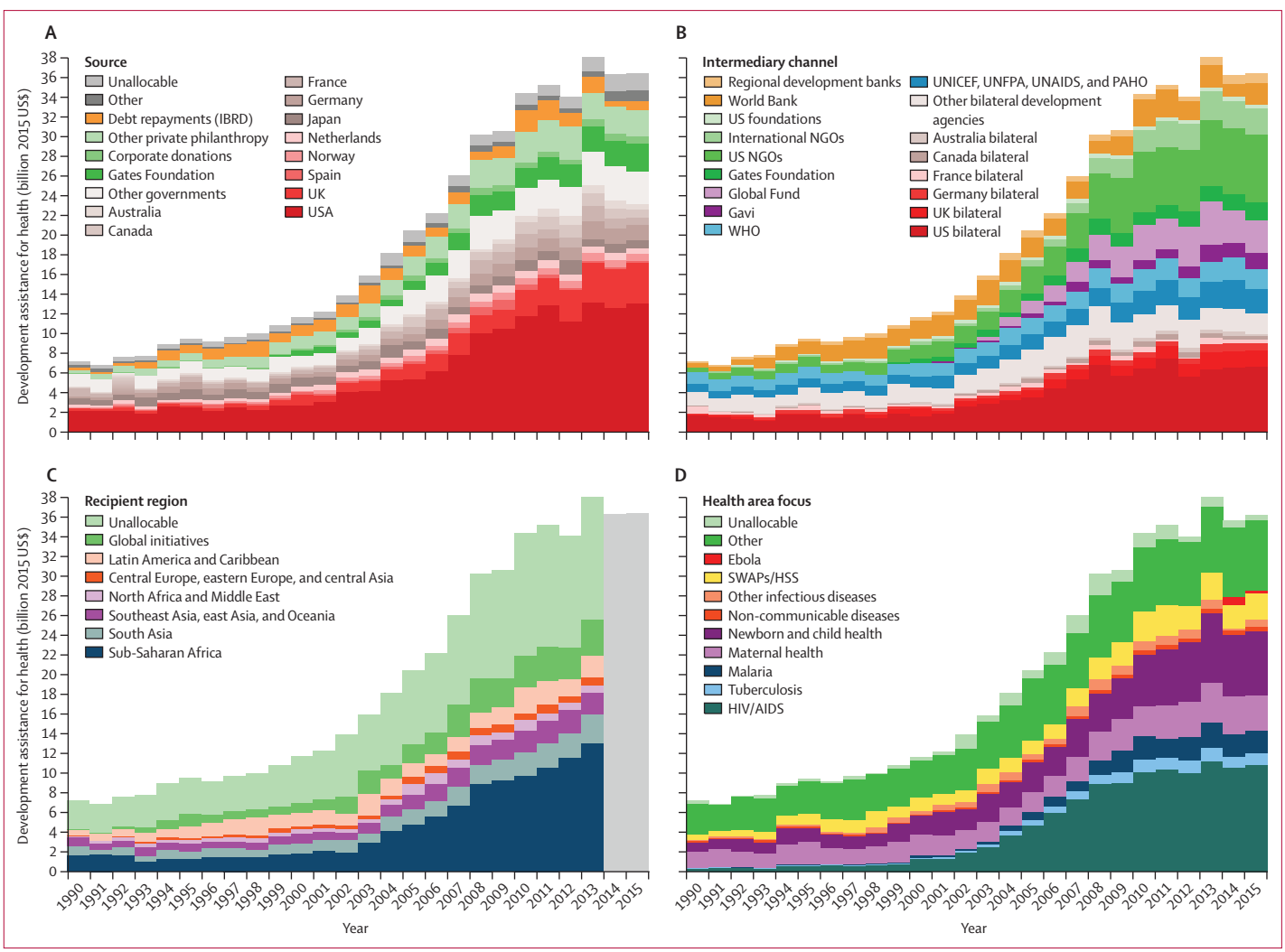

Figure 1: **Disaggregated DAH, 1990–2015**

DAH disaggregated by source (A), intermediary channel (B), recipient region (C), and health focus area (D). DAH is shown in billions of 2015 US dollars. 2014 and 2015 are preliminary estimates. Absolute values used to create this figure are shown in the appendix. In A, unallocable corresponds to DAH for which we do not have project-level information and cannot parse across source; and other corresponds to net investment income. In B, the World Bank includes the International Development Association and the International Bank for Reconstruction and Development; and regional development banks include the Inter-American Development Bank, the African Development Bank, and the Asian Development Bank. In C, regions are grouped into Global Burden of Disease super-regions; Latin America and the Caribbean includes Argentina, Chile, and Uruguay, which are now high-income countries so no longer receive DAH; southeast Asia, east Asia, and Oceania includes South Korea, which is also now a high-income country, only for those years in which it received DAH; unallocable corresponds to DAH for which we do not have project-level information and cannot parse to a region; and 2014 and 2015 are not disaggregated to recipient level because of data limitations. In D, other corresponds to DAH for which we have project-level information but which is not identified as funding any of the health focus areas that we tracked; and unallocable corresponds to DAH for which we do not have project-level information and cannot parse across health focus areas. DAH=development assistance for health. IBRD=International Bank for Reconstruction and Development. Gates Foundation=the Bill & Melinda Gates Foundation. NGO=non-governmental organisation. Global Fund=The Global Fund to Fight AIDS, Tuberculosis and Malaria. Gavi=Gavi, the Vaccine Alliance. UNICEF=United Nations Children's Fund. UNFPA=United Nations Population Fund. UNAIDS=Joint United Nations Programme on HIV/AIDS. PAHO=Pan American Health Organization. SWAPs/HSS=sector-wide approaches and health system strengthening.

sufficient information for these areas. Together, these two categories made up less than 5% of total DAH in 2015. All tracked funds are converted to 2015 US dollars to adjust for inflation.

Past trends and associations

We used linear regression to estimate whether DAH for the MDG-related focus areas has increased significantly faster than for other focus areas, and to test whether structural shifts exist in the manner in which DAH has grown over time. By use of ordinary least squares analysis, we regressed annual changes in DAH on an intercept and five binary indicators. The first indicator marked the years between 2000 and 2009 and tested whether a structural shift (eg, a systematic change) occurred in annual increases in DAH disbursed during these years. The second indicator marked the years after 2009 and tested whether a structural shift occurred in annual increases in DAH during these years. The third indicator marked MDG-related health focus areas and tested whether DAH for these areas increased at a faster pace than for non-MDG-related health focus areas between 1990 and 1999. Finally, the MDG indicator was multiplied by each of the time indicators to produce the fourth and fifth indicators, which tested whether the MDG-related health focus areas grew at distinct rates during either of these periods. We used a Wald test to assess the statistical significance of differences between the coefficient estimates. We also did sensitivity analyses to test the robustness of our results, which are described in the appendix.

Estimation of total development assistance to 2040

We use past trends and associations and an ensemble model to estimate future disbursements of DAH through the end of 2040. For this analysis, we stratified DAH by source using an ensemble modelling method. This approach, which aggregates across a diverse set of modelled scenarios, allows us to avoid basing estimates on a single model specification. We chose an ensemble model because exploration of various model specifications showed that estimates were highly dependent on the specification and choice of variable.

DAH was measured as the share of the source country's gross domestic product (GDP), where GDP was measured 2 years before disbursement of the DAH. We used this 2 year lag because DAH is budgeted and committed several years before it is disbursed. We took the natural log of the DAH divided by GDP fraction to avoid modelling negative values and to ease interpretation of coefficient estimates. We modelled year-over-year changes in DAH (first differences). We used first differences because the Levin-Lin-Chu unit root test could not reject the null hypothesis that the non-differenced data were non-stationary ($p=0 \cdot 167$) and suitable for econometric forecasts. Potential covariates to predict changes in DAH disbursed by each source were auto-regressive terms (up to three lags of the dependent variable), the first-differenced natural logarithm of GDP per capita, a convergence term (lagged level of the dependent variable), and country-specific fixed or random intercepts. Finally, we included an indicator to control for the 2000 to 2009 scale-up of DAH. This indicator allows the growth observed during these years to be treated as an anomaly, with the high growth during this time unlikely to be repeated. All potential combinations of these covariates, 400 models in total, were considered for inclusion in our ensemble.

To be included in the ensemble, a model needed to pass three inclusion criteria. First, only models for which all coefficient estimates were significant ($\alpha=0 \cdot 1$) were included. Second, if included, the coefficient estimate for the convergence term was required to be less than zero, prohibiting exponential growth. Third, scenarios were required to fall within a range of plausible growth rates. This range was determined empirically based on annual changes in DAH between 1990 and 2015. The appendix contains complete descriptions of these criteria and all our methods. 22 models passed all three criteria so were included in our ensemble model.

We included four types of uncertainty for these prospective estimates. First, we used the ensemble modelling approach to show the uncertainty in model specification by averaging across a diverse set of 22 specifications. Second, we took draws from the variance-covariance matrix estimated for each model to represent parameter uncertainty. Third, we randomly selected a GDP series from the previously forecasted distribution of GDP estimates. This sampling captures uncertainty in our underlying data. Fourth, for each scenario, we estimated the country-specific distribution of residuals. These residuals represent unexplained change in the amount of DAH disbursed. We added random draws from each distribution to each country and year for each scenario to capture fundamental model uncertainty. The mean of these draws is the reported point estimate,

Development assistance for health by health focus area	1990–99	2000–09	2010–15
Malaria	9·1%	28·3%	–0·9%
Tuberculosis	11·1%	26·9%	–0·2%
HIV/AIDS	9·5%	24·1%	1·3%
Child and newborn health	7·7%	9·1%	4·6%
Maternal health	2·6%	4·7%	3·1%
Non-communicable diseases	2·5%	10·2%	1·9%
Other infectious diseases	15·4%	9·8%	3·8%
Sector-wide approaches and health system strengthening	8·8%	7·0%	–2·3%
Other	2·2%	5·4%	1·9%
Unallocable	2·2%	14·3%	–17·3%
MDG areas	5·5%	14·8%	2·1%
Non-MDG areas	4·0%	6·3%	0·7%
Total	**4·6%**	**11·3%**	**1·2%**

Figure 2: **Development assistance for health annualised growth rates**

and the 2·5th and 97·5th percentiles mark the lower and upper bounds of the uncertainty interval (95% UI).

Role of the funding source

The funder of the study had no role in study design, data collection, data analysis, data interpretation, or writing of the report. The corresponding author had full access to all the data in the study and had final responsibility for the decision to submit for publication.

For **detailed results of the study** see http://ghdx.healthdata.org/record/development-assistance-health-database-1990-2015

Results

We used more than 60 data sources. Data were collected from the Organisation for Economic Co-operation and Development (OECD)'s Creditor Reporting System (CRS); the OECD's Development Assistance Committee (DAC); project-level data from the Gates Foundation, the Global Fund, Gavi, and the World Bank; grant-level data from the Foundation Center; non-governmental organisation (NGO) data from the US Agency for International Development (USAID)'s annual Report of Voluntary Agencies; and a diverse set of audited financial records and annual budgets. Detailed data used to create the figures are available online. From 1990 to 2015, a total of $502·7 billion of DAH was disbursed. In 2015 alone, $36·4 billion was provided, a major increase from 1990, in which DAH amounted to $7·2 billon, and 2000, when DAH was $11·7 billion. Since 2010 annual disbursements have changed very little, with DAH generally stable at about $35·0 billion. Past trends and associations suggest that DAH will remain stable, with the 2040 estimate of DAH at

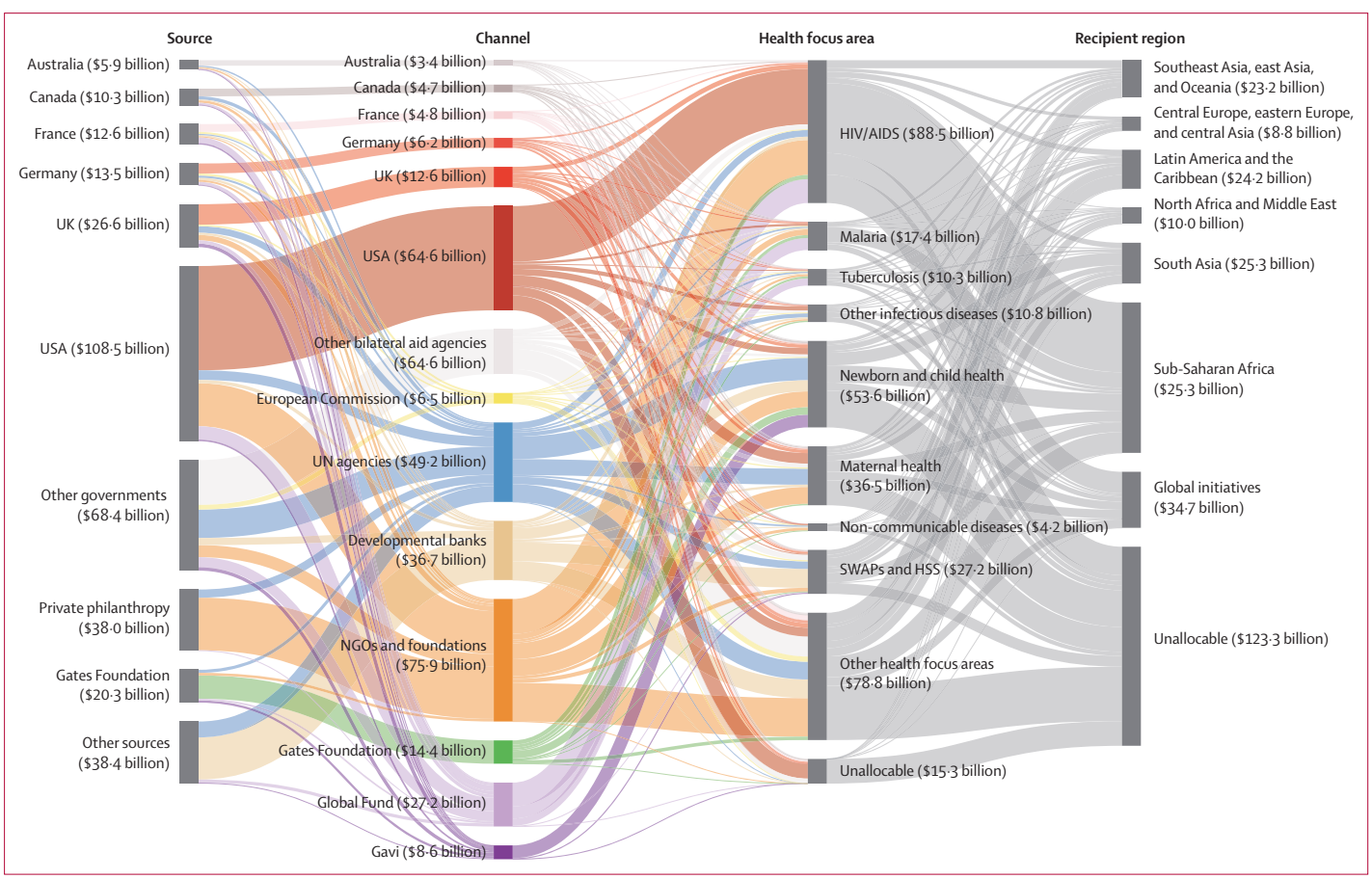

Figure 3: **Flow of DAH, 2000–13**

The figure shows the amount of DAH that originated with each source, flowed through each intermediary channel, was targeted at each health focus area, and was ultimately received in each geographic region. Data are cumulative DAH from 2000 to the end of 2013 in billions of 2015 US dollars. Sources of funds are shown on the left, channels are shown in the middle left, health focus areas are shown on the middle right, and Global Burden of Disease recipient super-regions are shown on the right. Absolute values used to create this figure are available online. Private philanthropy includes corporate donations and other private philanthropy. Other sources includes debt repayments and unallocable funds by source. NGOs and Foundations include NGOs and US foundations. UN Agencies include the UN Children's Fund, UN Population Fund, Joint UN Programme on HIV/AIDS, Pan American Health Organization, and WHO. Development banks include the World Bank International Development Association, the World Bank International Bank for Reconstruction and Development, the Inter-American Development Bank, the African Development Bank, and the Asian Development Bank. Other health focus areas corresponds to DAH for which we have project-level information but which is not identified as funding any of the health focus areas we tracked. Unallocable in terms of health focus area corresponds to DAH for which we do not have project-level information and cannot parse across health focus areas. Latin America and the Caribbean includes Argentina, Chile, and Uruguay, which are now high-income countries. Southeast Asia, east Asia, and Oceania includes South Korea for 1994, which is also now a high-income country. Unallocable in recipient region also corresponds to DAH for which we do not have project-level information and thus, cannot parse across recipients. DAH=development assistance for health. NGO=non-governmental organisation. Gates Foundation=the Bill & Melinda Gates Foundation. Global Fund=The Global Fund to Fight AIDS, Tuberculosis and Malaria. Gavi=Gavi, the Vaccine Alliance. SWAPs/HSS=sector-wide approaches and health system strengthening.

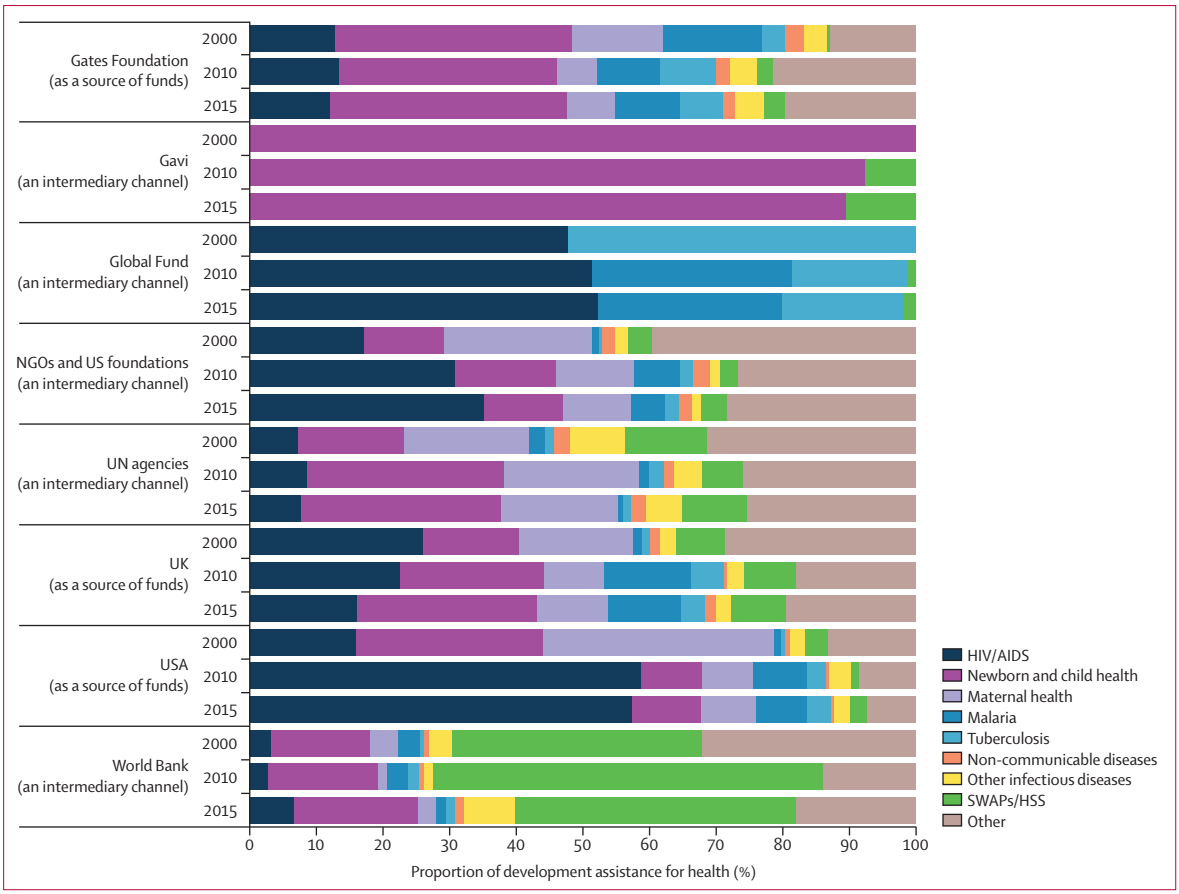

Figure 4: **Priority health focus areas for the major sources and channels of DAH**

Proportions of DAH provided to nine health focus areas in three time periods from major sources and intermediary channels. The time periods are 2000, 2010, and 2015, except for The Global Fund to Fight AIDS, Tuberculosis and Malaria, which began its operations in 2002. Absolute values used to create this figure are shown in the appendix. Other corresponds to DAH for which we have project-level information, but which is not identified as funding any of the health focus areas we tracked. Estimates for 2015 are preliminary. DAH=development assistance for health. Gates Foundation=the Bill & Melinda Gates Foundation. Gavi=Gavi, the Vaccine Alliance. Global Fund=The Global Fund to Fight AIDS, Tuberculosis and Malaria. NGO=non-governmental organisation. SWAPs/HSS=sector-wide approaches and health system strengthening.

$64·1 billion (95% UI $30·4 billion to $161·8 billion) with a large uncertainty interval surrounding the estimate.

Figure 1 shows these increases and the recent stagnation of DAH disbursements. The US Government was consistently the largest source of DAH throughout the study period, providing between 23·0% and 36·8% of total DAH each year. A diverse set of intermediary channels have disbursed DAH, with substantial support provided by NGOs ($6·9 billion [18·9%] in 2015) and bilateral aid agencies ($11·7 billion [32·1%] in 2015). Additionally, figure 1 marks the genesis of several now major channels of DAH, including the Global Fund ($3·3 billion [9·1%] of the total in 2015), the Gates Foundation ($1·8 billion [4·9%]), and Gavi ($1·6 billion [4·5%]). The largest share of DAH that can be traced to a specific geographic region was targeted at sub-Saharan Africa. In 2015, $10·8 billion (29·7%) of DAH was for HIV/AIDS, $6·5 billion (17·9%) was for child and newborn health, and $3·6 billion (9·8%) was for maternal health.

Between 1990 and 1999, total DAH grew at an annualised rate of 4·6% (figure 2), and between 2000 and 2009, the annualised growth rate rose to 11·3%. However, the annualised growth rate fell to 1·2% between 2010 and 2015. During the period of accelerated growth between 2000 and 2009, DAH for MDG-related focus areas increased the most compared with other focus areas. HIV/AIDS, in particular, received substantial support, with annualised growth reaching 24·1%. Since 2010, DAH for HIV/AIDS grew at 1·3% annually, slower than the annual growth of DAH for NCDs, which was 1·9%. Between 2010 and 2015, MDG-related health focus areas increased at an annualised rate of 2·1% each year, whereas non-MDG-related health focus areas increased at 1·0% annually. However, all health focus areas were affected by the major deceleration in 2010. Since 2010, DAH for maternal health and newborn and child health has continued to climb, although DAH for HIV/AIDS and most other health focus areas has remained flat or decreased.

	Average annual increase (million 2015 US$)	p value
Before 2000, non-MDG focus areas	$46·6 (–31·5 to 124·7)	0·241
Before 2000, MDG focus areas	$41·6 (–19·6 to 102·8)	0·181
2000–09, non-MDG focus areas	$98·6 (14·6 to 182·6)	0·022
2000–09, MDG focus areas	$290·4 (174·3 to 406·5)	<0·0001
After 2010, non-MDG focus areas	$74·6 (–38·4 to 187·7)	0·195
After 2010, MDG focus areas	$164·5 (–9·1 to 338·2)	0·063

Data are average annual increase (95% uncertainty interval) or p value for the linear regression of MDG vs non-MDG focus areas or vice versa. MDG focus areas are HIV/AIDS, malaria, tuberculosis, child and newborn health, and maternal health. Non-MDG focus areas are non-communicable diseases, other infectious diseases, health system strengthening, and other. The Ebola and unallocable focus areas were removed because of insufficient information. MDG=Millennium Development Goals.

Table: **Average annual increases of development assistance for health by focus area**

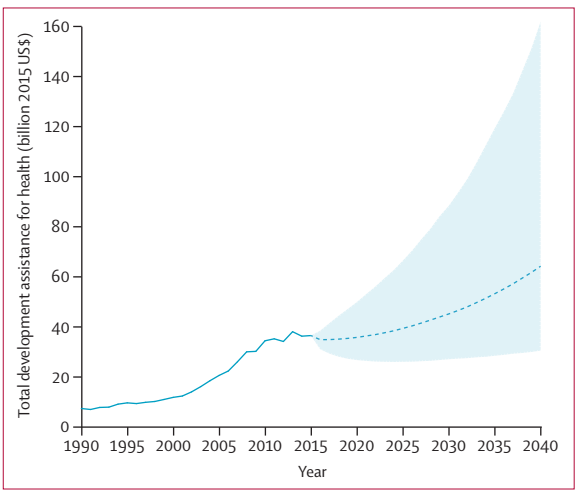

Figure 5: **Estimated total development assistance for health to the end of 2040**
The dotted line shows predicted development assistance for health from 2016 to 2040. Shading shows the uncertainty interval.

Figure 3 shows the complexity of international funding flows for health from 2000 to 2013. Between 2000 and 2013, 31·7% of DAH was provided by the US Government, 25·8% of DAH targeted HIV/AIDS, and 27·2% was disbursed in sub-Saharan Africa. During this period, 60·2% of DAH allocable to a health focus area was associated with the MDGs.

In 2000, $5·7 billion of DAH was disbursed for MDG-related health focus areas, with 18·3% of total DAH targeting maternal health and 16·1% targeting newborn and child health programmes. In that same year, HIV/AIDS was the focus of 11·1% of DAH, and malaria and tuberculosis programmes each received less than 2·1%. By 2015, the cumulative total amount of DAH targeting MDG-related focus areas was $24·4 billion, with DAH for HIV/AIDS reaching 29·7% of total DAH. Newborn and child health received 17·9% of total disbursements, maternal health received 9·8%, malaria received 6·3%, and tuberculosis received 3·4%. DAH for other health focus areas also increased between 2000 and 2015, but to a lesser extent. For example, in 2015 health system support represented $2·7 billion (7·3%) and non-communicable diseases represented $475 million (1·3%).

The primary sources and intermediary channels of DAH prioritise different health focus areas and these priorities can shift over time, as shown in figure 4. The Gates Foundation has had mostly constant priorities, with the largest focus on newborn and child health and HIV/AIDS. Gavi has prioritised child health, although the share of Gavi funding focused on health system strengthening has increased. The Global Fund targets nearly 50% of its resources at HIV/AIDS, with the remaining resources mainly focused on malaria, tuberculosis, and health system strengthening. Similar to the Global Fund, the US Government targets most of its assistance at HIV/AIDS. UN agencies and the UK gvovernment both fund a wide variety of priority areas. The World Bank is the largest funder of health system strengthening.

According to our linear regression testing for structural shifts in DAH disbursement rates over time, between 2000 and 2009, DAH for MDG-related health focus areas increased faster than did DAH for non-MDG health focus areas (table). On average, DAH for MDG-related health focus areas increased by $290·4 million per year (95% UI 174·3 million to 406·5 million) between 2000 and 2009. This increase is significantly larger than the annual increase for the same causes before 2000 (p<0·0001), which was $41·6 million (95% UI –19·6 million to 102·8 million). This increase was also significantly larger than the average annual increase for non-MDG health focus areas between 2000 and 2009 (p=0·009), which was $98·6 million per year (95% UI 14·6 million to 182·6 million). Since 2010, growth has been significantly slower for both MDG and non-MDG health focus areas than in either of the previous two decades. During this period, the annual increases for MDG and non-MDG health focus areas were not significantly different from each other. These conclusions were supported by the results of our sensitivity analysis (appendix).

The future of DAH disbursements is uncertain (figure 5). We estimate annualised growth rates between 2015 and 2040 ranging from –0·72% (lower UI bound) to 5·96% (upper UI bound). The mean 2040 estimate predicts that across all sources of DAH, $64·1 billion (95% UI 30·4 billion to 161·8 billion) will be provided. Our estimates, reported with inflation-adjusted 2015 US dollars, are strongly affected by whether the scale-up between 2000 and 2009 is judged to be an anomaly or a persistent part of a long-term trend.

Discussion

Substantial, statistically significant shifts have characterised the disbursement of DAH over the past 26 years. The health focus areas associated with the MDGs were a central part of the development agenda from 2000 onward. The relatively narrow scope of well defined priorities marks 2000 as a moment of unique international consensus. Our DAH estimates support

claims that the international community rallied around the health focus areas targeted by the MDGs.

Not only was the majority of health aid over the past 16 years concentrated on the MDGs, but DAH for MDG-related health focus areas (HIV/AIDS, malaria, tuberculosis, maternal health, and newborn and child health) grew substantially faster than for other areas. Since 2000, $254·7 billion, or 61·3% of DAH, was provided for the MDG-related health focus areas. Annual growth in DAH for these health focus areas reached 10·2% per year from 2000 to 2015, substantially higher than the 4·8% annual growth for non-MDG-related DAH. Our evidence also shows that 2000 marked a shift in the annual rate of DAH growth. Since then, the health focus areas that grew the most, in absolute and relative terms, were those encompassed by the MDGs.

Data from the 2010 to 2015 and our future projections, suggest that substantial scale-up of DAH has not been sustained. Our projections for the next 25 years present growth rates surrounded by substantial uncertainty. The end of the scale-up suggests that we have entered an era of stagnation in DAH, which might lead to substantial shifts in how global health is financed. Recipient countries, organisations such as the Global Fund and Gavi, and programmes such as PEPFAR, which have grown nearly exponentially since their creation, might find themselves in a new period of constrained resources.

Compounding the impact of this stagnation is the possibility that development assistance partners might move away from the health focus areas that they previously prioritised. Throughout the past decade, some people pointed out the seemingly disproportional focus of DAH on HIV/AIDS compared with the health burden of HIV/AIDS.[9,14–17] Since 2010, DAH for non-communicable diseases and other infectious diseases has grown faster than DAH for HIV/AIDS, malaria, and tuberculosis (figure 2). These estimates suggest that sources of assistance and development partners might be shifting their attention towards other health focus areas. This shift is hugely consequential for the 15·6 million individuals on antiretroviral therapy, and necessitates important discussions about the need to scale up domestic funding in low-income and middle-income countries.[18]

Data issues represent the main limitation of our analysis. Our assumptions about the relevance of keywords and how projects are divided between health focus areas affect the division of funds. For some estimates, we also used models to estimate disbursements, based on commitment data and how DAH was allocated in the most recent years (appendix). These methods are described in full in the appendix, have been peer-reviewed, and discussed in depth previously.[10,19] Still, advanced methods do not replace the need for improved accounting and tracking.[9–13] Development assistance partners have greatly improved the detail and availability of financial data, but key improvements are still needed.

An additional limitation of this paper is that we tracked and estimated only a single type of health financing: DAH. DAH reached $36·4 billion in 2015, although other sources of health financing such as government or private health spending are, in many countries, a much larger share of total health spending. In 2013, governments in low-income and middle-income countries spent $764·9 billion on health.[20,21] However, government spending is highly variable between countries and is substantially lower in the low-income countries where most DAH is targeted. On average, across low-income countries in 2013, $0·71 of DAH was provided for every $1 of domestic government financing,[20,21] making it a critical resource. Additionally, DAH can play an important part in the funding of global public goods, providing for neglected populations or diseases and encouraging increases in domestic financing.

The launch of the MDGs was marked by growth in the size and number of development partners concentrating on health, especially those concentrating on HIV/AIDS and other MDG-related health focus areas. Development assistance for these areas grew quickly, especially before the global financial crisis. Our results show that 2000 and 2009 mark significant shifts in the growth rates of DAH. MDG-related and non-MDG health focus areas had distinct growth trajectories during the scale-up in funding from 2000 to 2009. At the launch of the MDGs, DAH for all health focus areas began to grow at increased rates, but DAH associated with the MDGs increased the most. Although the period of scale-up corresponds with the establishment of MDGs and subsequent stagnation following the financial crisis, it is outside the scope of this paper to test whether these events are causally connected.

Since 2010, stagnation has characterised growth in DAH across all health focus areas. Past trends and associations suggest that this stagnation might be the new reality, rather than just a temporary anomaly. However, the wide uncertainty intervals surrounding our projections represent a challenge for global health donors. The amount of DAH provided, and what it is targeted towards in the future, will have critical effects on health systems and health services provided in some countries. The uncertain future of DAH suggests that now is the moment for global leaders and donors to sustain their commitment to global health. Ongoing support can target marginalised sub-populations, encourage and catalyse efficiency, and garner additional domestic support.

With the official ending of the MDG era, we look forward to the broader realisation of the Sustainable Development Goals with the hope that this new era pushes gains in health forward. However, this new era has so far been punctuated by a host of other major international crises. This situation underlines the unprecedented need for coordination among international and domestic funders to ensure critical resources for health are provided and used efficiently. To this end, timely and detailed retrospective and prospective

estimates of health financing are more important than ever, providing a vital input into decision making about resource allocation choices and how to tackle acute funding gaps.

Contributors

JLD managed the research project and wrote the first draft of the article. LS, AR, and MB collected data and created databases. JLD and MTS completed the linear regression analysis. JLD, NS, and TT completed the trends analyses. All authors contributed to the interpretation of results. JLD, AH, MTS, and CJLM wrote the second draft. All authors reviewed and contributed to the final draft.

Declaration of interests

We declare no competing interests.

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