National spending on health by source for 184 countries between 2013 and 2040

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Summary

Background A general consensus exists that as a country develops economically, health spending per capita rises and the share of that spending that is prepaid through government or private mechanisms also rises. However, the speed and magnitude of these changes vary substantially across countries, even at similar levels of development. In this study, we use past trends and relationships to estimate future health spending, disaggregated by the source of those funds, to identify the financing trajectories that are likely to occur if current policies and trajectories evolve as expected.

Methods We extracted data from WHO's Health Spending Observatory and the Institute for Health Metrics and Evaluation's *Financing Global Health 2015* report. We converted these data to a common purchasing power-adjusted and inflation-adjusted currency. We used a series of ensemble models and observed empirical norms to estimate future government out-of-pocket private prepaid health spending and development assistance for health. We aggregated each country's estimates to generate total health spending from 2013 to 2040 for 184 countries. We compared these estimates with each other and internationally recognised benchmarks.

Findings Global spending on health is expected to increase from US$7·83 trillion in 2013 to $18·28 (uncertainty interval 14·42–22·24) trillion in 2040 (in 2010 purchasing power parity-adjusted dollars). We expect per-capita health spending to increase annually by 2·7% (1·9–3·4) in high-income countries, 3·4% (2·4–4·2) in upper-middle-income countries, 3·0% (2·3–3·6) in lower-middle-income countries, and 2·4% (1·6–3·1) in low-income countries. Given the gaps in current health spending, these rates provide no evidence of increasing parity in health spending. In 1995 and 2015, low-income countries spent $0·03 for every dollar spent in high-income countries, even after adjusting for purchasing power, and the same is projected for 2040. Most importantly, health spending in many low-income countries is expected to remain low. Estimates suggest that, by 2040, only one (3%) of 34 low-income countries and 36 (37%) of 98 middle-income countries will reach the Chatham House goal of 5% of gross domestic product consisting of government health spending.

Interpretation Despite remarkable health gains, past health financing trends and relationships suggest that many low-income and lower-middle-income countries will not meet internationally set health spending targets and that spending gaps between low-income and high-income countries are unlikely to narrow unless substantive policy interventions occur. Although gains in health system efficiency can be used to make progress, current trends suggest that meaningful increases in health system resources will require concerted action.

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Introduction

Substantial health gains have been achieved over the last several decades. This progress has been used to argue that a grand convergence in health could be reached within a generation.[1] This term has been defined to mean that infectious diseases and reproductive and maternal mortality for all countries could reach the level set by a group of middle-income countries. Although estimates for the necessary investment in low-income and middle-income countries exist, little is known about the availability of resources to achieve this grand convergence in health. What is clear is that even when financial support from abroad is included, the countries that need the largest health advances are precisely those spending the least on health.[2] Underpinned by high child mortality and low life expectancy, spending on health amounted to just US$24 per capita in 2013 in the Democratic Republic of the Congo and $26 in the Central African Republic (in 2010 purchasing power parity-adjusted dollars), for example.[3,4]

Existing literature suggests that gains in national income lead to increased health spending and that an increased amount of that expenditure is prepaid through government and private financing mechanisms.[5] This observation is known as the health financing transition. However, the speed and magnitude of these changes varies substantially across countries, even at similar levels of development. Although two international organisations produce long-range government health spending estimates, no long-range estimates for total or private health spending for all countries are available.[6,7]

The objective of this research was to fill this gap and estimate spending on health on the basis of past trends and relationships by source, for 184 countries, between 2013 and 2040. We used these estimates to measure

Research in context

Evidence before this study

Substantial effort by researchers and government agencies has been dedicated to estimation of future health spending. Forecasting inputs and methods vary dramatically from country to country, and study to study. These studies tend to focus on a single country or small set of countries. On Jan 8, 2016, and April 4, 2016, we searched Google, Google Scholar, and MEDLINE for articles published in English with the search terms "health expenditure" and "health spending forecast". The two endeavours that focus on a broad set of countries are led by the Organisation for Economic Co-operation and Development and the International Monetary Fund. The Organisation for Economic Co-operation and Development has estimated government spending on health and total spending on long-term care in high-income countries and four major middle-income countries up to 2060. The International Monetary Fund has estimated the annual percentage change in government health spending for all countries up to 2020. Both assess only government spending, report spending estimates only as a share of gross domestic product, and do not provide uncertainty intervals.

Added value of this study

This is the first study to estimate total health spending for a large set of countries. We estimate health spending for 184 countries from 2013 to 2040. We disaggregate our estimates by source, providing annual estimates for government health spending, prepaid private health spending, out-of-pocket health spending, and development assistance for health received, for each country. One important contribution of this study is that these four sources of health spending can be combined to measure total health spending. Previous studies focused on government health spending, excluding private spending and development assistance, which are crucial means to finance health spending for many countries, particularly low-income and middle-income countries. We report annual estimates as a share of gross domestic product and in purchasing power-adjusted, inflation-adjusted dollars, so that we can compare against notable health spending benchmarks. Furthermore, we compare the amount of health spending across income classifications and regions, assess progress in the health financing transition, and measure health financing inequality.

Implications of all the available evidence

This research highlights the persistence of health financing gaps and continued reliance on out-of-pocket health spending in some countries into the future. Even in 2040, 111 (60%) of the 184 countries are not meeting an international health financing target that 5% of gross domestic product be government health spending. Additionally, this research highlights global health spending inequality. These estimates indicate where change is most needed to bend health financing trajectories. In many cases, these countries are the world's poorest, with the largest disease burdens. This research emphasises that policy makers and global leaders need to work together to assess where more resources can be raised for health than at present and where existing resources can be squeezed to ensure essential health services are affordable for those most in need.

progress towards international financing goals and assess if a health financing convergence will occur, which we take pragmatically to be a narrowing of the gap in per-capita spending between low-income and high-income countries.

Methods

Data

We extracted health financing data from WHO's Global Health Observatory[3] and the Institute for Health Metrics and Evaluation (IHME)'s *Financing Global Health 2015* report.[8,9] The intersection of these two data sources is 184 countries from 1995 to 2013. WHO spending estimates by source are updated annually and draw on a diverse set of data from countries and international organisations. We adjusted these data by converting them into 2010 purchasing power parity-adjusted dollars. For these 184 countries, missingness ranged from 1·2% in government health spending data to 26·1% in prepaid private spending. We completed the series using multiple imputation. We took exchange and deflator rates from the International Monetary Fund's *World Economic Outlook*[10] and completed imputation in R using Amelia (version 1.7.4).[11]

As defined by the WHO and IHME databases, health spending is spending that has the primary purpose to maintain or improve health. This spending includes, for example, provision of preventive, curative, and palliative medicine, but not expenses related to water and sanitation, humanitarian aid, or distal health determinants. Using the WHO and IHME data, we identified and tracked health spending for four mutually exclusive and collectively exhaustive sources: government (resources originating domestically only), prepaid private (including private insurance), out of pocket, and development assistance for health (DAH; external funding). These series are constructed by removing from WHO's government and private spending estimates the portions that are provided from external sources as DAH.

Additional data used for this research were national population estimates provided by the UN and gross domestic product (GDP) up to and including 2040, produced by the IHME.[9,12,13] We considered other forecasts of GDP, but a comprehensive set of estimates did not extend beyond 2020.[10] Finally, we developed an indicator of sociodemographic development, also estimated between 2013 and 2040, using principal components

analysis of the total fertility rate, mean age, mean years of education, and lag-distributed income, all covariates from IHME's Global Burden of Disease (GBD) 2013 study.[14] Detailed information about these data and the methods used are provided in the appendix.

Government, prepaid private, and out-of-pocket health spending between 2013 and 2040

We assessed, measured, and extrapolated time trends among and relationships between economic development, demographic transition, and health financing indicators to estimate health spending by source between 2013 and 2040. Other health spending estimates made for high-income countries rely on additional covariates, such as variables measuring consumer behaviour, treatment practices, prices and productivity, health system organisation, and technological progress.[15] These drivers of health spending were not accounted for explicitly in our model but were included as unexplained health spending change. To include these factors, we estimated the country-specific distribution of unexplained changes (residuals). For each model, country, and year, we randomly drew from the country-specific distribution of unexplained changes and added this draw to the estimate.

We modelled government, prepaid private, and out-of-pocket health spending measured for each country as a share of the country's GDP. This transformation is common for those projecting health spending.[6,16] Because preliminary analyses showed that estimates were dependent on model specification, we used an ensemble modelling approach. Ensemble models are increasingly considered a valuable method for prediction as they guard against the flaws of one particular model.[17–22] Our approach was to consider an expansive set of potential models. These models include dependent and independent variables that are year-over-year differences in addition to non-differenced variables. Additionally, the 1 year lag of each estimated value is included as a potential predictor of the other health financing variables being estimated. We also considered country-specific fixed and random intercepts.

See Online for appendix

We estimated and assessed all viable combinations of these models against three inclusion criteria. First, all covariates needed to be statistically significant (α=0·1) to be included. Second, no parameter estimates could contradict known health financing relationships. For example, a positive relationship between government spending and GDP was required. Third, we excluded models that fell outside the bounds of growth observed in the underlying data (1995–2013). For example, a country with government health spending equal to 3·0% of the GDP could not have more than a 24·7% increase or 24·4% decrease in spending over a single year. These bounds are constructed on the basis of the level of spending and observed patterns in the data. Bounds are source specific and are explained more fully

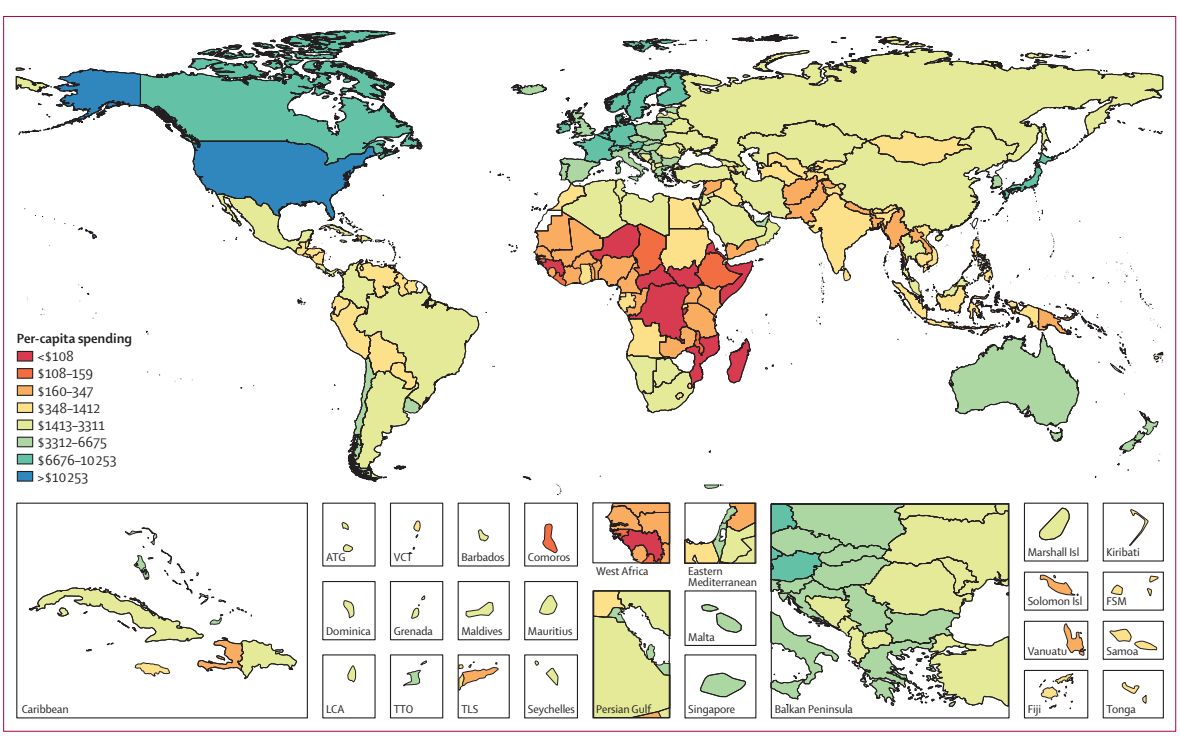

Figure 1: **Total projected health spending per capita in 2040**
ATG=Antigua and Barbuda. Isl=islands. FSM=Federated States of Micronesia. LCA=Saint Lucia. TLS=Timor-Leste. TTO=Trinidad and Tobago. VCT=Saint Vincent and the Grenadines.

	THE per capita (US$)	Domestic GHE per THE (%)	Prepaid per THE (%)	OOP per THE (%)	DAH per THE (%)	2013–40 growth in THE per capita (%)
Global						
Global	2167 (1707–2636)	66·5% (55·0–78·5)	12·0% (7·0–16·7)	20·6% (18·4–23·3)	0·9% (0·3–2·9)	2·4% (1·6–3·1)
Income group						
High income	9019 (7165–10 949)	56·9% (48·0–65·9)	30·4% (19·9–41·6)	12·6% (11·5–14·0)	0	2·7% (1·9–3·4)
Upper-middle income	1935 (1482–2400)	56·4% (44·4–68·7)	16·5% (8·9–23·3)	27·0% (23·3–31·7)	0·1% (0·0–0·3)	3·4% (2·4–4·2)
Lower-middle income	507 (413–590)	36·6% (29·9–42·2)	13·2% (6·9–17·5)	49·0% (44·1–54·4)	1·2% (0·5–2·2)	3·0% (2·3–3·6)
Low income	164 (131–202)	31·2% (25·7–37·2)	7·4% (4·0–10·4)	49·7% (44·7–55·0)	11·7% (5·9–20·7)	2·4% (1·6–3·1)
Global Burden of Disease super region						
High income	10 055 (7986–12 193)	56·7% (48·1–65·3)	31·9% (20·9–43·4)	11·4% (10·5–12·5)	0	2·6% (1·8–3·3)
Central Europe, eastern Europe, and central Asia	2636 (2204–3068)	59·2% (49·3–68·5)	6·5% (3·7–9·2)	34·2% (30·6–38·2)	0·1% (0·0–0·5)	3·1% (2·5–3·7)
Latin America and the Caribbean	2050 (1571–2521)	51·4% (41·3–61·0)	19·7% (10·2–28·1)	28·6% (25·0–33·1)	0·3% (0·1–0·8)	2·8% (1·9–3·6)
North Africa and the Middle East	1321 (1041–1652)	59·2% (46·4–74·3)	8·1% (4·1–12·6)	32·4% (28·2–37·6)	0·3% (0·1–0·7)	2·4% (1·6–3·2)
Southeast Asia, east Asia, and Oceania	1425 (1083–1781)	54·6% (42·0–67·5)	15·8% (8·7–22·3)	29·4% (25·3–34·8)	0·2% (0·1–0·4)	3·7% (2·7–4·5)
Sub-Saharan Africa	294 (227–361)	36·3% (30·4–43·5)	25·7% (14·4–33·6)	31·3% (29·0–33·6)	6·7% (3·2–12·0)	1·9% (0·9–2·6)
South Asia	440 (355–507)	33·2% (27·1–37·6)	14·7% (7·4–19·4)	51·4% (46·0–57·2)	0·7% (0·3–1·1)	3·5% (2·7–4·0)
Country						
Afghanistan	265 (225–309)	13·4% (11·1–15·4)	0·5% (0·2–0·7)	78·7% (71·4–86·1)	7·4% (2·4–14·4)	2·7% (2·1–3·2)
Albania	1534 (1282–1779)	52·6% (42·5–59·5)	0·2% (0·1–0·3)	46·7% (40·9–53·3)	0·5% (0·0–3·0)	3·7% (3·0–4·2)
Algeria	1440 (1189–1664)	76·2% (62·1–87·9)	1·1% (0·6–1·5)	22·6% (19·8–26·0)	0·0% (0·0–0·1)	2·5% (1·8–3·0)
Andorra	8162 (6827–9558)	74·8% (63·0–86·8)	8·9% (5·6–12·5)	16·3% (15·1–17·9)	0	1·9% (1·3–2·5)
Angola	360 (296–451)	64·3% (54·9–78·8)	11·7% (6·9–17·9)	21·3% (18·9–23·8)	2·7% (1·4–4·9)	1·6% (0·9–2·4)
Antigua and Barbuda	1883 (1481–2344)	64·1% (51·0–78·3)	12·7% (7·6–18·2)	23·1% (20·1–27·2)	0·1% (0·0–0·7)	2·7% (1·9–3·5)
Argentina	2674 (2189–3235)	67·7% (57·5–81·4)	13·9% (7·7–18·4)	18·3% (16·6–19·9)	0·1% (0·0–1·2)	2·5% (1·8–3·2)
Armenia	951 (757–1167)	41·3% (33·3–47·2)	7·0% (3·4–9·9)	49·1% (42·8–55·9)	2·6% (0·0–9·7)	4·0% (3·2–4·8)
Australia	6529 (5392–7819)	64·4% (55·0–75·0)	19·2% (12·4–27·1)	16·3% (15·2–17·7)	0	1·9% (1·2–2·5)
Austria	8890 (7391–10 347)	74·7% (63·2–85·0)	11·7% (7·4–16·4)	13·7% (12·6–15·0)	0	2·4% (1·7–2·9)
Azerbaijan	1854 (1519–2249)	24·2% (18·5–29·3)	6·9% (4·0–9·7)	68·8% (59·5–81·4)	0·1% (0·0–0·8)	3·2% (2·5–3·9)
Bahrain	3814 (2661–5533)	67·3% (49·3–95·1)	20·6% (10·6–34·1)	12·2% (9·8–15·9)	0	2·6% (1·3–4·0)
Bangladesh	258 (210–307)	33·1% (26·6–38·6)	6·2% (3·0–9·6)	57·7% (50·3–65·7)	3·0% (1·2–4·7)	3·6% (2·9–4·2)
Barbados	2648 (2176–3057)	62·1% (51·0–70·2)	10·2% (6·2–14·1)	27·7% (25·0–31·1)	0	3·0% (2·3–3·5)
Belarus	2703 (2269–3161)	68·5% (56·7–80·9)	4·3% (2·5–5·9)	27·3% (24·8–30·1)	0·0% (0·0–0·1)	3·5% (2·9–4·1)
Belgium	7947 (6791–9208)	76·3% (65·3–88·2)	6·1% (3·9–8·6)	17·6% (16·3–19·0)	0	2·2% (1·7–2·8)
Belize	766 (577–1037)	54·1% (44·4–62·2)	11·4% (6·2–15·8)	25·2% (22·5–28·4)	9·3% (2·2–29·0)	2·3% (1·3–3·4)
Benin	170 (138–208)	45·6% (39·0–53·3)	7·7% (4·1–11·9)	34·6% (32·2–36·8)	12·1% (6·3–20·9)	2·4% (1·6–3·1)
Bhutan	634 (508–793)	75·4% (60·7–89·4)	0·4% (0·2–0·6)	22·8% (19·4–26·8)	1·3% (0·0–8·3)	3·6% (2·8–4·4)
Bolivia	730 (615–839)	77·9% (66·2–88·2)	2·2% (1·1–2·8)	17·3% (15·7–19·0)	2·6% (1·2–4·9)	2·8% (2·2–3·3)
Bosnia and Herzegovina	2555 (2108–3016)	73·5% (59·8–83·8)	0·1% (0·0–0·1)	25·7% (22·7–29·3)	0·7% (0·0–4·9)	4·0% (3·3–4·6)
Botswana	1988 (1360–2649)	46·8% (38·0–54·7)	47·8% (26·8–66·4)	4·2% (3·6–4·8)	1·2% (0·0–7·4)	3·0% (1·7–4·1)
Brazil	2989 (2184–3766)	44·6% (35·8–53·2)	31·2% (16·3–44·6)	24·2% (21·0–28·0)	0·0% (0·0–0·2)	3·0% (1·9–3·8)
Brunei	2968 (2167–4228)	92·5% (67·4–132·2)	0·3% (0·1–0·5)	7·2% (5·4–9·8)	0	1·8% (0·7–3·1)
Bulgaria	3353 (2887–3826)	63·7% (53·5–73·9)	1·3% (0·8–1·9)	34·9% (31·8–38·3)	0	3·8% (3·3–4·3)
Burkina Faso	161 (134–195)	51·4% (43·3–62·0)	6·1% (3·6–8·3)	33·0% (31·0–34·7)	9·5% (5·4–16·2)	2·1% (1·5–2·8)
Burundi	61 (46–94)	36·7% (30·8–45·1)	3·4% (2·1–4·9)	30·0% (27·3–32·8)	29·9% (15·1–71·6)	1·4% (0·3–2·9)
Cambodia	435 (362–535)	20·3% (16·0–24·2)	0·5% (0·2–0·6)	71·4% (63·2–81·1)	7·8% (3·9–17·2)	3·2% (2·5–3·9)
Cameroon	240 (210–273)	30·1% (25·9–36·3)	5·7% (3·1–7·5)	59·6% (56·5–62·4)	4·7% (2·1–7·6)	2·1% (1·7–2·6)
Canada	7868 (6387–9334)	67·0% (56·5–76·3)	20·1% (12·9–28·1)	12·9% (11·8–14·2)	0	2·2% (1·4–2·8)
Cape Verde	653 (500–931)	61·8% (51·4–70·4)	4·4% (2·1–6·1)	18·0% (15·9–20·2)	15·8% (7·1–45·8)	2·9% (1·9–4·2)
Central African Republic	60 (46–108)	31·5% (26·8–38·3)	2·5% (1·3–3·2)	40·6% (38·2–43·2)	25·4% (9·6–94·0)	3·0% (2·0–5·1)
Chad	137 (119–165)	29·3% (25·0–36·6)	0·3% (0·2–0·4)	61·8% (57·6–66·4)	8·6% (4·3–16·4)	1·9% (1·4–2·5)
Chile	3458 (2582–4217)	44·0% (35·5–51·4)	30·3% (16·6–41·1)	25·7% (22·6–29·4)	0	2·9% (1·9–3·6)
China	1812 (1371–2282)	56·2% (43·0–70·0)	15·8% (8·6–22·4)	28·0% (24·0–33·5)	0	3·9% (2·9–4·7)

(Table 1 continues on next page)

	THE per capita (US$)	Domestic GHE per THE (%)	Prepaid per THE (%)	OOP per THE (%)	DAH per THE (%)	2013–40 growth in THE per capita (%)
(Continued from previous page)						
Colombia	1930 (1439–2441)	72·7% (57·5–88·3)	15·2% (7·6–21·9)	11·7% (9·4–14·3)	0·4% (0·0–2·0)	3·3% (2·3–4·2)
Comoros	132 (101–292)	23·6% (19·1–28·4)	0·2% (0·1–0·3)	49·9% (45·3–54·7)	26·3% (11·9–138·4)	2·3% (1·4–5·2)
Congo	328 (278–406)	75·8% (64·2–93·3)	1·2% (0·8–1·7)	19·3% (18·0–20·6)	3·6% (1·8–8·1)	1·7% (1·1–2·5)
Costa Rica	2766 (2260–3261)	76·7% (62·6–89·9)	2·2% (1·2–3·2)	21·0% (18·0–24·5)	0·0% (0·0–0·2)	2·9% (2·1–3·4)
Côte d'Ivoire	301 (247–359)	28·5% (24·7–34·7)	21·3% (12·2–29·1)	45·4% (42·7–47·9)	4·8% (2·5–7·5)	2·6% (1·9–3·2)
Croatia	3598 (2961–4171)	77·6% (65·7–87·6)	12·0% (7·1–17·1)	10·4% (9·5–11·2)	0	3·5% (2·8–4·0)
Cuba	2980 (2354–3609)	93·6% (74·1–113·1)	1·7% (0·9–2·3)	4·6% (4·0–5·5)	0·0% (0·0–0·2)	3·5% (2·6–4·2)
Cyprus	3601 (2980–4189)	46·8% (38·6–53·5)	11·6% (6·5–16·6)	41·6% (37·6–46·2)	0	2·2% (1·5–2·7)
Czech Republic	4434 (3757–5023)	84·8% (71·5–96·1)	1·5% (0·9–2·2)	13·6% (12·3–15·0)	0	3·1% (2·5–3·5)
Democratic Republic of the Congo	39 (29–51)	33·6% (27·9–41·4)	7·2% (3·9–9·6)	33·7% (30·1–37·5)	25·5% (12·5–43·9)	1·6% (0·6–2·6)
Denmark	7826 (6753–9096)	86·0% (74·0–100·4)	2·7% (1·7–3·8)	11·3% (10·7–12·1)	0	2·2% (1·7–2·8)
Djibouti	709 (575–900)	60·6% (49·5–69·4)	0·1% (0·1–0·1)	34·6% (30·6–38·7)	4·7% (1·0–18·8)	3·4% (2·6–4·2)
Dominica	1473 (1218–1722)	73·6% (60·3–84·2)	1·3% (0·8–1·9)	24·2% (21·7–27·2)	0·9% (0·0–3·7)	3·1% (2·5–3·7)
Dominican Republic	1471 (1159–1757)	51·8% (41·8–60·1)	13·9% (7·1–18·6)	33·8% (29·9–38·4)	0·5% (0·0–2·2)	3·2% (2·4–3·9)
Ecuador	1381 (1125–1619)	55·4% (44·3–64·7)	2·5% (1·4–3·4)	41·8% (35·7–48·3)	0·3% (0·0–0·8)	2·4% (1·7–3·0)
Egypt	785 (695–878)	43·5% (37·0–50·2)	2·0% (1·3–2·8)	54·3% (50·3–58·5)	0·2% (0·0–0·4)	2·1% (1·7–2·5)
El Salvador	1068 (857–1255)	65·0% (54·3–73·0)	8·2% (3·8–11·5)	24·5% (21·3–28·0)	2·3% (0·9–5·0)	3·7% (2·9–4·3)
Equatorial Guinea	1283 (1009–1582)	78·0% (60·8–94·7)	4·1% (2·5–6·2)	17·7% (15·3–20·6)	0·3% (0·0–1·8)	1·2% (0·3–1·9)
Eritrea	62 (47–100)	18·0% (15·1–21·7)	0·3% (0·2–0·4)	50·5% (46·9–54·2)	31·1% (13·4–84·3)	2·3% (1·3–4·0)
Estonia	3556 (2993–4137)	78·8% (66·4–91·3)	5·2% (3·0–7·6)	16·1% (14·7–17·4)	0	3·4% (2·8–4·0)
Ethiopia	121 (98–146)	38·3% (32·1–44·6)	4·0% (1·9–5·3)	42·9% (39·4–46·3)	14·8% (7·4–23·6)	2·6% (1·8–3·2)
Federated States of Micronesia	1124 (826–2135)	74·6% (63·2–86·7)	0·1% (0·0–0·1)	6·9% (6·1–7·7)	18·5% (4·1–95·4)	3·4% (2·3–5·7)
Fiji	858 (636–1065)	64·2% (51·3–73·5)	14·2% (7·7–18·6)	17·5% (15·2–20·2)	4·1% (0·0–11·9)	3·9% (2·8–4·6)
Finland	6781 (5771–7934)	74·9% (64·4–87·5)	9·0% (5·5–12·4)	16·1% (15·2–17·1)	0	2·5% (1·9–3·0)
France	8298 (6778–9914)	73·4% (63·2–84·8)	20·4% (12·8–28·1)	6·2% (5·7–6·6)	0	2·5% (1·8–3·1)
Gabon	1179 (1010–1423)	55·3% (47·5–68·1)	9·3% (5·1–12·7)	35·1% (33·0–37·3)	0·3% (0·0–2·5)	1·9% (1·3–2·5)
Georgia	2064 (1651–2574)	22·5% (18·5–25·8)	23·6% (12·6–37·7)	53·0% (49·0–57·6)	0·9% (0·0–3·6)	4·2% (3·4–5·0)
Germany	9933 (8154–11 546)	74·5% (63·2–84·5)	14·6% (8·9–19·9)	10·9% (10·0–11·8)	0	2·8% (2·1–3·4)
Ghana	377 (315–443)	56·8% (47·1–67·6)	3·8% (2·2–5·1)	33·4% (30·8–36·0)	6·0% (3·3–8·8)	2·3% (1·6–2·8)
Greece	5243 (4421–5940)	69·8% (59·6–78·5)	6·9% (3·7–9·0)	23·3% (21·1–25·8)	0	3·0% (2·4–3·4)
Grenada	1673 (1431–1904)	51·4% (42·8–58·3)	2·0% (1·0–2·7)	46·5% (41·8–51·3)	0·2% (0·0–1·6)	3·4% (2·9–3·9)
Guatemala	691 (582–793)	39·4% (33·3–45·1)	7·0% (3·7–9·1)	50·8% (45·5–55·9)	2·9% (1·7–4·6)	2·3% (1·7–2·8)
Guinea	93 (80–120)	33·1% (27·9–40·2)	1·6% (0·9–2·1)	56·1% (53·2–58·7)	9·2% (3·5–27·3)	2·1% (1·5–2·9)
Guinea-Bissau	126 (94–207)	12·6% (10·3–15·7)	0·2% (0·1–0·3)	50·2% (47·4–52·8)	37·0% (17·3–96·3)	1·8% (0·8–3·6)
Guyana	1049 (793–1327)	66·2% (52·4–78·2)	0·2% (0·1–0·2)	27·6% (23·1–33·2)	6·0% (0·0–14·9)	3·7% (2·7–4·5)
Haiti	179 (131–239)	11·7% (9·4–13·7)	2·1% (1·1–2·9)	54·7% (43·1–66·2)	31·5% (19·5–50·5)	2·7% (1·5–3·7)
Honduras	830 (664–997)	48·2% (39·5–56·0)	8·1% (3·8–11·9)	40·5% (35·0–46·6)	3·2% (1·7–5·6)	3·1% (2·3–3·8)
Hungary	4530 (3749–5390)	65·0% (55·3–74·5)	11·4% (5·7–18·8)	23·7% (21·7–25·7)	0	3·6% (2·9–4·2)
Iceland	6658 (5630–7514)	81·5% (68·6–91·8)	2·2% (1·3–3·0)	16·2% (14·7–18·1)	0	2·3% (1·7–2·8)
India	503 (405–580)	33·0% (26·9–37·3)	15·7% (7·8–20·4)	50·9% (45·6–56·8)	0·4% (0·1–0·6)	3·6% (2·8–4·1)
Indonesia	630 (483–752)	38·3% (30·6–44·5)	22·5% (12·1–29·7)	38·7% (33·9–44·2)	0·5% (0·0–0·9)	3·4% (2·4–4·0)
Iran	2348 (1838–2958)	41·2% (32·9–51·1)	12·8% (6·3–20·2)	46·0% (39·1–54·5)	0·0% (0·0–0·1)	3·1% (2·3–4·0)
Iraq	1213 (961–1510)	66·3% (51·1–84·4)	3·9% (2·3–5·7)	29·7% (25·8–33·8)	0·2% (0·0–0·6)	2·5% (1·6–3·2)
Ireland	7740 (6121–9091)	64·1% (53·5–72·2)	21·8% (13·0–29·4)	14·1% (12·6–15·8)	0	2·6% (1·7–3·1)
Israel	3496 (2899–4178)	57·2% (49·1–67·4)	20·2% (12·7–27·9)	22·6% (21·1–24·2)	0	1·8% (1·2–2·5)
Italy	5968 (5013–6804)	78·4% (65·9–88·7)	5·8% (3·5–8·0)	15·8% (14·5–17·3)	0	2·6% (2·0–3·1)
Jamaica	1242 (911–1519)	51·8% (42·5–59·3)	26·2% (13·1–35·0)	20·0% (17·7–22·6)	1·9% (0·0–5·4)	3·9% (2·8–4·6)
Japan	8022 (6796–9156)	82·1% (70·0–93·6)	5·5% (3·2–7·3)	12·4% (11·5–13·3)	0	3·0% (2·4–3·5)
Jordan	1464 (1133–1759)	63·6% (52·0–73·0)	14·5% (7·9–19·9)	20·2% (17·5–23·4)	1·7% (0·0–4·0)	2·7% (1·8–3·4)
Kazakhstan	1747 (1500–1999)	57·1% (46·8–67·0)	0·8% (0·5–1·1)	42·1% (38·6–46·2)	0·0% (0·0–0·2)	2·5% (1·9–3·0)

(Table 1 continues on next page)

	THE per capita (US$)	Domestic GHE per THE (%)	Prepaid per THE (%)	OOP per THE (%)	DAH per THE (%)	2013–40 growth in THE per capita (%)
(Continued from previous page)						
Kenya	204 (161–248)	25·6% (21·4–30·1)	12·9% (7·3–17·0)	42·9% (39·7–46·1)	18·6% (10·5–28·5)	1·9% (1·0–2·6)
Kiribati	517 (313–1452)	62·0% (51·4–69·3)	0·1% (0·0–0·1)	1·3% (1·2–1·5)	36·6% (7·8–210·3)	3·1% (1·3–6·8)
Kuwait	3768 (2752–5236)	84·0% (60·7–117·4)	2·2% (1·2–3·6)	13·8% (11·2–17·9)	0	2·2% (1·0–3·3)
Kyrgyzstan	441 (356–567)	60·0% (47·9–69·6)	0·1% (0·1–0·2)	33·7% (30·2–38·1)	6·2% (2·4–20·5)	3·3% (2·5–4·2)
Laos	163 (126–222)	35·8% (27·9–43·5)	2·3% (1·1–3·1)	44·5% (38·2–50·9)	17·5% (9·5–38·4)	2·9% (1·9–4·0)
Latvia	3036 (2648–3472)	65·4% (55·6–76·5)	2·7% (1·6–3·8)	31·9% (30·0–34·1)	0	3·6% (3·1–4·0)
Lebanon	4003 (2933–4884)	48·7% (38·6–57·1)	24·4% (11·6–33·1)	26·9% (23·1–31·5)	0·0% (0·0–0·3)	4·5% (3·4–5·2)
Lesotho	650 (502–857)	68·6% (57·1–83·8)	0·1% (0·0–0·1)	13·8% (12·7–15·0)	17·5% (7·4–32·9)	2·6% (1·6–3·6)
Liberia	108 (69–177)	9·8% (8·0–11·9)	11·8% (6·3–17·0)	42·0% (38·2–45·7)	36·5% (11·3–88·6)	1·8% (0·2–3·6)
Libya	1582 (1247–1966)	71·8% (56·5–88·6)	3·6% (1·9–5·3)	24·5% (20·5–29·6)	0·1% (0·0–0·9)	3·0% (2·1–3·8)
Lithuania	3554 (3081–4094)	70·2% (59·3–82·9)	1·2% (0·8–1·8)	28·5% (26·7–30·5)	0	3·4% (2·9–3·9)
Luxembourg	9122 (7593–10 894)	83·1% (70·3–97·2)	7·4% (4·4–11·4)	9·5% (8·5–10·8)	0	1·5% (0·9–2·2)
Macedonia	1919 (1581–2215)	71·7% (58·3–81·2)	3·3% (1·8–4·4)	24·8% (22·3–27·7)	0·2% (0·0–2·1)	3·6% (2·9–4·1)
Madagascar	101 (81–127)	52·2% (43·8–61·4)	9·1% (5·4–12·5)	27·1% (25·1–29·4)	11·5% (5·6–22·2)	2·3% (1·5–3·1)
Malawi	131 (85–183)	15·1% (12·3–19·5)	40·5% (21·5–57·0)	11·9% (10·7–13·4)	32·4% (20·5–49·6)	1·9% (0·4–3·1)
Malaysia	1805 (1427–2160)	54·9% (44·1–64·7)	13·7% (7·5–18·8)	31·3% (27·4–36·2)	0	2·6% (1·8–3·3)
Maldives	2891 (2282–3542)	57·6% (46·9–68·3)	9·0% (4·3–14·0)	33·3% (27·8–39·7)	0·1% (0·0–0·5)	2·9% (2·1–3·6)
Mali	178 (154–210)	33·9% (29·7–41·8)	0·2% (0·1–0·3)	54·4% (51·3–57·6)	11·4% (5·5–18·6)	1·7% (1·2–2·3)
Malta	5307 (4550–6031)	68·5% (57·8–78·5)	3·7% (2·2–5·0)	27·9% (25·7–30·1)	0	2·8% (2·3–3·3)
Marshall Islands	1616 (1158–2751)	70·2% (58·8–79·1)	2·9% (1·7–3·8)	9·1% (8·4–10·0)	17·8% (2·8–77·3)	3·6% (2·4–5·5)
Mauritania	252 (211–305)	47·0% (38·8–55·7)	4·6% (2·8–6·3)	44·1% (40·9–47·6)	4·2% (1·2–11·5)	2·3% (1·7–3·0)
Mauritius	1897 (1513–2277)	51·6% (40·9–61·8)	7·2% (3·7–10·1)	41·2% (35·2–48·2)	0	3·3% (2·5–4·0)
Mexico	1950 (1590–2324)	53·6% (43·3–63·5)	6·5% (3·3–9·4)	39·9% (34·9–46·0)	0·0% (0·0–0·3)	2·6% (1·9–3·3)
Moldova	1496 (1219–1783)	52·9% (43·3–60·0)	1·1% (0·5–1·5)	44·0% (37·7–50·6)	2·0% (0·0–7·1)	4·3% (3·6–5·0)
Mongolia	1259 (942–1613)	62·0% (47·7–75·7)	1·6% (0·9–2·3)	34·8% (26·1–46·2)	1·6% (0·0–3·8)	3·0% (2·0–3·9)
Montenegro	2286 (1907–2628)	61·1% (50·1–70·6)	5·1% (2·7–6·7)	33·7% (30·7–36·7)	0·1% (0·0–1·0)	3·6% (3·0–4·1)
Morocco	940 (757–1108)	35·4% (28·3–41·4)	11·8% (6·3–15·8)	52·3% (45·9–59·7)	0·5% (0·0–1·0)	3·3% (2·5–3·8)
Mozambique	87 (58–119)	39·1% (31·8–49·7)	10·4% (5·6–14·2)	10·0% (9·3–10·8)	40·5% (20·7–62·1)	1·4% (0·0–2·5)
Myanmar	162 (133–193)	32·1% (25·6–36·9)	0·6% (0·3–0·7)	62·8% (55·6–71·1)	4·5% (0·6–10·6)	3·6% (2·9–4·2)
Namibia	1423 (987–1761)	52·8% (44·2–61·1)	34·9% (20·1–45·9)	5·8% (5·1–6·5)	6·6% (0·0–10·3)	2·7% (1·4–3·5)
Nepal	271 (229–313)	44·7% (37·0–51·2)	0·2% (0·1–0·4)	50·4% (44·7–56·5)	4·7% (2·8–7·5)	3·5% (2·9–4·0)
Netherlands	10 088 (8262–11 827)	83·8% (70·0–95·7)	11·2% (7·3–16·1)	5·0% (4·6–5·5)	0	2·5% (1·8–3·1)
New Zealand	5678 (4686–6537)	81·6% (68·6–92·4)	9·1% (5·5–12·4)	9·3% (8·5–10·3)	0	2·3% (1·6–2·8)
Nicaragua	823 (639–1027)	50·8% (40·4–61·3)	9·3% (4·6–14·6)	35·3% (30·6–40·7)	4·6% (2·0–8·2)	3·5% (2·6–4·3)
Niger	71 (60–94)	31·7% (26·7–40·8)	2·1% (1·3–3·4)	55·3% (51·9–58·5)	10·9% (3·8–29·3)	1·2% (0·6–2·2)
Nigeria	279 (244–320)	20·9% (17·7–25·9)	5·2% (3·1–7·3)	69·6% (65·2–73·9)	4·3% (1·6–7·7)	1·7% (1·2–2·2)
Norway	8909 (7723–10 318)	86·6% (74·4–101·0)	0·8% (0·5–1·2)	12·6% (11·7–13·6)	0	1·7% (1·2–2·2)
Oman	2109 (1536–2867)	79·2% (58·6–106·8)	10·5% (5·7–16·2)	10·3% (8·6–13·0)	0	2·7% (1·6–3·8)
Pakistan	215 (181–249)	33·5% (28·4–38·9)	11·5% (6·5–16·4)	52·2% (47·9–56·4)	2·8% (1·6–4·0)	2·7% (2·0–3·2)
Panama	2504 (2006–2962)	69·3% (55·9–80·7)	9·0% (5·0–12·2)	21·6% (19·3–24·5)	0·1% (0·0–1·0)	2·6% (1·8–3·2)
Papua New Guinea	263 (197–332)	66·7% (54·6–76·2)	2·3% (1·2–3·0)	9·1% (8·1–10·3)	21·8% (11·1–36·6)	2·8% (1·8–3·6)
Paraguay	1387 (1165–1569)	40·4% (33·7–45·3)	7·7% (4·0–10·0)	51·3% (46·2–56·4)	0·6% (0·0–1·4)	2·9% (2·3–3·3)
Peru	1236 (1006–1433)	60·6% (49·6–69·1)	7·7% (4·0–10·3)	31·2% (27·8–35·2)	0·4% (0·0–1·4)	2·8% (2·1–3·3)
Philippines	588 (477–679)	32·2% (26·5–36·3)	17·2% (9·5–22·6)	49·8% (44·8–55·3)	0·7% (0·4–1·2)	3·0% (2·3–3·5)
Poland	3959 (3183–4498)	68·3% (56·5–76·2)	12·6% (6·7–16·5)	19·0% (17·2–21·0)	0	3·6% (2·9–4·1)
Portugal	5688 (4599–6513)	63·1% (53·0–70·8)	14·3% (7·5–18·5)	22·7% (20·4–25·2)	0	3·2% (2·4–3·7)
Qatar	4219 (2698–6664)	83·4% (55·1–131·5)	8·8% (3·2–15·1)	7·8% (5·7–11·3)	0	1·8% (0·2–3·4)
Romania	2361 (1937–2813)	82·3% (66·2–99·4)	0·8% (0·5–1·1)	16·9% (15·3–18·6)	0	3·8% (3·1–4·5)
Russia	3281 (2781–3823)	51·2% (42·9–59·9)	6·0% (3·8–8·7)	42·8% (38·1–47·9)	0	3·0% (2·4–3·6)
Rwanda	357 (260–456)	52·5% (42·2–62·0)	11·3% (5·4–14·9)	21·9% (19·1–24·7)	14·3% (6·0–26·3)	3·3% (2·2–4·2)

(Table 1 continues on next page)

	THE per capita (US$)	Domestic GHE per THE (%)	Prepaid per THE (%)	OOP per THE (%)	DAH per THE (%)	2013–40 growth in THE per capita (%)
(Continued from previous page)						
Saint Lucia	1940 (1575–2341)	55·5% (45·4–64·0)	2·7% (1·4–3·9)	39·7% (34·4–45·3)	2·2% (0·0–7·4)	2·9% (2·2–3·6)
Saint Vincent and the Grenadines	1307 (1047–1580)	83·5% (67·4–98·4)	2·0% (1·0–2·8)	13·4% (11·7–15·4)	1·1% (0·0–4·3)	3·5% (2·7–4·2)
Samoa	918 (668–1419)	66·8% (54·8–75·3)	4·0% (2·4–5·4)	5·6% (4·8–6·5)	23·6% (10·8–67·5)	3·1% (2·0–4·7)
São Tomé and Príncipe	457 (348–865)	23·7% (18·8–29·5)	0·1% (0·1–0·1)	47·9% (44·8–50·8)	28·3% (12·4–109·0)	2·2% (1·2–4·4)
Saudi Arabia	2599 (1853–3621)	61·8% (45·7–84·2)	21·6% (12·0–34·1)	16·6% (13·6–21·0)	0	2·3% (1·1–3·5)
Senegal	168 (133–211)	41·0% (34·7–49·6)	14·5% (8·9–20·0)	30·8% (28·4–33·2)	13·7% (7·1–22·7)	2·0% (1·2–2·8)
Serbia	3400 (2894–3902)	64·1% (53·7–74·0)	2·5% (1·4–3·4)	33·3% (30·0–36·7)	0·1% (0·0–0·6)	3·6% (3·1–4·1)
Seychelles	2174 (1646–2703)	89·5% (69·2–108·9)	6·5% (3·3–10·4)	4·0% (3·2–5·0)	0	3·3% (2·3–4·1)
Sierra Leone	229 (203–280)	10·2% (8·2–12·8)	1·1% (0·6–1·5)	79·9% (75·1–84·9)	8·8% (4·6–23·1)	1·5% (1·1–2·2)
Singapore	5493 (4320–7010)	42·0% (32·0–54·5)	5·4% (3·0–8·4)	52·7% (43·6–64·7)	0	1·9% (1·0–2·7)
Slovakia	5163 (4081–6157)	69·2% (57·2–77·5)	12·0% (6·7–18·6)	18·7% (15·2–23·2)	0	3·4% (2·5–4·0)
Slovenia	5841 (4621–6866)	68·2% (56·6–76·5)	22·0% (13·5–30·1)	9·9% (9·1–10·9)	0	3·2% (2·4–3·8)
Solomon Islands	278 (172–573)	29·0% (23·0–35·2)	1·1% (0·6–1·4)	2·6% (2·4–2·9)	67·3% (35·7–166·5)	1·9% (0·2–4·5)
Somalia	34 (26–62)	38·1% (33·4–47·3)	0·2% (0·1–0·4)	35·8% (34·1–37·5)	25·9% (10·8–99·0)	1·8% (1·0–4·0)
South Africa	2910 (1986–3609)	40·1% (33·4–46·9)	54·6% (30·3–69·7)	5·1% (4·5–5·7)	0·3% (0·0–1·8)	3·6% (2·3–4·4)
South Korea	4918 (3807–6171)	54·2% (41·5–67·4)	14·1% (8·4–20·3)	31·7% (27·5–37·8)	0	2·8% (1·9–3·6)
South Sudan	103 (79–135)	23·6% (19·3–30·2)	5·8% (3·3–8·0)	54·6% (50·8–58·4)	16·0% (3·0–33·8)	1·2% (0·2–2·1)
Spain	6012 (4914–6875)	69·7% (58·0–78·5)	10·6% (5·9–13·9)	19·7% (17·8–22·0)	0	2·9% (2·2–3·4)
Sri Lanka	806 (632–960)	45·7% (35·9–53·8)	13·4% (6·7–17·8)	40·6% (35·8–46·4)	0·3% (0·0–1·0)	3·8% (3·0–4·5)
Sudan	403 (348–462)	21·3% (17·5–25·5)	4·8% (2·7–6·4)	72·2% (65·1–80·1)	1·7% (1·0–2·7)	2·0% (1·5–2·5)
Suriname	1338 (1021–1676)	70·3% (56·9–81·1)	16·0% (8·7–22·0)	12·6% (10·7–14·9)	1·1% (0·0–7·4)	3·2% (2·2–4·0)
Swaziland	1302 (983–1645)	66·8% (57·7–80·3)	16·1% (8·1–21·2)	10·4% (9·7–11·0)	6·8% (0·0–13·9)	2·9% (1·9–3·7)
Sweden	7058 (6154–8424)	82·3% (71·8–98·8)	3·2% (1·9–5·2)	14·4% (13·5–15·3)	0	2·1% (1·6–2·7)
Switzerland	9752 (8217–11 478)	66·1% (55·8–76·8)	11·0% (7·2–15·9)	22·9% (21·2–25·0)	0	1·9% (1·3–2·5)
Syria	284 (236–335)	47·5% (39·2–55·0)	4·1% (2·1–5·9)	48·0% (41·7–55·6)	0·4% (0·1–1·7)	2·1% (1·5–2·7)
Tajikistan	363 (300–453)	34·4% (27·3–40·3)	0·3% (0·2–0·4)	61·0% (53·3–70·1)	4·3% (1·7–13·9)	3·1% (2·4–3·9)
Tanzania	175 (139–216)	25·4% (20·8–31·9)	11·1% (6·6–15·4)	46·7% (42·5–51·2)	16·8% (9·7–25·3)	1·6% (0·8–2·4)
Thailand	1659 (1239–2104)	78·5% (60·9–97·5)	12·2% (6·2–17·5)	9·3% (7·6–11·5)	0·0% (0·0–0·3)	3·6% (2·6–4·5)
The Bahamas	3323 (2497–4199)	41·3% (33·0–49·4)	33·8% (20·6–47·7)	24·8% (21·5–29·2)	0	2·7% (1·7–3·5)
The Gambia	127 (90–212)	30·3% (24·9–37·7)	7·8% (4·7–10·8)	24·1% (22·8–25·3)	37·8% (18·7–93·3)	1·5% (0·2–3·3)
Timor-Leste	174 (114–282)	67·9% (53·6–88·4)	0·6% (0·3–0·9)	12·1% (11·5–12·8)	19·4% (0·0–60·0)	2·4% (0·9–4·1)
Togo	218 (181–270)	50·4% (41·4–60·7)	3·8% (2·1–5·0)	39·9% (37·4–42·3)	5·9% (1·9–15·9)	2·5% (1·8–3·3)
Tonga	652 (422–1365)	53·6% (43·5–63·9)	4·1% (2·3–5·4)	8·4% (7·5–9·3)	33·9% (11·2–130·6)	3·3% (1·7–5·9)
Trinidad and Tobago	3434 (2785–3954)	48·1% (39·7–54·6)	15·3% (8·4–19·9)	36·6% (33·0–40·6)	0	3·0% (2·3–3·6)
Tunisia	1600 (1313–1849)	61·0% (49·8–69·8)	7·4% (4·1–9·9)	31·4% (28·1–35·5)	0·1% (0·0–0·4)	2·9% (2·2–3·4)
Turkey	1932 (1581–2248)	85·4% (69·2–99·5)	0·2% (0·1–0·2)	14·4% (12·6–16·5)	0·0% (0·0–0·2)	2·8% (2·1–3·4)
Turkmenistan	668 (522–816)	68·1% (52·6–82·9)	4·9% (2·6–6·8)	26·8% (22·9–31·3)	0·2% (0·0–1·2)	3·4% (2·6–4·2)
Uganda	217 (169–267)	16·9% (14·3–21·2)	23·4% (13·1–32·4)	46·3% (42·7–50·3)	13·3% (7·8–19·4)	1·8% (0·9–2·5)
Ukraine	1838 (1583–2126)	57·9% (48·6–68·3)	4·4% (2·5–6·0)	37·5% (35·0–40·3)	0·2% (0·0–1·1)	3·6% (3·1–4·1)
United Arab Emirates	3561 (2099–6171)	71·4% (44·1–125·6)	12·9% (3·4–23·9)	15·7% (11·4–23·8)	0	2·6% (0·7–4·5)
UK	6348 (5335–7498)	81·8% (70·2–95·4)	10·2% (6·3–14·2)	8·0% (7·5–8·5)	0	2·4% (1·8–3·0)
USA	16 592 (12 716–20 692)	42·0% (35·6–48·3)	48·7% (32·4–66·3)	9·3% (8·6–10·1)	0	2·5% (1·6–3·3)
Uruguay	3853 (3090–4525)	65·9% (56·6–76·1)	20·4% (11·0–26·6)	13·7% (12·7–14·8)	0	3·3% (2·5–3·9)
Uzbekistan	849 (699–993)	53·2% (42·9–61·0)	5·0% (2·5–7·8)	41·2% (36·6–46·5)	0·5% (0·2–1·6)	3·4% (2·7–3·9)
Vanuatu	343 (179–934)	17·6% (14·4–20·2)	3·0% (1·7–4·0)	3·7% (3·2–4·2)	75·8% (32·7–243·7)	2·0% (–0·3 to 5·6)
Venezuela	833 (698–981)	30·1% (23·9–36·0)	4·5% (2·6–6·4)	65·3% (57·3–75·2)	0·0% (0·0–0·3)	1·6% (1·0–2·2)
Vietnam	761 (601–924)	41·6% (32·5–50·3)	13·7% (7·7–18·8)	43·5% (38·2–50·4)	1·2% (0·6–1·9)	3·6% (2·8–4·3)
Yemen	204 (174–247)	19·8% (16·5–23·7)	0·2% (0·1–0·3)	74·0% (65·8–83·4)	6·0% (2·8–13·5)	0·8% (0·2–1·4)
Zambia	284 (221–367)	46·8% (39·7–59·1)	7·8% (4·6–11·8)	22·7% (21·4–24·0)	22·7% (12·2–34·4)	1·1% (0·2–2·1)

Data in parentheses are uncertainty intervals. THE=total health expenditure. GHE=government health expenditure. Prepaid=prepaid private health expenditure. OOP=out-of-pocket health expenditure. DAH=development assistance for health.

Table 1: **Health spending per capita by income group, region, country, and source in 2040**

in the appendix. We took random draws from the included models and collated them to create a distribution of 10 000 potential future scenarios. The mean of these future scenarios is the reported point estimate, whereas the 2·5th and 97·5th percentiles mark the lower and upper bounds of the uncertainty interval (UI).

DAH between 2013 and 2040

We used a three-step process to estimate the amount of DAH disbursed to each low-income or middle-income country. DAH has tremendous year-on-year fluctuation in the amount of assistance received by a country. Furthermore, the amount of DAH disbursed to each country is dependent on the characteristics of that country and of donors.[23,24] Therefore, we first extracted estimates reporting the total amount of DAH disbursed each year between 2013 and 2040.[9] These estimates were made by projection of DAH by donor for 24 major sources of DAH with use of an ensemble model. Second, we estimated the share of total DAH that is to be received by each country using a second ensemble model and characteristics of the recipient. These covariates were the same as those used for estimation of government, prepaid private, and out-of-pocket spending. Finally, we estimated the transition of countries from middle-income to high-income status on the basis of GDP per-capita estimates. This transition, identified when a country's GDP per capita reaches $18 108 (in 2010 purchasing power parity-adjusted dollars), marks the point when most countries stop receiving development assistance and are excluded from the IHME development assistance database. For each year, we estimated DAH received for each country that had not transitioned to high-income status by multiplying total DAH by the share that the country was predicted to receive.

Uncertainty

We included four types of uncertainty for each estimate. First, we used the ensemble modelling approach to reflect the uncertainty in model specification. Second, we took draws from the variance-covariance matrix estimated for each model to reflect estimated parameter uncertainty. Third, we sampled randomly across imputed datasets (for 1995–2013) and GDP estimates to capture uncertainty in our underlying data. Fourth, for each country, model, and variance-covariance combination, we estimated the country-specific distribution of residuals. We added random draws from each distribution to each country and year of each estimate to capture fundamental model uncertainty. For each draw, we added government, prepaid private, and out-of-pocket health spending to DAH to derive our estimate for total health spending.

Context of future health spending estimates

To explore these health spending estimates in depth, we completed several additional analyses. First, we compared the amount of health spending among different income classifications and regions. Second, we assessed the relationship between sociodemographic status and the shift away from out-of-pocket health financing. Third, we compared the amount of health spending in low-income countries with a set of international health financing targets.

Role of the funding source

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

Results

In 2013, $7·83 trillion was spent on health globally. By 2040, we expect health spending to expand to $18·28 (UI 14·42–22·24) trillion worldwide. Figure 1 provides estimates of country-specific health spending per capita. Most striking is the persistent gap between health spending in high-income countries relative to other countries, particularly in sub-Saharan Africa (table 1). By contrast, past trends and relationships suggest that low-income countries will continue to spend much less on health than will high-income countries. Low-income countries spent $0·03 on health per capita for every $1 spent per capita by high-income countries in 1995 and 2013, and the same is projected for 2040. The lowest levels of total health spending will remain in sub-Saharan African countries, including the Democratic Republic of the Congo, Niger, Somalia, Mozambique, Madagascar, the Central African Republic, and South Sudan (table 1).

Figure 2 illustrates the evolution of health spending, measured in per-capita terms and disaggregated by World Bank income groups, GBD super region, and source (lists of which countries are included in these groupings are given in the appendix). All regions show substantial growth, although the level of actual spending varies dramatically. Health spending per capita is lowest in low-income and lower-middle-income countries, at $84 per capita in low-income countries and $217 per capita in lower-middle-income countries. This spending is expected to rise to $164 (UI 132–202) per capita in low-income countries and $507 (413–590) per capita in lower-middle-income countries. Spending in both income groups is well below the estimates of spending for high-income countries, which is $9019 (7165–10 949) per capita. Across the regions, per-capita spending is lowest in sub-Saharan Africa, at $294 (227–361), and south Asia, at $440 (355–507). Table 1 provides estimates for the year 2040 for each income group, region, and country included in the study, and associated figures are in the appendix.

Table 1 also makes evident how the financing of health spending varies by income group and region. The share of total health spending financed through

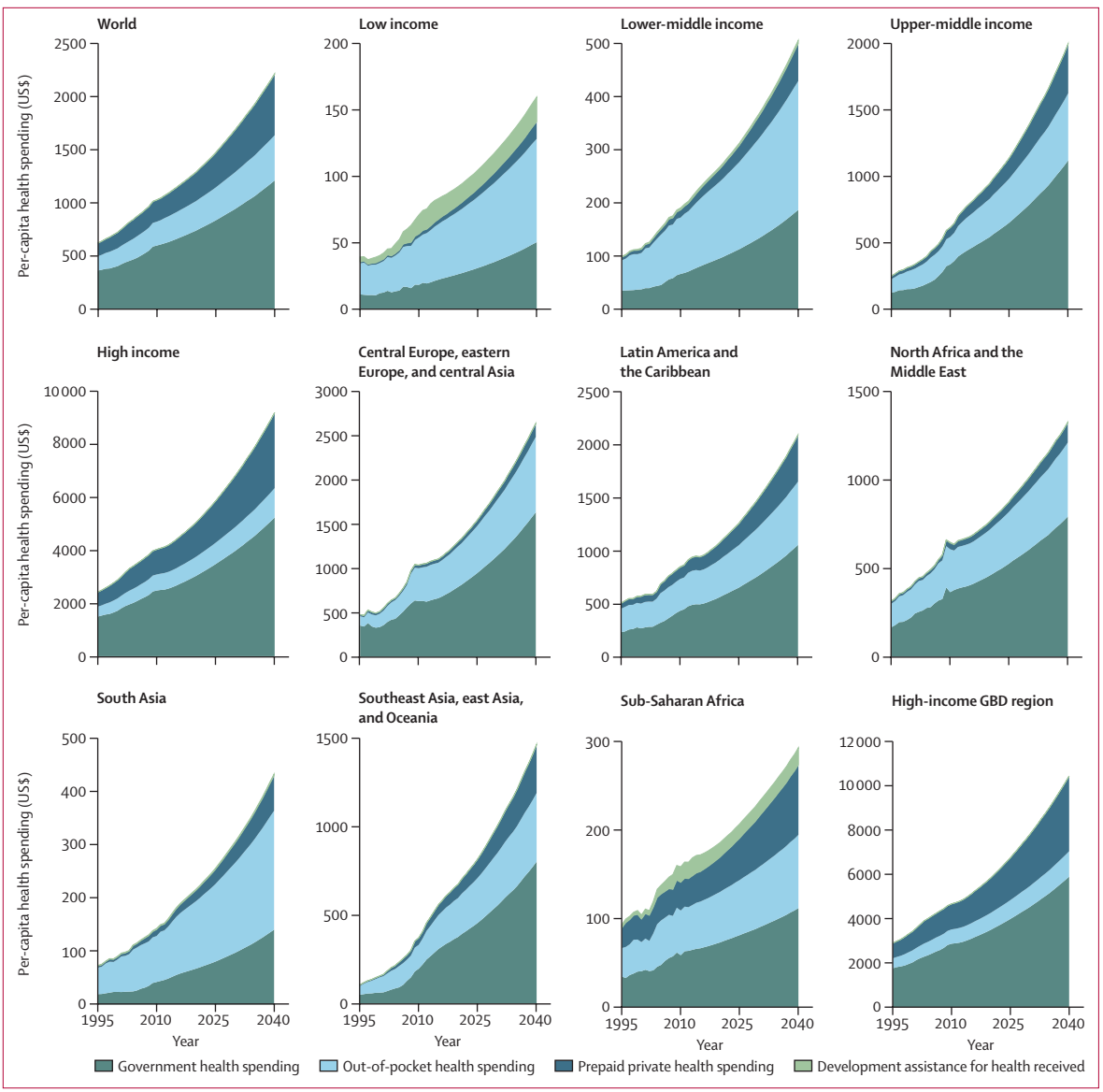

Figure 2: **Health spending per capita by by income group and GBD super region**
GBD=Global Burden of Disease.

out-of-pocket spending is highest in low-income settings and south Asia. In accordance with the health financing transition, out-of-pocket health spending is lowest in high-income countries. Government health spending tends to rise with income. It is lowest, as a share of total health spending, in south Asia and sub-Saharan Africa. By contrast, all other regions are estimated to finance more than 50% of their health spending via the government. The share of health spending that is prepaid private spending is estimated to be highest in high-income countries. Central Europe, eastern Europe, and central Asia, and north Africa and the Middle East have the lowest total spending using prepaid private mechanisms.

Figure 3 shows that, across most sources and all regions, health spending is increasing over time. Globally, total health spending per capita is expected to increase by 2·4% (UI 1·6–3·1) annually from 2013 to 2040, slightly greater than the 1·8% (1·1–2·6) in gains expected for GDP per capita. According to our estimates, spending will increase most rapidly in upper-middle-income countries (3·4% [UI 2·4–4·2]) and southeast Asia, east Asia, and Oceania (3·7% [2·7–4·5]). Health spending growth is estimated to be the lowest in sub-Saharan Africa, where we estimate 1·9% (0·9–2·6) annualised growth between 2013 and 2040. For all income groups and regions, prepaid private health spending is growing the fastest, whereas DAH is growing

Figure 3: **Annualised growth in per-capita health spending by source and Global Burden of Disease super region**
Error bars represent the uncertainty interval. GBD=Global Burden of Disease.

the least or even shrinking, although substantive uncertainty prevents these differences from being statistically significant. Table 2 reports 2040 estimates, but provides them as a share of GDP. As a share of GDP, health spending is highest in high-income countries, lower in upper-middle-income and lower-middle-income countries, and substantially lower in low-income countries.

Figure 4 illustrates the association between socio-demographic status and health financing transition—ie, the higher the sociodemographic status, the higher the health spending and the greater the share of health spending that is prepaid. This trend, in turn, marks a shift away from out-of-pocket health financing. Over the next 25 years, we predict that southeast Asia, east Asia, and Oceania will increase most substantially, transitioning from the 52nd sociodemographic percentile to the 86th, increasing the share of domestic health financing that is prepaid from 64·9% (UI 61·9–68·9) to 70·6% (50·8–90·0). Latin America and the Caribbean will also show a considerably larger reliance on prepaid financing in 2040 than in 2013, growing from 65·9% (63·4–68·7) in 2013 to 71·3% (51·7–89·4) in 2040; its sociodemographic percentile is also expected to increase, starting at the 48th percentile in 2013 and reaching the 81st percentile in 2040. Although we expect a shift in all regions to a greater share of prepaid health financing in 2040 than in 2015, considerable variation is expected to remain, even in 2040. South Asia continues to spend a great deal out of pocket, with 48·3% (34·7–57·4) of domestic health financing prepaid. In comparison, the high-income GBD super region operates with 88·6% (86·8–89·9) of health spending originating with prepaid sources in the year 2040.

Table 3 compares countries' expected spending in 2040 against three health spending targets set by Chatham House. The first Chatham House benchmark is that $86 per capita be spent on health. Chatham House found that $86 was required to ensure access to primary health care.[25] The second benchmark is that this $86 per capita should be financed by the government to provide universal access to services and protection against catastrophic health spending.[26] Finally, the third benchmark is that 5% of GDP should be spent on health by the government. Chatham House found that when government health spending was greater than 5% of GDP, few households faced financial difficulties related to health costs.[25]

All three benchmarks suggest that a health spending gap exists in some settings (table 3). Six (13%) of 45 low-income countries in sub-Saharan Africa are not estimated to spend $86 per capita on health, even in 2040 (benchmark 1). 35 (44%) of 80 low-income and lower-middle-income countries are not estimated to have governments that spend that amount on health, per capita (benchmark 2). Finally, 111 (60%) of the 184 countries are not estimated to have governments that will spend 5% of national GDP on health in 2040 (benchmark 3). This includes nearly all low-income countries, many middle-income countries, and 16 high-income countries.

Discussion

On the basis of past trends and relationships, we expect that the future will include more resources spent on health than in the past. This increased spending corresponds to the expectation of the health financing transition, which suggests that as countries develop, they spend more on health than they did before. This expected growth is driven by long-term trends showing that, over time, countries spend an increasing amount on health. Previous research suggests that these increases are due to long-term growth in national income and spending power, prices and medical inflation, and novel, but costly interventions that are on patent or simply more expensive than are the interventions that they replace.[27] Additionally,

	1995 THE per GDP (%)	2013 THE per GDP (%)	2040 THE per GDP (%)
Global			
Global	6·0%	7·1%	9·0% (7·2–10·9)
Income group			
High income	6·4%	7·5%	9·8% (7·9–11·7)
Upper-middle income	5·4%	6·2%	7·9% (6·3–9·7)
Lower-middle income	4·7%	6·0%	7·2% (5·7–9·4)
Low income	4·6%	5·5%	5·7% (4·6–7·4)
Global Burden of Disease super region			
High income	7·4%	9·1%	11·5% (9·4–13·5)
Central Europe, eastern Europe, and central Asia	6·2%	6·7%	8·2% (6·8–9·6)
Latin America and the Caribbean	5·4%	6·5%	8·3% (6·6–10·0)
North Africa and the Middle East	3·8%	3·7%	5·5% (4·0–7·5)
Southeast Asia, east Asia, and Oceania	4·4%	5·4%	6·8% (5·1–9·6)
Sub-Saharan Africa	4·5%	5·5%	6·8% (5·2–8·8)
South Asia	3·8%	3·7%	4·4% (3·6–5·3)
Country			
Afghanistan	7·5%	8·3%	8·1% (6·9–9·4)
Albania	9·6%	5·9%	6·9% (5·8–8·1)
Algeria	3·7%	6·6%	8·1% (6·7–9·4)
Andorra	6·0%	8·1%	9·8% (8·2–11·5)
Angola	4·5%	3·8%	4·5% (3·7–5·7)
Antigua and Barbuda	4·9%	4·9%	6·4% (5·0–7·9)
Argentina	8·3%	7·1%	8·8% (7·2–10·6)
Armenia	6·4%	4·6%	5·4% (4·3–6·6)
Australia	7·3%	9·4%	11·7% (9·7–14·0)
Austria	9·6%	11·0%	13·6% (11·3–15·8)
Azerbaijan	5·4%	5·4%	6·3% (5·2–7·6)
Bahrain	4·2%	4·9%	7·2% (5·0–10·4)
Bangladesh	3·5%	3·7%	4·2% (3·4–5·0)
Barbados	5·2%	6·8%	8·4% (6·9–9·7)
Belarus	6·3%	6·1%	7·3% (6·1–8·5)
Belgium	7·6%	11·2%	13·3% (11·4–15·4)
Belize	4·0%	5·3%	6·2% (4·7–8·4)
Benin	4·8%	5·1%	5·6% (4·6–6·9)
Bhutan	3·8%	3·6%	4·4% (3·5–5·5)
Bolivia	4·3%	6·2%	7·4% (6·2–8·4)
Bosnia and Herzegovina	9·0%	9·6%	11·7% (9·6–13·8)
Botswana	3·2%	5·5%	7·7% (5·3–10·3)
Brazil	6·6%	9·6%	13·6% (9·9–17·1)
Brunei	2·9%	2·5%	3·5% (2·6–5·0)
Bulgaria	5·2%	7·6%	8·7% (7·5–10·0)
Burkina Faso	4·3%	6·1%	6·7% (5·6–8·1)
Burundi	4·7%	5·7%	5·6% (4·2–8·6)
Cambodia	6·9%	6·2%	6·8% (5·7–8·4)
Cameroon	3·8%	5·1%	5·4% (4·7–6·2)
Canada	8·9%	10·9%	13·8% (11·2–16·3)
Cape Verde	5·3%	5·3%	6·1% (4·7–8·7)

(Table 2 continues in next column)

	1995 THE per GDP (%)	2013 THE per GDP (%)	2040 THE per GDP (%)
(Continued from pevious column)			
Central African Republic	4·0%	4·7%	4·4% (3·4–7·9)
Chad	5·8%	3·5%	3·6% (3·1–4·3)
Chile	6·0%	7·7%	10·6% (7·9–13·0)
China	3·5%	5·6%	7·5% (5·7–9·4)
Colombia	6·7%	6·8%	9·2% (6·9–11·7)
Comoros	5·2%	5·2%	5·5% (4·2–12·2)
Congo	3·3%	4·2%	4·8% (4·1–5·9)
Costa Rica	6·5%	9·8%	12·3% (10·0–14·5)
Côte d'Ivoire	6·3%	5·7%	6·5% (5·4–7·8)
Croatia	6·9%	7·3%	9·2% (7·6–10·7)
Cuba	5·1%	8·8%	11·5% (9·1–13·9)
Cyprus	4·7%	7·4%	9·1% (7·5–10·6)
Czech Republic	6·6%	7·2%	8·7% (7·4–9·9)
Democratic Republic of the Congo	3·3%	4·3%	3·4% (2·5–4·5)
Denmark	8·1%	10·6%	12·5% (10·8–14·6)
Djibouti	4·1%	9·4%	10·9% (8·8–13·8)
Dominica	5·8%	5·9%	7·2% (6·0–8·4)
Dominican Republic	5·1%	5·4%	6·8% (5·3–8·1)
Ecuador	3·2%	7·5%	9·0% (7·3–10·5)
Egypt	3·8%	5·1%	5·7% (5·1–6·4)
El Salvador	6·5%	7·0%	8·7% (7·0–10·3)
Equatorial Guinea	5·5%	3·5%	4·2% (3·3–5·2)
Eritrea	4·6%	3·1%	3·3% (2·5–5·4)
Estonia	6·3%	5·7%	6·9% (5·8–8·1)
Ethiopia	2·8%	4·7%	4·3% (3·5–5·2)
Federated States of Micronesia	9·3%	15·4%	18·0% (13·2–34·1)
Fiji	3·1%	4·2%	5·3% (3·9–6·6)
Finland	7·8%	9·4%	11·3% (9·6–13·2)
France	10·4%	11·7%	14·7% (12·0–17·6)
Gabon	3·4%	3·8%	4·4% (3·8–5·3)
Georgia	5·4%	9·3%	11·3% (9·0–14·1)
Germany	10·1%	11·3%	14·2% (11·6–16·4)
Ghana	3·0%	5·4%	6·1% (5·1–7·1)
Greece	9·6%	9·8%	11·9% (10·0–13·4)
Grenada	6·8%	6·3%	7·4% (6·3–8·4)
Guatemala	4·0%	6·0%	7·0% (5·9–8·0)
Guinea	3·3%	4·5%	4·9% (4·2–6·3)
Guinea-Bissau	6·2%	5·8%	4·9% (3·6–8·0)
Guyana	5·1%	6·7%	8·1% (6·1–10·2)
Haiti	6·4%	6·3%	5·4% (4·0–7·2)
Honduras	5·3%	8·8%	10·8% (8·6–12·9)
Hungary	7·2%	7·9%	9·6% (7·9–11·4)
Iceland	8·2%	9·1%	11·0% (9·3–12·4)
India	4·0%	3·9%	4·9% (3·9–5·6)
Indonesia	1·9%	3·0%	4·0% (3·0–4·7)
Iran	3·8%	6·7%	8·7% (6·8–11·0)
Iraq	6·1%	5·2%	6·2% (4·9–7·7)
Ireland	6·6%	8·9%	11·6% (9·2–13·7)

(Table 2 continues in next column)

	1995 THE per GDP (%)	2013 THE per GDP (%)	2040 THE per GDP (%)
(Continued from pevious column)			
Israel	7·3%	7·2%	8·9% (7·4–10·7)
Italy	7·1%	9·1%	11·1% (9·3–12·6)
Jamaica	4·1%	5·8%	8·0% (5·9–9·8)
Japan	6·8%	10·3%	12·4% (10·5–14·2)
Jordan	8·3%	7·2%	9·2% (7·1–11·1)
Kazakhstan	4·6%	4·3%	4·9% (4·2–5·7)
Kenya	4·0%	5·0%	4·9% (3·9–6·0)
Kiribati	9·9%	14·4%	15·8% (9·6–44·5)
Kuwait	3·8%	2·9%	4·0% (2·9–5·5)
Kyrgyzstan	5·6%	6·5%	7·7% (6·2–9·9)
Laos	4·0%	1·8%	1·9% (1·5–2·6)
Latvia	5·8%	5·7%	6·6% (5·8–7·6)
Lebanon	14·4%	7·2%	9·9% (7·3–12·1)
Lesotho	6·9%	13·3%	11·8% (9·1–15·5)
Liberia	5·0%	8·4%	6·3% (4·0–10·3)
Libya	3·3%	4·3%	5·5% (4·3–6·8)
Lithuania	5·2%	6·2%	7·2% (6·3–8·3)
Luxembourg	5·6%	7·1%	8·6% (7·2–10·3)
Macedonia	8·4%	6·4%	7·8% (6·5–9·1)
Madagascar	3·8%	4·4%	5·0% (4·0–6·2)
Malawi	4·2%	8·3%	8·3% (5·4–11·5)
Malaysia	2·8%	4·0%	5·2% (4·1–6·2)
Maldives	5·6%	10·8%	13·7% (10·9–16·8)
Mali	5·3%	8·0%	8·0% (7·0–9·5)
Malta	5·6%	8·7%	10·3% (8·8–11·7)
Marshall Islands	16·4%	18·0%	23·8% (17·0–40·5)
Mauritania	4·5%	3·6%	4·1% (3·5–5·0)
Mauritius	3·6%	4·8%	6·1% (4·8–7·3)
Mexico	5·1%	6·2%	7·8% (6·3–9·2)
Moldova	8·4%	10·8%	12·5% (10·2–14·9)
Mongolia	3·0%	5·8%	7·1% (5·3–9·1)
Montenegro	7·4%	6·4%	7·7% (6·4–8·8)
Morocco	3·9%	6·0%	7·3% (5·9–8·6)
Mozambique	5·0%	5·6%	4·3% (2·9–5·9)
Myanmar	2·2%	1·9%	2·1% (1·7–2·5)
Namibia	6·3%	7·8%	10·2% (7·1–12·6)
Nepal	5·2%	5·4%	5·9% (5·0–6·9)
Netherlands	8·3%	12·0%	14·9% (12·2–17·5)
New Zealand	7·0%	9·7%	12·1% (10·0–13·9)
Nicaragua	6·6%	8·4%	10·5% (8·2–13·2)
Niger	5·8%	6·1%	6·3% (5·3–8·4)
Nigeria	2·7%	3·8%	4·0% (3·5–4·6)
Norway	7·9%	9·6%	11·3% (9·8–13·0)
Oman	3·6%	2·6%	3·7% (2·7–5·0)
Pakistan	3·2%	2·6%	3·1% (2·6–3·5)
Panama	7·7%	7·1%	9·1% (7·3–10·8)
Papua New Guinea	3·5%	5·6%	5·7% (4·2–7·1)
Paraguay	5·9%	9·0%	10·6% (8·9–12·0)
Peru	4·5%	5·2%	6·5% (5·3–7·5)

(Table 2 continues in next column)

	1995 THE per GDP (%)	2013 THE per GDP (%)	2040 THE per GDP (%)
(Continued from pevious column)			
Philippines	3·4%	4·4%	5·3% (4·3–6·1)
Poland	5·4%	6·7%	8·5% (6·9–9·7)
Portugal	7·5%	9·7%	12·3% (9·9–14·0)
Qatar	3·7%	2·2%	3·3% (2·1–5·3)
Romania	3·2%	5·3%	6·5% (5·3–7·7)
Russia	5·2%	6·5%	7·6% (6·4–8·8)
Rwanda	3·1%	9·7%	9·9% (7·2–12·7)
Saint Lucia	4·7%	8·5%	10·0% (8·1–12·1)
Saint Vincent and the Grenadines	4·4%	5·2%	6·6% (5·3–7·9)
Samoa	5·2%	8·3%	9·4% (6·9–14·6)
São Tomé and Príncipe	6·9%	8·9%	9·0% (6·8–17·0)
Saudi Arabia	2·9%	3·2%	4·5% (3·2–6·3)
Senegal	4·0%	4·7%	5·3% (4·2–6·6)
Serbia	6·7%	10·6%	12·4% (10·5–14·2)
Seychelles	5·2%	4·1%	5·6% (4·2–6·9)
Sierra Leone	10·5%	8·9%	9·5% (8·4–11·6)
Singapore	2·9%	4·6%	5·8% (4·5–7·4)
Slovakia	6·0%	8·2%	10·4% (8·2–12·4)
Slovenia	7·5%	9·2%	11·9% (9·5–14·0)
Solomon Islands	3·6%	9·5%	8·1% (5·0–16·7)
Somalia	2·7%	3·9%	3·8% (3·0–7·0)
South Africa	7·2%	8·9%	13·4% (9·1–16·6)
South Korea	3·8%	7·2%	9·4% (7·3–11·8)
South Sudan	2·0%	2·8%	2·5% (1·9–3·3)
Spain	7·4%	8·9%	11·2% (9·1–12·8)
Sri Lanka	3·4%	3·2%	4·0% (3·2–4·8)
Sudan	3·7%	6·6%	7·2% (6·2–8·3)
Suriname	5·6%	4·4%	5·7% (4·4–7·2)
Swaziland	4·2%	7·7%	8·8% (6·6–11·1)
Sweden	8·0%	9·7%	11·3% (9·9–13·5)
Switzerland	9·3%	11·5%	13·8% (11·6–16·3)
Syria	5·5%	3·3%	3·9% (3·2–4·6)
Tajikistan	3·0%	6·3%	7·1% (5·9–8·9)
Tanzania	3·4%	5·5%	5·3% (4·3–6·6)
Thailand	3·5%	4·5%	6·3% (4·7–7·9)
The Bahamas	6·9%	7·3%	10·0% (7·5–12·6)
The Gambia	2·4%	5·4%	5·4% (3·8–9·0)
Timor-Leste	1·9%	1·6%	1·6% (1·1–2·7)
Togo	4·4%	8·4%	9·0% (7·5–11·2)
Tonga	4·2%	6·0%	7·2% (4·7–15·2)
Trinidad and Tobago	4·7%	5·5%	6·9% (5·6–7·9)
Tunisia	5·8%	7·0%	8·7% (7·1–10·0)
Turkey	3·4%	5·2%	6·5% (5·3–7·5)
Turkmenistan	3·0%	2·0%	2·5% (2·0–3·1)
Uganda	5·2%	8·4%	9·0% (7·0–11·1)
Ukraine	7·7%	7·8%	9·0% (7·8–10·4)
United Arab Emirates	2·6%	3·2%	5·2% (3·1–9·0)
UK	6·7%	9·1%	11·1% (9·4–13·1)

(Table 2 continues in next column)

	1995 THE per GDP (%)	2013 THE per GDP (%)	2040 THE per GDP (%)
(Continued from pevious column)			
USA	13·2%	17·1%	23·2% (17·8–28·9)
Uruguay	15·1%	8·8%	11·2% (9·0–13·2)
Uzbekistan	6·9%	6·1%	7·4% (6·1–8·6)
Vanuatu	2·8%	7·5%	8·1% (4·2–22·1)
Venezuela	4·1%	3·4%	4·1% (3·4–4·8)
Vietnam	5·2%	5·9%	7·4% (5·9–9·0)
Yemen	4·0%	5·2%	5·9% (5·0–7·1)
Zambia	4·3%	6·2%	6·3% (4·9–8·2)

Data in parentheses are uncertainty intervals. THE=total health expenditure. GDP=gross domestic product.

Table 2: **Health spending as a share of gross domestic product, by income group, region, country, and year**

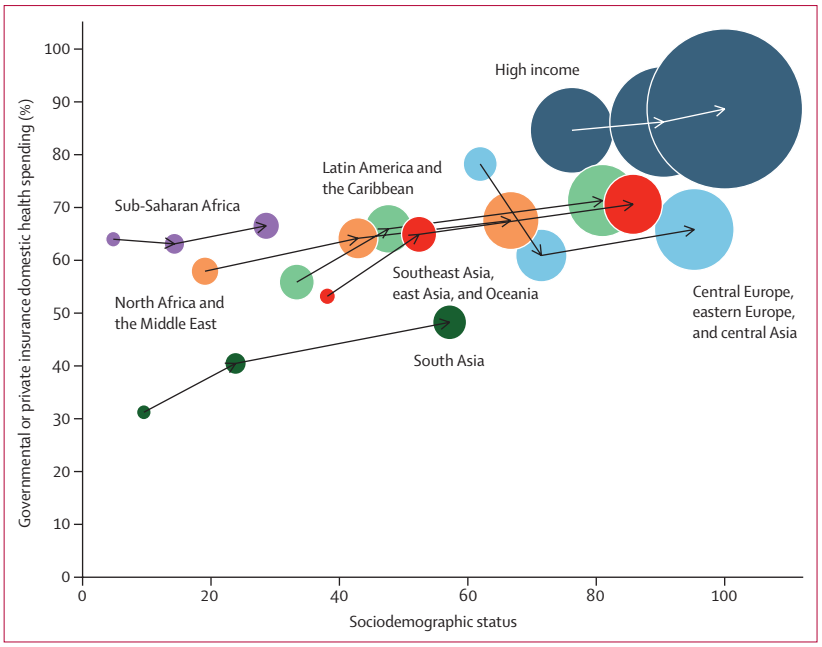

Figure 4: **Health financing transition by Global Burden of Disease super region**
Total health spending excluding development assistance for health. The size of the dot is scaled to reflect the amount of health spending per capita. Sociodemographic status is a function of lag-distributed income per capita, mean age, mean years of education, and total fertility rate. The dots from left to right represent 1995, 2013, and 2040.

populations in sub-Saharan Africa and south Asia are expected to continue to grow, whereas populations are expected to age in all regions. Larger and older populations generally require more health-care resources than do smaller and younger ones and are likely to continue to drive increases in health spending.[27]

In addition to increased health spending, we expect ongoing movement towards prepaid financing and away from out-of-pocket financing in all of the 184 countries. We estimate growth in government health spending in all countries, a key determinant in progress towards universal health coverage.[28] Prepaid private spending is estimated to increase most rapidly across sources and in all regions, although these estimates are surrounded by the most uncertainty. The projected growth is evidence of a transition away from out-of-pocket spending, an important driver of improved financial risk protection across regions.[29]

Despite the evidence of a global health financing transition, a close look highlights the sluggish nature of these transitions in some settings. Substantial variation exists in the amount of health spending across countries. Even within income groups, substantial variation exists. Although economic development is associated with high levels of health spending, this rule is not without exception. Within the lower-middle income group, 2040 total health spending per-capita estimates vary from $163 (UI 126–222) in Laos to $2064 (1651–2574) in Georgia. Total health spending per-capita estimates in 2040 in upper-middle income countries varies from $360 (296–451) in Angola to $4530 (3749–5390) in Hungary. These wide ranges highlight the role that policy can play in the catalysation of health spending.

In addition to low total health spending estimated for some countries, the share of out-of-pocket financing is expected to remain high in many countries. Like government and prepaid private spending, out-of-pocket spending is also expected to grow over the next 25 years. Although the growth estimates for out-of-pocket financing are lower than are those for government and prepaid private spending, these differences are not significant. A major portion of health financing is expected to remain out of pocket. This finding is especially true in south Asia, where more than half of health spending is expected to be out of pocket in 2040.

In addition to persistent dependence on out-of-pocket financing, tepid growth in health spending is expected in many of the places that need health investments the most. Annualised growth rates of total health spending are greatest for upper-middle-income countries, followed by lower-middle-income countries. Yet, many countries are not expected to reach some of the concrete financing targets set globally, even by 2040. Of 132 currently low-income and middle-income countries, only 37 are expected to reach the Chatham House goal of spending 5% of GDP on health.[30] Similarly, six countries in sub-Saharan Africa are not expected to reach the most basic target of $86 per capita. Missing these targets suggests that some countries will not have sufficient resources to ensure access to essential health care. Moreover, we do not expect the spending gap between low-income and high-income countries to narrow. In 1995 and 2015, low-income countries spent $0·03 for every dollar spent in high-income countries, even after adjusting for purchasing power, and the same is projected for 2040. For low-income and middle-income countries to reach international spending targets and close this gap, domestic and international health financing will need to increase beyond historical trends.

	Number of countries	Benchmark 1: THE ≥US$86 per capita (%)	Benchmark 2: Domestic GHE ≥US$86 per capita (%)	Benchmark 3: Domestic GHE ≥5% of GDP (%)
Income group				
High income	52	52 (100%)	52 (100%)	36 (69%)
Upper-middle income	52	52 (100%)	52 (100%)	23 (44%)
Lower-middle income	46	46 (100%)	38 (83%)	13 (28%)
Low income	34	28 (82%)	7 (21%)	1 (3%)
Global Burden of Disease super region				
High income	33	33 (100%)	33 (100%)	29 (88%)
Central Europe	29	29 (100%)	29 (100%)	15 (52%)
Latin America and the Caribbean	29	29 (100%)	28 (97%)	14 (48%)
Southeast Asia	20	20 (100%)	18 (90%)	4 (20%)
North Africa and the Middle East	23	23 (100%)	19 (83%)	5 (22%)
Sub-Saharan Africa	45	39 (87%)	18 (40%)	6 (13%)
South Asia	5	5 (100%)	4 (80%)	0

Data are n (%). Benchmarks refer to Chatham House benchmarks. THE=total health expenditure. GHE=government health expenditure. GDP=gross domestic product.

Table 3: **Benchmarking country progress by 2040**

Historically, these financing gaps have been addressed in part by DAH. Over the last 25 years, remarkable growth has occurred in DAH, contributing to the provision of essential services for priority diseases, particularly in sub-Saharan Africa.[31–33] However, the future of how much health financing will be provided by donors and where those resources will be disbursed remains uncertain. Donor countries and development agencies are balancing an ever-increasing set of demands for their attention and resources, including the emerging migrant crisis and a heightened focus on climate change. The long-term effects of the global financial crisis are also at play. Yet, development assistance is likely to remain crucial to attain health goals, catalyse increases in domestic financing, and drive efficiency gains in low-income countries.

The primary limitations of this research revolve around data and the challenges of creation of long-term estimates on the basis of a short time series. For this research, we estimate up to 27 years of health spending on the basis of as little as 19 years of data. Long-run estimates are subject to large errors as repeated small errors in growth rates are compounded over the years. Given this uncertainty, results should be interpreted with caution. Additionally, this analysis uses observed trends and relationships to predict what health spending would look like without divergence from past trends. The estimates therefore assume no drastic changes to the ways in which these variables relate and assume that health-seeking behaviour, health insurance coverage, technology, and policy broadly evolve as they have in the past, associated with time, demographic changes, and economic development. In the future, we believe that sophisticated models that consider diverse scenarios that include unexpected policy changes or changes to the demand for health care should be developed. Additionally, we know that the distribution of health spending varies widely within nearly all countries on the basis of income, status, and education. Therefore, our measurements of per-capita health spending are probably overestimates for the poorest and least educated groups within each country. Future research should also consider these within-country spending disparities. Nevertheless, we believe the value for decision makers of long-run estimates is high, especially for low-income countries' long-term growth or investment strategy and for advocacy purposes when a need exists to prioritise investment in health.

In addition to limitations related to estimation, numerous spending benchmarks have been recommended. This research focuses on three benchmarks produced by Chatham House.[25] Although these targets can serve as global benchmarks and provide inputs for estimation of global financing gaps, they are often not helpful for determination of appropriate levels of spending at the country level. Many countries spend more than these targets and have yet to provide a basic package of services to their population, whereas others spend less and achieve near-universal levels of population coverage. Instead of using global targets to assess what they should spend, governments should carefully assess what they can spend on improvement to the health sector. In many cases, how much a country can spend reflects the country's budgetary room to increase spending on health without crowding out investment in other sectors and impairing fiscal solvency over the medium and long term.

Past trends and relationships suggest that global health financing gaps will persist. However, gains in the amount spent on health and equitable distribution of funds for health is still possible. As pointed out by Evans and Pablos-Méndez,[34] a wide set of policy options can generate additional funds for health without adversely affecting other sectors. Many low-income country governments can raise health budgets by improving the capacity to raise tax revenue and prioritise health spending, and scope exists for better harnessing of private financing than in the past. Together, governments, the private sector, and international development partners can implement changes that can improve health system efficiency.

With this conclusion in mind, projections like these can be a catalyst for change. Broad variation in spending levels and composition suggests that much remains to be established about the future of health financing. Using estimates based on trends and relationships from the recent past, policy makers, health advocates, and others are better equipped than without these estimates to take action now to ensure sufficient resources are available for health.

Contributors
JLD managed the research project and wrote the first draft of the report. NS and TT collected data, created databases, and completed all analyses. KF, TT, PR, NS, and JLD developed the methods. All authors interpreted results. All authors reviewed and contributed to the final draft.

Declaration of interests
We declare no competing interests.

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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.

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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

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

See **Online** for appendix

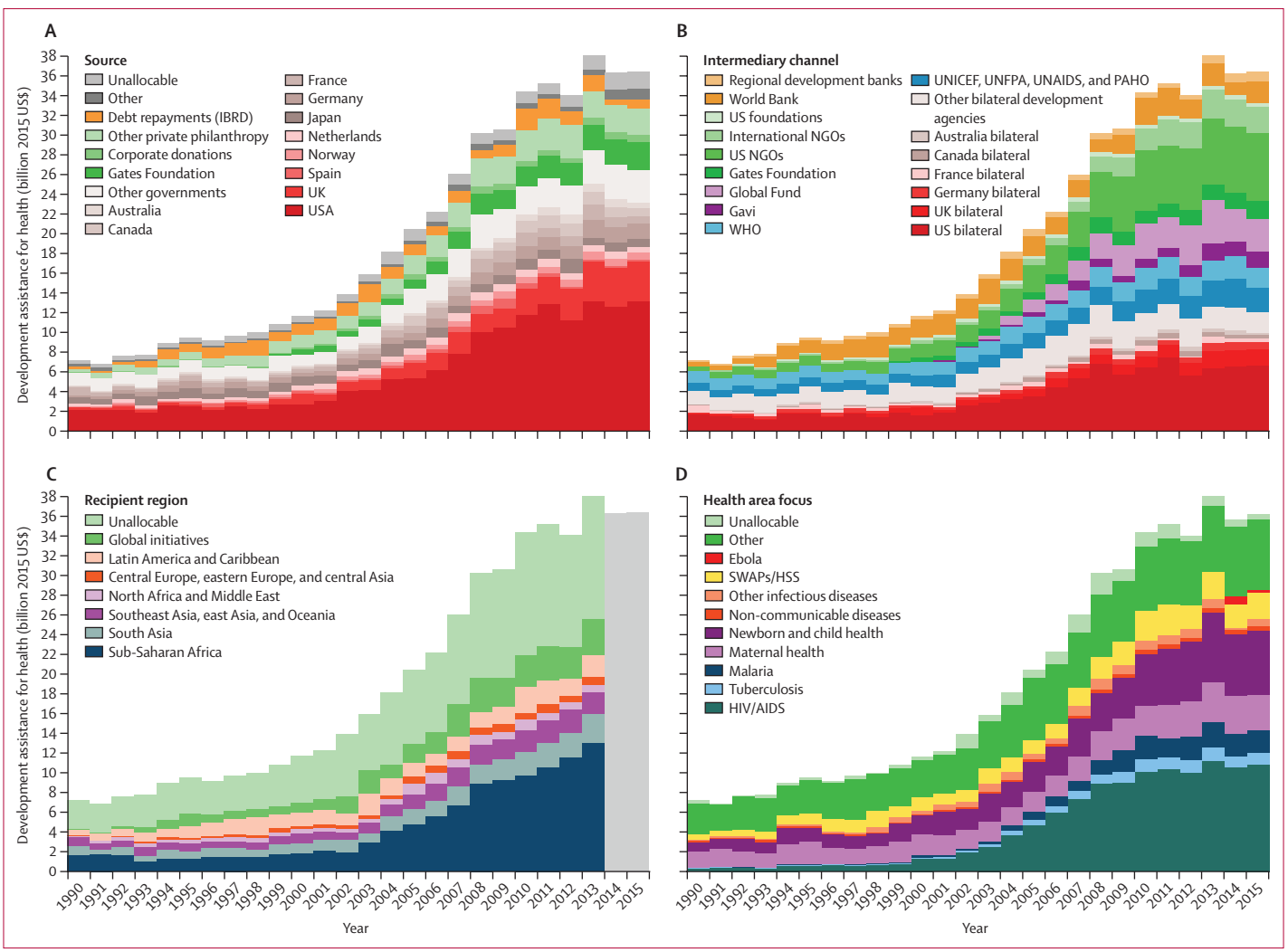

Figure 1: **Disaggregated DAH, 1990–2015**

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=0·167) 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 (α=0·1) 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.

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

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

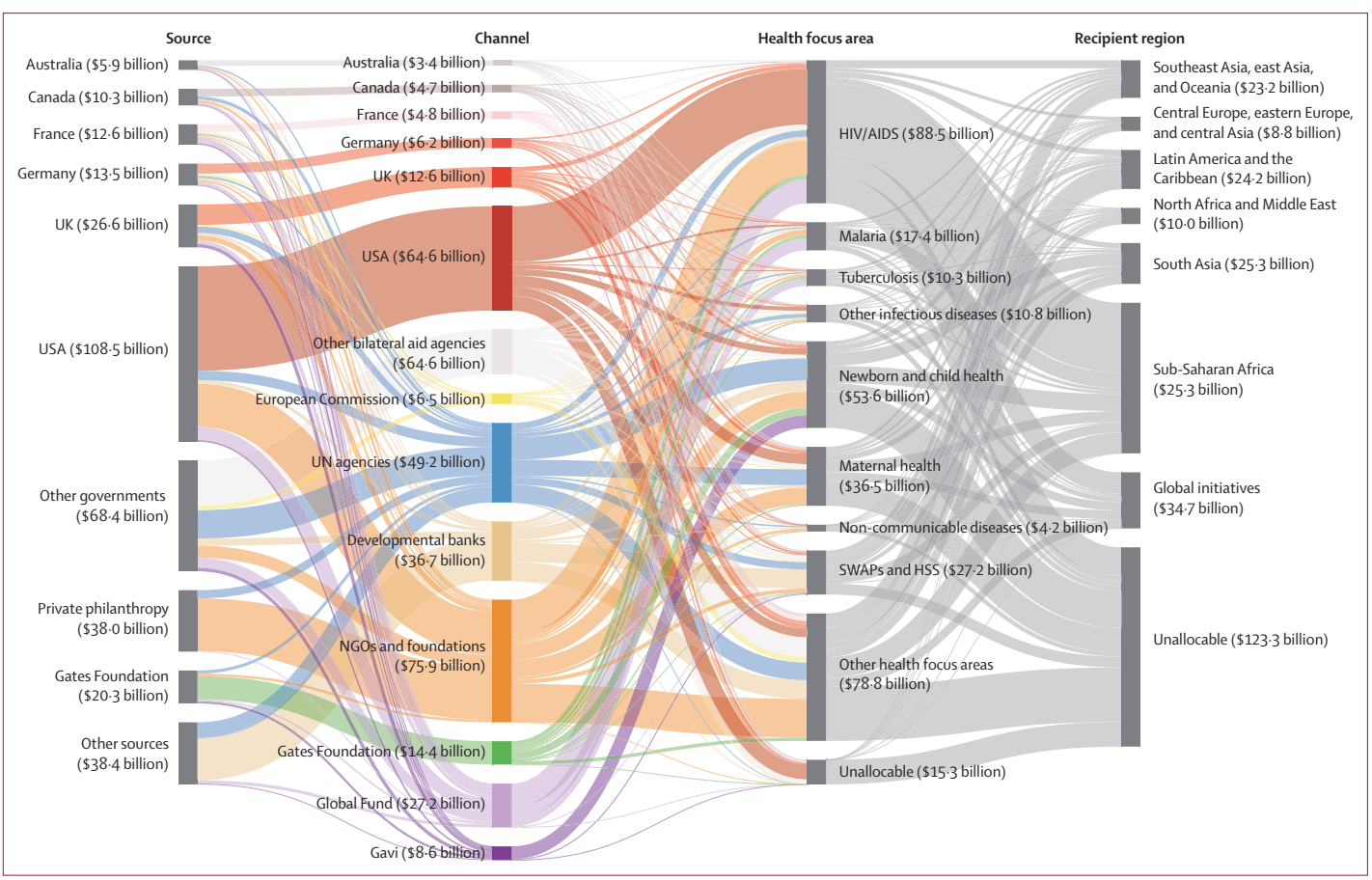

Figure 3: **Flow of DAH, 2000–13**

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.

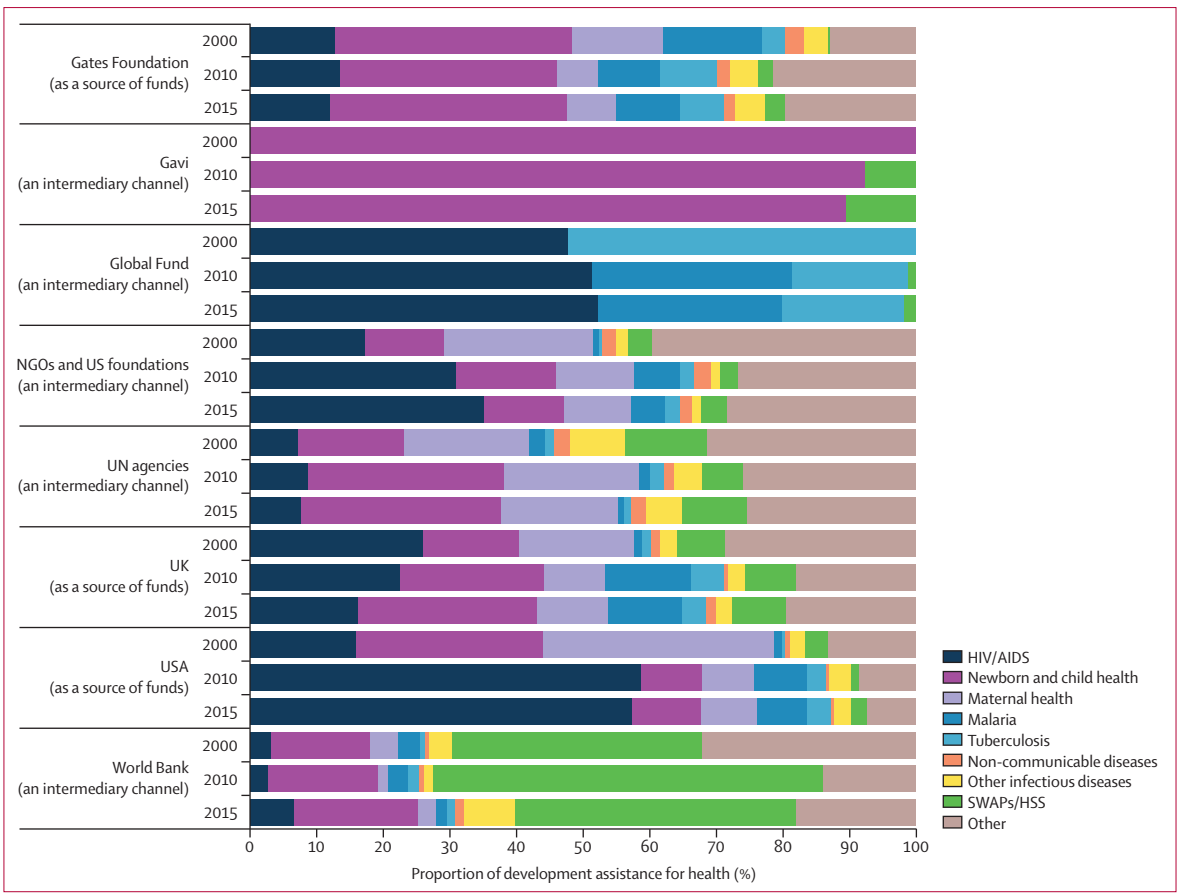

Figure 4: **Priority health focus areas for the major sources and channels of DAH**
Proportions of DAH provided to nine health focus areas in three time periods from major sources and intermediary channels. The time periods are 2000, 2010, and 2015, except for The Global Fund to Fight AIDS, Tuberculosis 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.

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 gvoovernment 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).

	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**

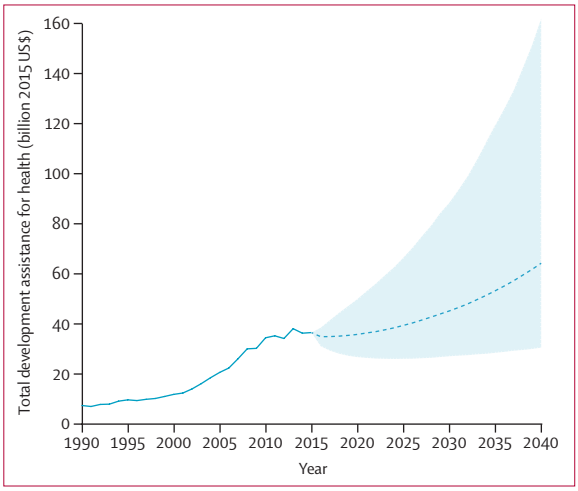

Figure 5: **Estimated total development assistance for health to the end of 2040**
The dotted line shows predicted development assistance for health from 2016 to 2040. Shading shows the uncertainty interval.

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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Shaping of a new era for health financing

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At the Annual Universal Health Coverage (UHC) Financing Forum in Washington, DC, USA, on April 14–15, 2016, governments and development partners will debate how to raise and organise public and private resources needed for low-income and lower-middle-income countries to assure affordable, quality health care to all of their people by 2030.

The health financing challenge to reach UHC and the health-related Sustainable Development Goals is daunting. The *Lancet* Commission[1] on investing in health estimated in 2013 that an additional US$70 billion to $90 billion is needed annually to make basic services universally available, which corresponded to a third of low-income and lower-middle income countries' total health spending in 2013. But as Joseph Dieleman and colleagues show in *The Lancet*,[2] health expenditure growth will be insufficient to meet this financing gap based on current trend projections of government health expenditure: 27 (79%) of 34 low-income countries will still spend less than $86 per capita (a commonly accepted benchmark for provision of a basic package of services in low-income and lower-middle income countries). Moreover, although development assistance will be crucial to help bridge this gap, it will not be sufficient. To put these countries on a more ambitious trajectory than at present therefore requires a transformation of domestic and development financing for health in line with the Sustainable Development Goal financing agenda endorsed by the UN member states at the Third International Conference of Financing for Development in Addis Ababa, Ethiopia, in 2015.[3]

Domestic financing for health in low-income and lower-middle-income countries requires concerted strategies within strengthened public finance systems. Resources for health can be raised by growing of government revenues through effective tax collection and combating of tax evasion.[4] Use of indirect or so-called sin taxes on consumables such as cigarettes and high-sugar drinks are also growing, which can help generate revenue and promote healthy behaviours.[5] Prohealth subsidies targeted to the poor, such as conditional cash transfers, should be promoted,[6] whereas ineffective subsidies (eg, for fuel), which can exceed a country's spending on health,[7] should be eliminated. Likewise, optimisation of the health-enhancing effect of other sectors, such as water and sanitation, education, and transport, makes good health and fiscal policy.

But governments should also give health a larger share of the public resource envelope than at present. Twelve (35%) of 34 low-income countries' governments allocate less than 8% of total spending to health,[8] roughly half of the Abuja target endorsed by many African countries in 2001 (several sub-Saharan governments made a commitment to allocate at least 15% of their budgets to the health sector as signatories of the Abuja Declaration).[9] This spending equates, on average, to $12 per capita—far too little to provide even the most basic services to the 360 million people in these countries. Strategic planning, effective budget execution, and demonstrable results help to convince ministers of finance to create fiscal space for investment in health.

As governments increase health expenditures, they and their partners cannot ignore the large share of private spending and must effectively harness it for the needs of the health system. Most importantly, high out-of-pocket spending among those who fall ill continue to make up the largest share of health expenditure in most low-income and lower-middle income countries, with millions of people falling into or remaining trapped in poverty or foregoing care because of its prohibitive costs.[10] Given the size of the informal economy in low-income and lower-middle-income countries, an urgent need exists for innovations that direct private expenditure into prepaid pools; for example, through expansion of

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social health insurance towards informal sector workers and their families. Governments need to be much more strategic in interacting with the private sector in health (inclusive of foreign and local commercial interests as well as non-governmental organisations and faith-based organisations) in key areas such as service delivery, health worker training, pharmaceutical procurement, and management of supply chains.

As domestic financing grows, the role of development assistance for health must also evolve to accelerate progress toward UHC. Over the last two decades, development assistance for health has seen dramatic increases, predominantly supporting infectious disease programmes. While infection rates start to fall, international support needs to be sustained to reach all affected people, catalyse similar advancements in maternal and child health, curb non-communicable diseases, and promote global public goods, such as research and development and emergency preparedness.

Partners should also ensure that their investments are sustainable. Confronted with specific emergencies, large amounts of assistance have been funnelled through programmes established for quick results outside of country systems, often prompting governments to reduce their spending on health. This approach is no longer tenable. Development assistance for health has to be better coordinated among partners than at present, flow increasingly through country systems, and be linked to increases in government spending on health. The recent slowdown in development assistance for health growth also highlights the need to prioritise institutional capacity building and to develop plans that help countries ease the transition from grant to concessional and eventually self-financing. The *Global Financing Facility in Support of Every Woman Every Child*[11] will spearhead these changes with its focus on national leadership, alignment of financing behind strategic investments, and improvements in local health financing systems.

While the challenge is daunting, attaining UHC and its sustainable financing by 2030 is feasible for most countries. Success will depend on governments and partners aligning their objectives into a coordinated strategic effort. Together, we can rise to this challenge and shape a new era of global health financing.

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