Health sector spending and spending on HIV/AIDS, tuberculosis, and malaria, and development assistance for health: progress towards Sustainable Development Goal 3

Global Burden of Disease Health Financing Collaborator Network

Summary

Background Sustainable Development Goal (SDG) 3 aims to “ensure healthy lives and promote well-being for all at all ages”. While a substantial effort has been made to quantify progress towards SDG3, less research has focused on tracking spending towards this goal. We used spending estimates to measure progress in financing the priority areas of SDG3, examine the association between outcomes and financing, and identify where resource gains are most needed to achieve the SDG3 indicators for which data are available.

Methods We estimated domestic health spending, disaggregated by source (government, out-of-pocket, and prepaid private) from 1995 to 2017 for 195 countries and territories. For disease-specific health spending, we estimated spending for HIV/AIDS and tuberculosis for 135 low-income and middle-income countries, and malaria in 106 malaria-endemic countries, from 2000 to 2017. We also estimated development assistance for health (DAH) from 1990 to 2019, by source, disbursing development agency, recipient, and health focus area, including DAH for pandemic preparedness. Finally, we estimated future health spending for 195 countries and territories from 2018 until 2030. We report all spending estimates in inflation-adjusted 2019 US$, unless otherwise stated.

Findings Since the development and implementation of the SDGs in 2015, global health spending has increased, reaching $7.9 trillion (95% uncertainty interval 7.8–8.0) in 2017 and is expected to increase to $11.0 trillion (10.7–11.2) by 2030. In 2017, in low-income and middle-income countries spending on HIV/AIDS was $20.2 billion (17.0–25.0) and on tuberculosis it was $10.9 billion (10.3–11.8), and in malaria-endemic countries spending on malaria was $5.1 billion (4.9–5.4). Development assistance for health was $40.6 billion in 2019 and HIV/AIDS has been the health focus area to receive the highest contribution since 2004. In 2019, $374 million of DAH was provided for pandemic preparedness, less than 1% of DAH. Although spending has increased across HIV/AIDS, tuberculosis, and malaria since 2015, spending has not increased in all countries, and outcomes in terms of prevalence, incidence, and per-capita spending have been mixed. The proportion of health spending from pooled sources is expected to increase from 81.6% (81.6–81.7) in 2015 to 83.1% (82.8–83.3) in 2030.

Interpretation Health spending on SDG3 priority areas has increased, but not in all countries, and progress towards meeting the SDG3 targets has been mixed and has varied by country and by target. The evidence on the scale-up of spending and improvements in health outcomes suggest a nuanced relationship, such that increases in spending do not always result in improvements in outcomes. Although countries will probably need more resources to achieve SDG3, other constraints in the broader health system such as inefficient allocation of resources across interventions and populations, weak governance systems, human resource shortages, and drug shortages, will also need to be addressed.

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Evidence before this study

The Sustainable Development Goals (SDGs) and their related indicators and targets mark a consensus among global leaders about the importance of improving and maintaining health worldwide. To monitor progress towards the health-related SDGs, the United Nation’s Voluntary National Reviews Database, WHO, and the Global Burden of Diseases, Injuries, and Risk Factors study (GBD) Collaborator Network have measured health indicators to monitor achievement of SDG3, and the World Bank created the SDG atlas. A multitude of voices are championing progress towards achieving the SDGs, with some also proposing estimates of the financing needs to meet the related health goals. To track financing inputs for health, previous studies by the GBD Health Financing Collaborator Network have estimated past and projected future total health spending in 195 countries and territories from 1995 to 2050, and health investment from international donors to low-income and middle-income countries between 1990 and 2050. In the most recent study, in which spending was estimated in 2018 US$, global health spending was found to reach $8·0 trillion (95% uncertainty interval 7·8–8·1) comprising 8·6% (8·4–8·7) of the global economy in 2016 and was projected to increase to $15·0 trillion (14·0–16·0), that is 9·4% (7·6–11·3), of the global economy by 2050. Additionally, estimates have been published for HIV/AIDS spending in low-income and middle-income countries and malaria spending in 106 malaria-endemic countries (also from the GBD Collaborator Network). Similarly, UNAIDS and WHO have estimated for spending on HIV/AIDS, tuberculosis, and malaria in many low-income and middle-income countries. The studies from the GBD Health Financing Collaborator Network showed that in 2016, US$19·9 billion (15·8–26·3) was spent on HIV/AIDS and $4·3 billion (4·2–4·4) was spent on malaria. The World Malaria Report published by WHO in 2019 showed that US$2·7 billion was invested in malaria control and elimination activities by international partners and governments of malaria endemic countries. For HIV/AIDS, UNAIDS Global AIDS monitoring report showed that in 2018, $19 billion (in 2016 US$) from international and domestic sources was spent and the WHO’s Global Report on tuberculosis reported that in 2019 $6·8 billion was spent on tuberculosis diagnosis, prevention, and treatment services. Additionally, the Sustainable Development Solutions Network, the International Monetary Fund, World Bank, and Organization for Economic Co-operation and Development have offered different methods, assumptions, and measures related to the financing needs for SDG3.

The Working Group on SDG Costing and Financing has worked to provide updated estimates using consistent methods for any scale-up of the interventions needed to achieve the ambitious health goals will probably require some additional resources. As such, tracking how many resources are spent on health, when and where those resources are spent, and who benefits from them is vital for transparency and assessment of progress towards the goals. For SDG3 specifically, the Third Edition of the Disease Control Priorities in Developing Countries assessed financial needs for universal health coverage, while researchers at the Institute of Health Metrics and Evaluation have estimated funding gaps to achieve universal health coverage. The Department of Health Systems Governance and Financing at WHO has also projected resource needs to finance transformative health systems towards achievement of SDG3. Beyond estimated financing targets, needs, and gaps, only four of 27 SDG3 indicators have estimates of past or current total spending. These financial estimates are not directly comparable due to differences in study designs, scopes, and completeness.

Additional value of this study

This study is the first to our knowledge, that assesses spending on and explores the association with health gains for key SDG3 targets related to HIV/AIDS (3.3.1), tuberculosis (3.3.2), malaria (3.3.3), universal health coverage (3.8.1), financial risk protection (3.8.2), and development assistance for health (DAH; 3.b.2). We focused on quantifying total health spending on HIV/AIDS, malaria, and tuberculosis and DAH contributions. Additionally, we provide updated estimates using consistent methods for retrospective and prospective total health sector spending. This work adds value to existing literature by using similar methods as previous studies to quantify progress in financing SDG3 priority by estimating domestic spending by source spending on four SDG3 indicators and DAH funding on eight SDG3 indicators.

Implications of all the available evidence

Tracking progress towards the financing of health systems and specific targets associated with SDG3 draws attention to the need for sufficient resources to achieve health gains without placing financial hardship on households. Monitoring this progress requires comparable and consistent estimates in financing for health. By providing these estimates, we create a foundation for stakeholders to discuss, set, and reach achievable financial goals. In particular, for some low-income countries our results highlight that the available resources seem insufficient to achieve the SDG3 targets by 2030. This study also highlights the need to estimate the financing available for the other SDG3 priority areas. Furthermore, the nuanced evidence on the scale-up of spending and improvements in health outcomes suggest a complex association between spending and health outcomes. This complexity highlights that, although more resources are probably needed to achieve SDG3, other constraints such as inefficient resource allocation, weak governance systems, inadequate health workforce, and drug shortages will likely need to be addressed to achieve the SDG3 targets.
efficiency of health systems), knowing precisely how much is being spent and for what purpose is essential for tracking effectiveness and ensuring an equitable distribution of resources. Second, SDG3 target 3.8 identifies financial risk protection and access to essential services as key targets. Financial risk protection is ensuring that no household endures financial hardship due to large spending on health. Achieving SDG3 target 3.8 not only requires enough resources are available to provide the services and interventions needed to prevent and treat ill health, but also that an awareness of the source of those funds is key. Ensuring that health spending does not lead to financial hardship and impoverishment, known as catastrophic health spending, requires that funds for health be prepaid and pooled across individuals via public or private insurance schemes. The alternative to prepaid and pooled resources for health is reliance on out-of-pocket spending, which forces households without sufficient resources to choose between receiving health care or medical impoverishment.

This study builds on past work and aims to make progress towards filling the current gap in knowledge on the financing of SDG3 priority areas. Little evidence exists on how much is being spent towards the SDG3 targets and how this spending relates to changes in health outcomes of interest. The objectives of this study are to measure spending on SDG3 priority areas where estimates are relatively complete and comparable, examine the association between outcomes and financial risk protection and access to essential services, and supplies to deliver health care. This health spending is exclusive of informal care spending and major capital investments, such as building hospitals.

Domestic health spending, 1995–2017
We estimated three sources of domestic health spending: government, out-of-pocket, and prepaid private spending. The sum of spending from these three domestic sources, plus DAH, equate to total spending on health, meaning these four sources are mutually exclusive and collectively exhaustive. Government health spending is an aggregate of social health insurance and government public health programmes. Out-of-pocket health spending captures health-care spending by an individual patient or their household, excluding insurance premiums paid before needing care. Prepaid private-health spending includes non-governmental agency spending on health and private insurance. To estimate the three domestic health spending variables, we extracted data from the WHO Global Health Expenditure database for all available countries. We downloaded the data in current national currency units, adjusted for inflation, and then converted to 2019 $US, completed our analysis, and then also converted our estimates into 2019 purchasing-power parity-adjusted $. We used deflator series and exchange rate data based on data from the International Monetary Fund World Economic Outlook. For each extracted datapoint, we used the metadata provided by WHO to qualitatively assess the quality of data. We assigned a weight to each downloaded datapoint on the basis of documented source information, completeness of metadata, and documented methods of estimation (more details are in the appendix [pp 14–21]).

We then used a spatiotemporal Gaussian process model to generate a complete time series of data from 1995 until 2017 for each country, and 95% uncertainty intervals (UIs).

Domestic spending on HIV/AIDS, tuberculosis, and malaria, 2000–17
We generated estimates of domestic spending for three communicable diseases included in the SDG target 3.3: HIV/AIDS, tuberculosis, and malaria. To generate the three disease-specific spending estimates, we used a similar overarching strategy as for domestic health spending estimates. First, we did a comprehensive search and extracted all available and applicable data, which we put into a common currency for comparability (2019 US$). The input data for our disease-specific spending estimates came from multiple sources.
For HIV/AIDS, we extracted spending data for 135 low-income and middle-income countries from the National AIDS Spending Assessments,12 the Global Fund (including concept notes, proposals, and funding landscape documents), National Health Accounts and sub-accounts, UNAIDS Global AIDS response progress reports, and three online public databases provided by UNAIDS: the AIDSinfo database, the HIV financing dashboard, and the Asia-Pacific region AIDS Data Hub. Additional details on the data sources we used are in the appendix (pp 113–16).

For tuberculosis, we extracted spending data for 135 low-income and middle-income countries from the WHO Global Tuberculosis database, Global Fund (proposals, concept notes, and funding landscaping documents), National Health Accounts and sub-accounts, WHO Global Health Expenditure database,16 National Tuberculosis Reports, Ministry of Health Reports, GBD data, and unit cost data from WHO-CHOICE Interventions that are Cost Effective (CHOICE), and Moses et al.19 Additional details on the data sources we used are in the appendix (pp 13–21).

For malaria, we extracted spending data for 106 malaria-endemic low-income and middle-income countries from the World Malaria Report, the Global Fund (including concept notes, proposals, and funding landscape documents), National Health Accounts and sub-accounts, the Global Fund Price Quality Reporting, WHO Global Price Reporting Mechanism, Management Sciences for Health Surveys, malaria outpatient and inpatient cost literature, malaria inpatient and outpatient cost literature, and inpatient and outpatient unit costs from Moses et al.19 Further details on the data sources we used are in the appendix (pp 89–90).

Second, we used a spatiotemporal Gaussian process model to generate a complete time series of estimates by disease from 2000 to 2017 for each country included. For our HIV/AIDS spending estimates, tabulated data of annual spending of all components—government, out-of-pocket, and prepaid private spending—were available, so we used those to generate our estimates. For malaria and tuberculosis, little tabulated data and estimates on out-of-pocket spending were available, so we developed out-of-pocket spending estimates by taking the product of coverage (ie, volume) and unit costs for key services for which users pay out of pocket.

Universal health coverage, 2000–17
We extracted the universal health coverage service index from the GBD 2017 SDG Collaborators.1 The index aggregates across a diverse set of intermediate coverage estimates, such as vaccine coverage, and measured of health system performance. We extracted data on 195 countries from 2000 to 2017 used these data in this analysis.

No commonly agreed on system exists to differentiate between which health spending is intended to help countries achieve universal health coverage. Because of this, we track pooled health spending as a proxy for tracking progress towards financing universal health service coverage. Pooled spending is health-care spending collected in advance and spread across a large set of individuals, and includes government and prepaid private spending and DAH.

Estimating DAH, 1990–2019
We defined DAH as the financial and in-kind resources transferred through international development agencies to low-income and middle-income countries for the primary purpose of maintaining and improving health. We extracted project disbursement data from online databases, annual reports, and financial statements of the major international development agencies and philanthropic institutions including the World Bank, the Organisation for Economic Co-operation and Development’s (OECD’s) Creditor Reporting System, and the Bill & Melinda Gates Foundation; details on the agencies and institutions included are in the appendix (pp 28–33). The estimates of DAH include the expenses incurred to administer the grants and loans.

We classified estimates of how DAH funds were disbursed into ten mutually exclusive and collectively exhaustive health focus areas and 52 programme areas on the basis of project descriptions, project titles, including pandemic preparedness, and budget documents. Disbursement of DAH funds to single countries were identified as such, while global initiatives and administrative costs were classified separately. Administrative costs capture the operational cost of running projects—eg, staff salaries. The research and development funds that are included in our DAH estimates are those that are disbursed through international development agencies with the primary intent of the improvement and maintenance of health in low-income and middle-income countries. The DAH contributions towards human resources we captured here include indirect funding for human resources activities, such as per diems, and direct funding for human resources for health projects that invest in human resources activities, such as training, education, and policy development. The health focus areas included in this study are HIV/AIDS; tuberculosis; malaria; reproductive, maternal, newborn, and child health; other infectious disease; non-communicable diseases; sector-wide approaches; and health system strengthening. Detailed descriptions of the methods we used to isolate the disbursements of DAH funds for relevant health focus areas and preliminary estimates are in the appendix (pp 34–45) and elsewhere.7,25

The estimates presented here of DAH incorporated improvements in our methods compared with previous years, such as using additional project-level descriptions.
from the Creditor Reporting System for the allocation of disbursements channelled through non-governmental organisations and refinement of our keyword search list (appendix 34–42).

The Millennium Development Goals (MDGs) were eight development goals adopted by the UN in 2000. The goals, to be achieved by 2015, included the eradication of extreme poverty and hunger; achievement of universal primary enrolment; promotion of gender equality and empowerment of women; reduction in child mortality, HIV/AIDS, malaria, and other diseases; and improvement in maternal health. Like the SDGs, the MDGs included health specific goals and goals focused on other sectors indirectly linked to health. In our analyses, we examine spending over the duration of the MDGs, starting in 2000 up to 2015.

DAH data for 2018 and 2019 are preliminary estimates based on budget data and estimation. Detailed information on the sources of the budget data and the estimation approaches we used are provided in the appendix (pp 29–33).

Financial risk protection

We estimated catastrophic health spending estimates from World Bank World Development Indicators database for all years and countries for which data were available. Reliance on out-of-pocket spending has been shown to be associated with catastrophic health spending (also known as medical impoverishment), which defined by the World Bank World Development index as when a household spends more than 25% of annual household income on health.

Health spending in the future: 2018 to 2030 and 2050

We estimated gross domestic product (GDP); general government spending (across all sectors); government, out-of-pocket, and prepaid private health spending; and total DAH provided and received from 2018 to 2030 and 2050. The methods used for these projections draw heavily from our previous research, with the key updates being the improvement of the retrospective estimates on which these projections are based.

We generated each projection using ensemble modelling techniques, such that the estimates are the mean of 1000 estimated random draws. We determined model selection on the basis of autoregressive integrated moving average (ARIMA) modelling techniques. We aggregated total DAH across sources. We constructed a separate model that projected the fraction of total DAH that each recipient was expected to receive. As a country’s own GDP per capita increases, the fraction of total DAH received by the country is expected to go down. We also modelled when countries transitioned to being high-income and are no longer eligible to receive DAH.

All projections incorporated several types of uncertainty. We used ensemble modelling techniques to propagate model uncertainty. We took draws of the variance-covariance matrix of each estimate’s model to propagate parameter uncertainty. We based our projection models on the draws of the retrospective estimates to propagate data uncertainty. Finally, we added a random walk residual to each country’s and draw’s projection to propagate fundamental uncertainty—we, to mimic the inherent randomness of the observed data. We generated 95% uncertainty intervals (UIs) by taking the 2.5th and 97.5th percentile of the 1000 estimated random draws.

More details are in the appendix (pp 121–41).

Statistical analysis

We report all spending estimates in inflation-adjusted 2019 US$, although some data are also presented in 2019 purchasing-power parity-adjusted $ and proportion of GDP. We report spending estimates for Venezuela in 2014 US$ because necessary exchange rates for more recent years were not reliable. We evaluated health spending against key indicators relative to SDG3. In particular, we extracted estimates of incidence of HIV/AIDS, tuberculosis, and malaria from GBD 2017, and the universal health coverage service coverage index. We used different measures to report findings from our spending and outcomes analyses. For HIV/AIDS, we report spending per prevalent case, because a lot of HIV/AIDS spending is determined by the number of people undergoing treatment. For malaria, we report spending per capita, because as countries move towards elimination a lot of malaria spending is on surveillance. For tuberculosis, we report spending per incident case, because a lot of tuberculosis spending is determined by detection of incident cases. Population estimates, both retrospective and prospective were also extracted from the GBD 2017 study. We analysed the association between universal health coverage service index and pooled health spending by calculating the annualised rate of change in each metric from 2000 up to 2017. For our financial risk protection analysis, we used the estimates of catastrophic health spending and report catastrophic health spending estimates from the World Bank World Development Indicators database. We divided the extracted estimates by total domestic spending on health and then regressed on national income using loess regression methods. Annualised rate of change is only calculated for countries...
with more than 1 year of catastrophic health spending estimates and when catastrophic health spending was greater than zero.25,26 We report estimates of DAH from 1990 up to 2019 for low-income and middle-income countries. The data for 2018 and 2019 are preliminary estimates based on budget data and estimation. We compared DAH contributions over two periods: 2000 up to 2015 and 2015 up to 2019. We also analysed DAH by

| SDG target | Spending estimate | Existing unofficial financing target |
|------------|-------------------|--------------------------------------|
| **Target 3.1: by 2030, reduce the global maternal mortality ratio <7/0 per 100 000 livebirths** |
| 3.1.1: maternal mortality ratio | Reduce to <7/0 deaths per 100 000 livebirths by 2030 | DAH funding on maternal health was $1.5 billion for 135 low-income and middle-income countries in 2019 |
| 3.1.2: skilled birth attendance | Universal access (100%) | -- |
| **Target 3.2: by 2030, end preventable deaths of newborn babies and children younger than 5 years, with all countries aiming to reduce neonatal mortality to at least as low as 12 per 1000 livebirths and under-5 mortality to at least as low as 25 per 1000 livebirths** |
| 3.2.1: under-5 mortality | Reduce to <25 deaths per 1000 livebirths by 2030 | DAH on child health was $8.5 billion for 135 low-income and middle-income countries in 2019 |
| 3.2.2: neonatal mortality | Reduce to <12 deaths per 1000 livebirths by 2030 | DAH on child health was $8.5 billion for 135 low-income and middle-income countries in 2019 |
| **Target 3.3: by 2030, end the epidemics of AIDS, tuberculosis, malaria, and neglected tropical diseases and combat hepatitis, water-borne diseases, and other communicable diseases** |
| 3.3.1: HIV incidence | Eliminate by 2030 | Domestic spending in 2017 was $10.6 billion and DAH was $9.5 billion in 2019 for 135 low-income and middle-income countries |
| 3.3.2: tuberculosis incidence | Eliminate by 2030 | Domestic spending was $9.2 billion in 2017 and DAH was $1.7 billion in 2019 for 135 low-income and middle-income countries |
| 3.3.3: malaria incidence | Eliminate by 2030 | Domestic spending in 2017 was $2.6 billion and DAH was $1.1 billion in 2019 on malaria for 106 malaria-endemic countries |
| 3.3.4: hepatitis B incidence | Undefined | -- |
| 3.3.5: neglected tropical diseases prevalence | Eliminate by 2030 | -- |
| **Target 3.4: by 2030, reduce premature mortality from non-communicable diseases by a third through prevention and treatment and promotion of mental health and wellbeing** |
| 3.4.1: non-communicable disease mortality | Reduce by a third by 2030 | DAH on non-communicable disease was $0.7 billion for 135 low-income and middle-income countries in 2019 |
| 3.4.2: suicide mortality | Reduce by a third by 2030 | -- |
| **Target 3.5: strengthen the prevention and treatment of substance abuse, including narcotic drug abuse and harmful use of alcohol** |
| 3.5.1: substance abuse coverage | Undefined | -- |
| 3.5.2: alcohol use | Undefined | -- |
| **Target 3.6: by 2020, halve the number of global deaths and injuries from road traffic accidents** |
| 3.6.1: road injury mortality | Reduce by half by 2020 | -- |
| **Target 3.7: by 2030, ensure universal access to sexual and reproductive health-care services, including for family planning, information and education, and the integration of reproductive health into national strategies and programmes** |
| 3.7.1: family planning need met, modern contraception methods | Universal access (100%) | DAH on family planning was $1.2 billion for 135 low-income and middle-income countries in 2019 |
| 3.7.2: adolescent birth rate | Undefined | -- |

(Table 1 continues on next page)
### Table 1: Health-related goals, health indicators, health targets, and related spending for SDG3 targets

| SDG target | Spending estimate | Existing unofficial financing target |
|------------|-------------------|-------------------------------------|
| **(Continued from previous page)** | | |
| **Target 3.8: achieve universal health coverage, including financial risk protection, access to quality essential health-care services, and access to safe, effective, quality, and affordable essential medicines and vaccines for all** | | |
| § 3.8.1: universal health coverage service coverage index | Universal access (100%) | Domestic spending in 2017 and donor funding in 2019 on health was $7.9 trillion (95% II: 7.8–8.0) and $40.6 billion for 195 countries | $274–371 billion* per year in 67 low-income and middle-income countries;† $57.5 billion in 188 countries;‡ $113–223 billion* in 83 low-income and lower-middle-income countries;§ $75 per capita per year in 24 low-income countries and $110 per capita per year in 49 lower-middle-income countries;¶ $1101 per capita per year in 32 low-income developing countries, and $175§ per capita in 27 other low-income developing countries (required budget outlays)³² |
| § 3.8.2: financial risk protection | <10% or <25% of total expenditure or income | – | – |
| **Target 3.9: by 2030, substantially reduce the number of deaths and illnesses from hazardous chemicals and air, water, and soil pollution and contamination** | | |
| § 3.9.1: air pollution mortality | Undefined | – | $8.1 billion* per year in 67 low-income and middle-income countries⁶ |
| § 3.9.2: WaSH mortality, | Undefined | – | – |
| § 3.9.3: poisoning mortality | Undefined | – | – |
| **Target 3.a: strengthen the implementation of the WHO Framework Convention on Tobacco Control in all countries, as appropriate** | | |
| § 3.a.1: smoking prevalence | Undefined | DAH on tobacco control was $0.1 billion for 135 low-income and middle-income countries in 2019 | – |
| **Target 3.b: support the research and development of vaccines and medicines for communicable and non-communicable diseases that primarily affect developing countries; provide access to affordable essential medicines and vaccines, in accordance with the Doha Declaration on the TRIPS Agreement and Public Health, which affirms the right of developing countries to use to the full the provisions in the Agreement on TRIPS regarding flexibilities to protect public health, and, in particular, provide access to medicines for all** | | |
| § 3.b.1: vaccine coverage | Coverage of all target populations (100%) | DAH on immunisation was $3.1 billion for 135 low-income and middle-income countries in 2019 | $1.4 billion* per year in 67 low-income and middle-income countries⁶ |
| § 3.b.2: developmental assistance for research and health | Undefined | DAH on health was $40.6 billion for 135 low-income and middle-income countries in 2019 | – |
| § 3.b.3: essential medicines | Coverage of all target populations (100%) | DAH on immunisation was $3.1 billion for low-income and middle-income countries in 2019 | $1.4 billion* per year in 67 low-income and middle-income countries⁶ |
| **Target 3.c: substantially increase health financing and the recruitment, development, training, and retention of the health workforce in developing countries, especially in the least developed countries and small island developing states** | | |
| § 3.c.1: health worker density | Undefined | DAH on human resources was $4.0 billion for 135 low-income and middle-income countries in 2019 | $8.1 billion* per year in 67 low-income and middle-income countries⁶ |
| **Target 3.d: strengthen the capacity of all countries, particularly developing countries, for early warning, risk reduction, and management of national and global health risks** | | |
| § 3.d.1: international health regulation capacity | Undefined | DAH on human resources was $4.0 billion for 135 low-income and middle-income countries in 2019 | $8.1 billion* per year in 67 low-income and middle-income countries⁶ |

Spending data are reported in inflation-adjusted 2019 US$, unless otherwise indicated. Data for HIV/AIDS and tuberculosis are reported for 135 low-income and middle-income countries, for malaria are for 106 malaria-endemic countries, for universal health coverage for 195 countries and territories, and for DAH for each SDG indicator for 135 low-income and middle-income countries except malaria. Existing unofficial financing targets have been extracted from literature review. Low-income and middle-income countries are grouped as defined by 2019 World Bank classification. SDG=Sustainable Development Goal. DAH=development assistance for health. UNFPA=United Nations Population Fund. ICBD25=25th International Conference on Development. WaSH=water, sanitation, and hygiene. TRIPS=Trade-Related Aspects of Intellectual Property Rights. *2014 US$. †2017 US$. ‡2018 US$.
high-income; Latin America and Caribbean; north Africa and the Middle East; south Asia; southeast Asia, east Asia, and Oceania; and sub-Saharan Africa). Argentina is the only country in the World Bank category of low-income and middle-income countries to fall in the GBD high-income super-region; hence, in the present study we do not include Argentina, and its GBD super-region, in figures that disaggregate by GBD super-region. We report aggregate rates that reflect the group of countries or region as a whole, rather than a mean across the countries in that group or region.

We did all analyses using R (version 3.6.0) and Stata (version 15). All spending estimates used in this analysis are publicly available on the Global Health Data Exchange website.

Role of the funding source
The funder of this study had no role in study design, data collection, data analysis, data interpretation, or writing of the report. All authors had full access to all the data in the study, and AEM and JLD had final responsibility for the decision to submit for publication.

Results
Table 1 lists the SDG3 targets and the associated indicators for monitoring these targets, and reports existing estimates of financing needed for attaining these targets and our spending estimates. The targets and indicators were determined and agreed on by the member states of the UN, while the financing targets are unofficial estimates of resources needed produced by other researchers. Our estimates of disease-specific spending focus on domestic and DAH spending among 135 low-income and middle-income countries while spending on universal health coverage is measured for 195 countries and territories including high-income countries.

Globally, total health spending has increased since the start of the SDGs in 2015, reaching $7.9 trillion (95% UI 7.8–8.0) in 2017, and is expected to increase to $11.0 trillion (10.7–11.2) by 2030, and $16.7 trillion (16.0–17.4) in 2050, although with substantial disparity across countries. In 2017, in low-income and middle-income countries, $20.2 billion (17.0–25.0) was spent on HIV/AIDS, $10.9 billion (10.3–11.8) was spent on tuberculosis, and in 106 malaria-endemic countries, $5.1 billion (4.9–5.4) was spent on malaria. DAH was estimated to be $40.6 billion in 2019, the most recent year for which data are available. Estimates of DAH in 2019 were also available for the following SDG3 health areas: maternal health ($1.5 billion), neonatal and child health ($8.5 billion), HIV/AIDS ($9.5 billion), tuberculosis ($1.7 billion), malaria ($2.3 billion), non-communicable diseases ($735.0 million), family planning ($1.2 billion), tobacco control ($66.2 million), vaccine ($3.1 billion), and human resources ($4.0 billion). Spending for several SDG3 indicators, including hepatitis B incidence (3.3.4), substance abuse (3.5.1–5.2), road injuries (3.6.1), adolescent birth rate (3.7.2), and chemical and environmental pollution (3.9.1–9.3) do not have a large, comparable set of spending estimates for either development assistance or domestic spending and so are not included in these analyses.

In 2019, DAH for pandemic preparedness was estimated to be $374 million (<1% of total DAH). $2.4 billion (6%) of all DAH was for infectious diseases (other than HIV/AIDS, tuberculosis, and malaria) in 2019, but these funds were generally spent on treatment or disease focused efforts rather than pandemic preparedness more broadly. Despite DAH for pandemic preparedness being such a small fraction of total DAH, DAH for pandemic preparedness has grown faster than total DAH over the past 10 years. Since 2010, DAH for pandemic preparedness has more than doubled (increasing 8.1% annually from $185.8 million in 2010), while total DAH has increased by only 1.9% annually. The development agency that provided the most DAH for pandemic preparedness in 2019 was the WHO.

In 2017, global health spending per capita was $1048 (95% UI 1034–1062). Of this amount, 81.3% (80.7–81.8) was financed by domestic government and prepaid private health spending (table 2). Most health spending was in high-income countries, where health spending was $5307 (5262–3531) per capita in 2017, of which 86.0% (85.7–86.2) was government and prepaid private health spending. In 2017, spending in upper-middle-income countries was $487 (457–520) per capita and in lower-middle-income countries was $84 (76–93) per capita. Of $37 (36–39) spent per capita in low-income countries in 2017, 30.9% (28.5–33.6) was government and prepaid health spending.

Total HIV/AIDS spending disaggregated by financing source in 135 low-income and middle-income countries for 2000–17 is shown in figure 1A. For these countries, which included 93.9% (95% UI 91.2–96.3) of the global HIV incidence and 98.3% (98.2–98.4) of global HIV/AIDS deaths in 2017, total spending on HIV/AIDS was $4.3 billion (3.2–5.9) in 2000 and increased to $20.2 billion (17.0–25.0) in 2017, increasing at an annualised rate of 9.62% (8.86–10.35) between 2000 and 2017.10 Between 2000 and 2010, DAH for HIV/AIDS increased the fastest of all financing sources, growing at an annualised rate of 22.12%, although this annualised growth rate decreased to −1.64% between 2010 and 2017. In 2017, DAH for HIV/AIDS was $9.6 billion, with 49.4% being spent on grant administrations and global initiatives. In 2017, government spending on HIV/AIDS reached $9.7 billion (6.9–13.3), having increased at an annualised rate of 8.86% (8.40–9.34) since 2000. The amount sourced by out-of-pocket spending did not substantially increase, being $478.5 million (165.6–1069.9) in 2000 and $589.4 million (214.9–1347.9) in 2017 Total HIV/AIDS spending from
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|----------------|--------------------------------|---|

### Health spending per capita, 2019 US$

| World Bank income groups | 2017 | 2030 |
|--------------------------|------|------|
| **Global**               | 1048 (1034-1062) | 1285 (1257-1316) |
| **High-income**          | 5307 (5262-5351) | 6596 (6482-6708) |
| **Upper-middle-income**  | 487 (474-500) | 808 (780-835) |
| **Lower-middle-income**  | 84 (76-93) | 127 (114-141) |
| **Low-income**           | 37 (36-39) | 45 (42-48) |

### Health spending per capita, 2019 purchasing-power parity-adjusted US$

| World Bank income groups | 2017 | 2030 |
|--------------------------|------|------|
| **Global**               | 1418 (1393-1445) | 1816 (1766-1871) |
| **High-income**          | 5825 (5777-5872) | 7265 (7147-7385) |
| **Upper-middle-income**  | 1053 (1011-1100) | 1701 (1670-1730) |
| **Lower-middle-income**  | 289 (261-322) | 439 (391-496) |
| **Low-income**           | 119 (113-126) | 141 (132-152) |

### Total health spending per GDP, %

| World Bank income groups | 2017 | 2030 |
|--------------------------|------|------|
| **Global**               | 9.7% (9.6-9.9) | 10.5% (10.1-10.9) |
| **High-income**          | 12.2% (12.1-12.3) | 14.0% (13.5-14.4) |
| **Upper-middle-income**  | 5.7% (5.3-6.1) | 6.8% (6.0-7.6) |
| **Lower-middle-income**  | 3.9% (3.5-4.3) | 4.1% (3.6-4.6) |
| **Low-income**           | 5.3% (5.0-5.7) | 4.8% (4.4-5.3) |

### Total government health spending and prepaid private spending per total health spending, %

| World Bank income groups | 2017 | 2030 |
|--------------------------|------|------|
| **Global**               | 81.3% (80.7-81.8) | 82.9% (82.1-83.6) |
| **High-income**          | 86.0% (85.7-86.2) | 87.8% (87.5-88.1) |
| **Upper-middle-income**  | 66.9% (64.2-69.2) | 70.0% (69.6-76.1) |
| **Lower-middle-income**  | 41.6% (38.9-46.1) | 45.7% (40.1-51.0) |
| **Low-income**           | 30.9% (28.5-33.6) | 36.9% (33.9-40.4) |

### Central Europe, eastern Europe, and central Asia

| Country                  | 2017 | 2030 |
|--------------------------|------|------|
| **Armenia**              | 403 (364-447) | 538 (483-597) |
| **Azerbaijan**           | 304 (267-343) | 368 (321-418) |
| **Georgia**              | 307 (267-354) | 521 (449-606) |
| **Kazakhstan**           | 292 (249-340) | 344 (286-411) |
| **Kyrgyzstan**           | 82 (68-99) | 99 (80-122) |
| **Mongolia**             | 162 (129-188) | 226 (191-267) |
| **Tajikistan**           | 59 (48-74) | 68 (54-86) |
| **Turkmenistan**         | 585 (523-656) | 768 (683-859) |
| **Uzbekistan**           | 88 (72-106) | 124 (101-151) |
| **Albania**              | 364 (312-428) | 607 (516-725) |
| **Bosnia and Herzegovina** | 531 (474-593) | 838 (741-953) |
| **Bulgaria**             | 712 (657-774) | 1151 (1052-1280) |
| **Croatia**              | 900 (824-980) | 1165 (1011-1330) |
| **Czech Republic**       | 1585 (1515-1665) | 2308 (2120-2529) |
| **Hungary**              | 1107 (1042-1180) | 1445 (1343-1559) |
| **Montenegro**           | 672 (518-670) | 877 (674-1143) |
| **North**                | 433 (342-550) | 600 (466-759) |
| **Poland**               | 882 (827-945) | 1381 (1274-1498) |
| **Romania**              | 585 (535-641) | 955 (819-1104) |
| **Serbia**               | 465 (423-512) | 666 (596-743) |

| World Bank income groups | 2017 | 2030 |
|--------------------------|------|------|
| **Central Asia**         | 1332 (1276-1390) | 1726 (1656-1806) |
| **Armenia**              | 966 (822-1070) | 1287 (1156-1428) |
| **Azerbaijan**           | 1268 (1115-1430) | 1535 (1339-1747) |
| **Georgia**              | 870 (757-1003) | 1477 (1274-1718) |
| **Kazakhstan**           | 949 (811-1105) | 1118 (930-1339) |
| **Kyrgyzstan**           | 256 (210-309) | 307 (250-376) |
| **Mongolia**             | 563 (484-653) | 786 (664-929) |
| **Tajikistan**           | 247 (200-305) | 284 (224-358) |
| **Turkmenistan**         | 1417 (1265-1588) | 1858 (1654-2079) |
| **Uzbekistan**           | 479 (390-577) | 676 (548-823) |
| **Albania**              | 933 (799-1096) | 1554 (1321-1856) |
| **Bosnia and Herzegovina** | 1325 (1182-1471) | 2090 (1848-2378) |
| **Bulgaria**             | 1853 (1702-2012) | 2018 (1723-3327) |
| **Croatia**              | 1680 (1539-1831) | 2175 (1889-2484) |
| **Czech Republic**       | 2694 (2575-2829) | 3922 (3602-4298) |
| **Hungary**              | 2157 (2030-2299) | 2816 (2617-3039) |
| **Montenegro**           | 1555 (1598-2012) | 2029 (1559-2645) |
| **North**                | 1170 (925-1487) | 1662 (925-2051) |
| **Poland**               | 2003 (1879-2145) | 3125 (2894-3402) |
| **Romania**              | 1320 (1207-1446) | 2155 (1849-2492) |
| **Serbia**               | 1153 (1059-1281) | 1666 (1492-1858) |

(Continued on next page)
| Country          | 2017  | 2020  | 2017  | 2020  | 2017-2020 | 2017-2020 | 2017-2020 | 2017-2020 |
|------------------|-------|-------|-------|-------|-----------|-----------|-----------|-----------|
| **Southern Latin America** |       |       |       |       |           |           |           |           |
| Argentina        | 907   | 844   | 2006  | 1866  | 85%       | 87%       | 85%       | 85%       |
| Chile            | 1379  | 1829  | 2365  | 3236  | 9.2%      | 10.7%     | 9.2%      | 10.7%     |
| Uruguay          | 1582  | 2048  | 2218  | 2871  | 9.3%      | 10.3%     | 9.3%      | 10.3%     |
| **Western Europe** |       |       |       |       |           |           |           |           |
| Andorra          | 4491  | 4592  | 4712  | 5108  | 7.9%      | 9.4%      | 7.9%      | 9.4%      |
| Austria          | 5062  | 5602  | 5391  | 5966  | 10.4%     | 10.9%     | 10.4%     | 10.9%     |
| **Eastern Europe** |       |       |       |       |           |           |           |           |
| Belarus          | 373   | 470   | 1173  | 1478  | 5.9%      | 6.3%      | 5.9%      | 6.3%      |
| Estonia          | 1400  | 1812  | 2164  | 2802  | 6.4%      | 7.0%      | 6.4%      | 7.0%      |
| Latvia           | 1005  | 1278  | 1741  | 2213  | 6.0%      | 6.3%      | 6.0%      | 6.3%      |
| Lithuania        | 1139  | 1595  | 2171  | 3041  | 6.5%      | 7.4%      | 6.5%      | 7.4%      |
| Moldova          | 215   | 288   | 500   | 671   | 7.9%      | 8.9%      | 7.9%      | 8.9%      |
| Russia           | 574   | 681   | 1537  | 1825  | 5.3%      | 5.4%      | 5.3%      | 5.4%      |
| Ukraine          | 219   | 248   | 618   | 701   | 6.8%      | 7.0%      | 6.8%      | 7.0%      |
| **High-income Asia Pacific** |       |       |       |       |           |           |           |           |
| Brunei           | 690   | 766   | 1919  | 2130  | 2.4%      | 2.6%      | 2.4%      | 2.6%      |
| Japan            | 4290  | 5321  | 4784  | 5934  | 10.7%     | 12.0%     | 10.7%     | 12.0%     |
| Singapore        | 2729  | 3998  | 4293  | 5931  | 4.5%      | 5.6%      | 4.5%      | 5.6%      |
| South Korea      | 2138  | 3384  | 2993  | 4782  | 7.2%      | 10.2%     | 7.2%      | 10.2%     |
| **High-income North America** |       |       |       |       |           |           |           |           |
| Canada           | 4939  | 5061  | 5410  | 6159  | 10.7%     | 12.1%     | 10.7%     | 12.1%     |
| Greenland        | 6559  | 8140  | 4880  | 6057  | 11.8%     | 13.1%     | 11.8%     | 13.1%     |
| USA              | 10243 | 12734 | 10243 | 12734 | 16.4%     | 19.1%     | 16.4%     | 19.1%     |
| **Total government health spending and prepaid private spending per total health spending, %** |       |       |       |       |           |           |           |           |

(Note: Table 2 continues on the next page.)
### Health spending per capita, 2019 US$

| Country               | 2017 (US$) | 2020 (US$) | 2017 (2010) | 2020 (2010) |
|-----------------------|------------|------------|-------------|-------------|
| Belgium               | 4595       | 5387       | 4995        | 5857        |

### Health spending per purchasing power parity-adjusted $1

| Country               | 2017       | 2020       | 2017 (2010) | 2020 (2010) |
|-----------------------|------------|------------|-------------|-------------|
| Belgium               | 4995       | 5857       | 5552-6182   |             |

### Total health spending per GDP, %

| Country               | 2017 | 2020 |
|-----------------------|------|------|
| Belgium               | 10.4 | 11.7 |

### Total government health spending and prepaid private spending per total health spending, %

| Country               | 2017 | 2020 |
|-----------------------|------|------|
| Belgium               | 82.3 | 84.4 |

(Continued from previous page)

### Latin America and Caribbean

| Region                | 2017 (US$) | 2020 (US$) | 2017 (2010) | 2020 (2010) |
|-----------------------|------------|------------|-------------|-------------|
| Andean Latin America  |            |            |             |             |
| Bolivia               | 217 (184-258) | 288 (242-346) |             |             |
| Ecuador               | 524 (464-591) | 565 (496-646) |             |             |
| Peru                  | 339 (283-384) | 434 (369-514) |             |             |
| Caribbean             | 688 (588-750) | 909 (774-1065) |             |             |
| Antigua and Barbuda   | 1063 (935-1194) | 1447 (1232-1694) |             |             |
| The Bahamas           | 1967 (1841-2088) | 2119 (1946-2308) |             |             |

(2Table 2 continues on next page)
|                       | Health spending per capita, 2019 US$ | Health spending per capita, 2019 purchasing power parity-adjusted $ | Total health spending per GDP, % | Total government health spending and prepaid private spending per total health spending, % |
|-----------------------|-------------------------------------|---------------------------------------------------------------|-------------------------------|---------------------------------------------------------------|
| **2017**              | **2030**                             | **2017**                                                     | **2030**                       | **2017**                                                     | **2030**                       | **2017**                             | **2030**                             |
| Barbados             | 1180 (1119-1246)                    | 1066 (989-1152)                                             | 1224 (1160-1291)               | 1106 (1025-1195)                                            | 6.5%                           | 5.9%                           | 53.1%                           | 46.4%                             |
| Belize               | 287 (247-337)                       | 344 (297-401)                                               | 505 (435-593)                  | 605 (522-706)                                               | 5.7%                           | 5.9%                           | 73.7%                           | 74.6%                             |
| Bermuda              | 7027 (5973-8208)                    | 8358 (6986-9870)                                            | 4430 (3765-5174)               | 5269 (4404-6222)                                            | 6.4%                           | 5.5%                           | 90.1%                           | 91.8%                             |
| Cuba                 | 1208 (1129-1304)                    | 1724 (1566-1839)                                            | 3262 (3050-3522)               | 4659 (4231-5131)                                            | 11.3%                          | 14.5%                          | 89.8%                           | 91.7%                             |
| Dominica             | 493 (445-559)                       | 644 (539-774)                                               | 699 (631-780)                  | 915 (761-1099)                                              | 6.6%                           | 6.5%                           | 68.3%                           | 67.5%                             |
| Dominican Republic   | 426 (383-493)                       | 714 (650-828)                                               | 1037 (911-1174)                | 1689 (1450-1969)                                            | 5.7%                           | 6.6%                           | 54.5%                           | 60.3%                             |
| Grenada              | 528 (474-593)                       | 642 (553-748)                                               | 722 (692-867)                  | 937 (808-1093)                                              | 5.0%                           | 4.9%                           | 41.6%                           | 46.9%                             |
| Guyana               | 258 (226-299)                       | 621 (485-793)                                               | 456 (399-528)                  | 1097 (855-1400)                                             | 5.3%                           | 6.4%                           | 62.6%                           | 70.1%                             |
| Haiti                | 48 (40-57)                          | 50 (42-59)                                                  | 117 (99-139)                   | 122 (102-145)                                               | 5.2%                           | 4.9%                           | 19.3%                           | 17.3%                             |
| Jamaica              | 329 (280-389)                       | 395 (322-482)                                               | 583 (497-690)                  | 700 (571-855)                                               | 6.2%                           | 7.0%                           | 79.9%                           | 81.5%                             |
| Puerto Rico          | 1276 (1101-1487)                    | 1742 (1499-2034)                                            | 1611 (12390-1878)              | 2199 (1892-2568)                                            | 4.1%                           | 5.4%                           | 77.4%                           | 81.9%                             |
| Saint Lucia          | 549 (494-609)                       | 685 (595-781)                                               | 743 (668-824)                  | 926 (805-1056)                                              | 5.0%                           | 5.6%                           | 50.1%                           | 55.6%                             |
| Saint Vincent and the Grenadines | 335 (293-382) | 439 (377-507)                                               | 532 (465-606)                  | 696 (599-806)                                               | 5.2%                           | 5.0%                           | 65.5%                           | 67.8%                             |
| Suriname             | 414 (356-477)                       | 526 (439-637)                                               | 1044 (899-1203)                | 1328 (1107-1606)                                            | 6.6%                           | 7.7%                           | 73.4%                           | 75.5%                             |
| Trinidad and Tobago  | 1117 (1045-1352)                    | 1400 (1229-1577)                                            | 2247 (2096-2419)               | 2817 (2473-3174)                                            | 6.8%                           | 8.1%                           | 59.2%                           | 64.5%                             |
| Virgin Islands       | 1696 (1307-2117)                    | 2011 (1556-2585)                                            | 1696 (1327-2117)               | 2011 (1556-2585)                                            | 4.2%                           | 4.8%                           | 75.6%                           | 78.0%                             |
| **Central Latin America** |                       | **2017**                                                     | **2030**                       | **2017**                                                     | **2030**                       | **2017**                             | **2030**                             |
| Colombia             | 481 (416-555)                       | 709 (605-827)                                               | 1147 (992-1325)                | 1691 (1445-1973)                                            | 7.6%                           | 9.3%                           | 82.6%                           | 86.2%                             |
| Costa Rica           | 944 (869-1026)                      | 1189 (1045-1352)                                            | 1408 (1296-1530)               | 1733 (1559-2017)                                            | 8.1%                           | 8.9%                           | 78.2%                           | 80.3%                             |
| El Salvador          | 315 (275-366)                       | 411 (355-482)                                               | 650 (568-756)                  | 850 (733-996)                                               | 8.0%                           | 9.0%                           | 69.8%                           | 73.5%                             |
| Guatemala            | 265 (227-311)                       | 322 (270-382)                                               | 493 (424-530)                  | 600 (504-712)                                               | 5.9%                           | 6.0%                           | 44.3%                           | 48.0%                             |
| Honduras             | 185 (155-218)                       | 229 (189-275)                                               | 387 (324-457)                  | 479 (396-576)                                               | 7.6%                           | 7.7%                           | 47.5%                           | 50.9%                             |
| Mexico               | 562 (502-629)                       | 641 (569-721)                                               | 1358 (1035-1297)               | 1322 (1172-1486)                                            | 5.7%                           | 6.1%                           | 59.0%                           | 62.4%                             |
| Nicaragua            | 188 (161-222)                       | 210 (180-247)                                               | 516 (441-608)                  | 576 (492-677)                                               | 8.7%                           | 10.4%                          | 60.3%                           | 64.3%                             |
| Panama               | 1147 (1067-1235)                    | 1588 (1429-1766)                                            | 1883 (1752-2028)               | 2608 (2346-2899)                                            | 7.4%                           | 7.7%                           | 68.6%                           | 69.2%                             |
| Venezuela            | 107 (89-127)                        | 80 (64-101)                                                 | 555 (466-663)                  | 417 (334-526)                                               | 2.2%                           | 2.1%                           | 55.1%                           | 53.9%                             |

(Continued from previous page)
(Continued from previous page)

| Health spending per capita, 2019 US$ | Health spending per capita, 2019 purchasing power parity-adjusted $ | Total health spending per GDP, % | Total government health spending and prepaid private spending per total health spending, % |
|-------------------------------------|---------------------------------------------------------------|---------------------------------|-----------------------------------------------|
|                                     |                                                               |                                 |                                               |
| **North Africa and Middle East**    |                                                               |                                 |                                               |
| **Bahrain**                         |                                                               |                                 |                                               |
| 1230                                |                                                              |                                 |                                               |
| **Kuwait**                          |                                                               |                                 |                                               |
| 1556                                |                                                              |                                 |                                               |
| **Egypt**                           |                                                               |                                 |                                               |
| 147                                 |                                                              |                                 |                                               |
| **Iran**                            |                                                               |                                 |                                               |
| 555                                 |                                                              |                                 |                                               |
| **Iraq**                            |                                                               |                                 |                                               |
| 258                                 |                                                              |                                 |                                               |
| **Jordan**                          |                                                               |                                 |                                               |
| 348                                 |                                                              |                                 |                                               |
| **Kuwait**                          |                                                               |                                 |                                               |
| 500                                 |                                                              |                                 |                                               |
| **Lebanon**                         |                                                               |                                 |                                               |
| 339                                 |                                                              |                                 |                                               |
| **Libya**                           |                                                               |                                 |                                               |
| 465                                 |                                                              |                                 |                                               |
| **Morocco**                         |                                                               |                                 |                                               |
| 245                                 |                                                              |                                 |                                               |
| **Oman**                            |                                                               |                                 |                                               |
| 266                                 |                                                              |                                 |                                               |
| **Palestine**                       |                                                               |                                 |                                               |
| 290                                 |                                                              |                                 |                                               |
| **Qatar**                           |                                                               |                                 |                                               |
| 133                                 |                                                              |                                 |                                               |
| **Saudi Arabia**                    |                                                               |                                 |                                               |
| 1306                                |                                                              |                                 |                                               |
| **Sudan**                           |                                                               |                                 |                                               |
| 154                                 |                                                              |                                 |                                               |
| **Syria**                           |                                                               |                                 |                                               |
| 152                                 |                                                              |                                 |                                               |
| **Tunisia**                         |                                                               |                                 |                                               |
| 202                                 |                                                              |                                 |                                               |
| **Turkey**                          |                                                               |                                 |                                               |
| 163                                 |                                                              |                                 |                                               |
| **United Arab Emirates**            |                                                               |                                 |                                               |
| 145                                 |                                                              |                                 |                                               |
| **Yemen**                           |                                                               |                                 |                                               |
| 108                                 |                                                              |                                 |                                               |
| **South Asia**                      |                                                               |                                 |                                               |
| **Bangladesh**                      |                                                               |                                 |                                               |
| 40                                  |                                                              |                                 |                                               |
| **Bhutan**                          |                                                               |                                 |                                               |
| 108                                 |                                                              |                                 |                                               |
| **(Continued from previous page)**** |                                                               |                                 |                                               |

(2 Table continues on next page)
## Articles

### Health spending per capita, 2019 US$

| Country          | 2017 | 2020 | Health spending per capita, 2019 purchasing-powerparity-adjusted $ | Health spending per capita, 2019 purchasing-powerparity-adjusted $ |
|------------------|------|------|-------------------------------------------------|-------------------------------------------------|
| India            | 69   | 265  | (54-87)                                         | (509-353)                                        |
| Nepal            | 50   | 159  | (40-53)                                         | (62-100)                                        |
| Pakistan         | 37   | 115  | (29-46)                                         | (38-62)                                        |
| Southeast Asia,  | 365  | 757  | 4.9%                                            | 5.3%                                            |
| East Asia,        |      |      | (645-825)                                       | (1336-1683)                                     |
| Oceania          | 69   | 714  | 5.5%                                            | 5.0%                                            |
| China            | 455  | 875  | (400-517)                                       | (850-1132)                                      |
| North Korea      | 77   | 47   | (60-96)                                         | (68-110)                                        |
| Taiwan           | 147  | 3370 | (1311-1677)                                     | (1677-2172)                                     |
| Oceania          | 69   | 714  | 5.5%                                            | 5.0%                                            |
| Fiji             | 198  | 255  | (160-243)                                       | (200-221)                                       |
| Guam             | 1468 | 1607 | (1143-1903)                                     | (1236-2088)                                     |
| Kiribati         | 234  | 290  | (188-246)                                       | (195-282)                                       |
| Marshall Islands | 416  | 544  | (370-472)                                       | (468-648)                                       |
| Northern         | 752  | 806  | (585-992)                                       | (614-1071)                                     |
| Papua New Guinea | 54   | 82   | (44-64)                                         | (57-87)                                        |
| Solomon Islands  | 119  | 119  | (194-254)                                       | (209-293)                                       |
| Tonga            | 218  | 291  | (196-243)                                       | (235-329)                                       |
| Vanuatu          | 98   | 89   | (82-118)                                        | (89-154)                                        |
| Southeast Asia   |      |      | (74-107)                                        | (714-1071)                                      |
| Cambodia         | 83   | 236  | (67-101)                                        | (103-157)                                       |
| Indonesia        | 120  | 405  | (94-152)                                        | (166-277)                                       |
| Laos             | 58   | 172  | (48-70)                                         | (67-103)                                        |
| Malaysia         | 409  | 1960 | (353-475)                                       | (575-790)                                       |
| Maldives          | 988  | 2452 | (905-1081)                                      | (1430-1884)                                     |

| Total government health spending and prepaid private spending per total health spending, % |
|-------------------------------------------------|
| 36%                                             | 41%                                             |
| (56-48-80)                                      | (29-3-52-4)                                     |
| 31%                                             | 35%                                             |
| (22-7-42)                                       | (75-7-47-2)                                     |
| 33%                                             | 36%                                             |
| (23-5-43-5)                                     | (54-4-47-2)                                     |

(Continued from previous page)
### Articles

| Health spending per capita, 2019 US$ | Health spending per capita, 2019 purchasing-power-parity-adjusted $ | Total health spending per GDP, % | Total government health spending and prepaid private spending per total health spending, % |
|-------------------------------------|------------------------------------------------------------------|---------------------------------|-----------------------------------------------------------------------------------|
| **(Continued from previous page)**  |                                                                  |                                 |                                                                                   |
| Mauritius 606                      | 969                                                               | 1209                            | 2094                                                                              |
| (541-677)                           | (855-1106)                                                       | (1570-1462)                     | (1846-2389)                                                                       |
| Myanmar 52                         | 87                                                                | 279                             | 470                                                                               |
| (41-66)                             | (68-111)                                                         | (220-157)                       | (365-597)                                                                         |
| Philippines 133                     | 204                                                               | 374                             | 573                                                                               |
| (107-168)                           | (165-256)                                                        | (300-427)                       | (463-719)                                                                         |
| Sri Lanka 152                       | 204                                                               | 534                             | 718                                                                               |
| (124-182)                           | (164-247)                                                        | (417-641)                       | (579-871)                                                                         |
| Seychelles 754                      | 992                                                               | 1394                            | 1834                                                                              |
| (697-817)                           | (848-1161)                                                       | (1288-1510)                     | (1563-2146)                                                                       |
| Thailand 271                        | 388                                                               | 702                             | 1005                                                                              |
| (279-326)                           | (326-465)                                                        | (593-843)                       | (844-1205)                                                                        |
| Timor-Leste 86                      | 114                                                               | 197                             | 261                                                                               |
| (69-106)                            | (89-144)                                                         | (158-243)                       | (204-331)                                                                         |
| Vietnam 135                         | 208                                                               | 399                             | 614                                                                               |
| (111-164)                           | (167-257)                                                        | (327-484)                       | (492-758)                                                                         |
| **Sub-Saharan Africa**              |                                                                  |                                 |                                                                                   |
| Angola 90                           | 82                                                                | 205                             | 186                                                                               |
| (73-112)                            | (64-105)                                                         | (166-254)                       | (145-238)                                                                         |
| Central African 21                  | 26                                                                | 36                              | 45                                                                                |
| (18-23)                             | (22-31)                                                          | (32-41)                         | (38-54)                                                                           |
| Congo 59                            | 64                                                                | 175                             | 191                                                                               |
| (Brazzaville) (48-71)               | (49-84)                                                          | (143-210)                       | (147-248)                                                                         |
| Democratic Republic of the Congo 19 | 21                                                               | 30                              | 35                                                                                |
| (16-22)                             | (17-26)                                                          | (26-36)                         | (28-42)                                                                           |
| Equatorial Guinea 299               | 352                                                               | 711                             | 837                                                                               |
| (257-345)                           | (304-409)                                                        | (611-821)                       | (723-972)                                                                         |
| Gabon 289                           | 386                                                               | 702                             | 936                                                                               |
| (253-338)                           | (328-460)                                                        | (612-819)                       | (795-1115)                                                                        |
| **Eastern sub-Saharan Africa**      |                                                                  |                                 |                                                                                   |
| Burundi 30                          | 31                                                                | 70                              | 74                                                                                |
| (26-36)                             | (26-29)                                                          | (60-84)                         | (60-93)                                                                           |
| Comoros 74                          | 85                                                                | 150                             | 173                                                                               |
| (60-91)                             | (70-104)                                                         | (122-185)                       | (142-211)                                                                         |
| Djibouti 57                         | 63                                                                | 104                             | 113                                                                               |
| (48-69)                             | (51-79)                                                          | (87-124)                        | (92-142)                                                                          |
| Eritrea 24                          | 33                                                                | 33                              | 44                                                                                |
| (20-30)                             | (26-40)                                                          | (22-41)                         | (35-54)                                                                           |
| Ethiopia 31                         | 43                                                                | 81                              | 114                                                                               |
| (25-38)                             | (34-57)                                                          | (67-101)                        | (89-149)                                                                          |
| Kenya 96                            | 126                                                               | 185                             | 243                                                                               |
| (78-120)                            | (100-161)                                                        | (150-230)                       | (192-310)                                                                         |
| Madagascar 22                       | 28                                                                | 81                              | 102                                                                               |
| (12-27)                             | (22-26)                                                          | (65-100)                        | (80-130)                                                                          |
| Malawi 45                           | 46                                                                | 151                             | 154                                                                               |
| (41-51)                             | (40-55)                                                          | (136-169)                       | (132-184)                                                                         |
| Mozambique 34                       | 36                                                                | 91                              | 98                                                                                |
| (32-36)                             | (32-42)                                                          | (85-98)                         | (85-114)                                                                          |
| Rwanda 45                           | 60                                                                | 133                             | 175                                                                               |
| (39-53)                             | (46-78)                                                          | (114-157)                       | (136-229)                                                                         |

(Continued on next page)
### Health spending per capita, 2019 US$

| Country          | 2017 | 2030 |
|------------------|------|------|
| **Sub-Saharan Africa** |      |      |
| Botswana         | 498  | 738  |
| eSwatini         | 289  | 327  |
| Lesotho          | 129  | 172  |
| Namibia          | 553  | 630  |
| South Africa     | 533  | 673  |
| Zambia           | 66   | 67   |
| Zimbabwe         | 75   | 71   |
| **Western sub-Saharan Africa** |      |      |
| Benin            | 35   | 41   |
| Burkina Faso     | 41   | 55   |
| Cameroon         | 60   | 75   |
| Cape Verde       | 162  | 237  |
| Chad             | 29   | 32   |
| Côte d’Ivoire    | 24   | 38   |
| The Gambia       | 43   | 42   |
| Ghana            | 66   | 111  |
| Guinea           | 45   | 60   |
| Guinea-           | 60   | 71   |
| Bissau           | 49-73| 56-89|
| Liberia          | 65   | 74   |
| Mali             | 32   | 38   |
| Mauritania       | 61   | 80   |
| Niger            | 26   | 33   |
| Nigeria          | 78   | 85   |

### Health spending per capita, 2019 purchasing-power-parity-adjusted $

| Country          | 2017 | 2030 |
|------------------|------|------|
| **Sub-Saharan Africa** |      |      |
| Botswana         | 1017 | 1671 |
| eSwatini         | 773  | 873  |
| Lesotho          | 336  | 448  |
| Namibia          | 1100 | 1253 |
| South Africa     | 1195 | 1509 |
| Zambia           | 285  | 270  |
| Zimbabwe         | 25   | 51   |
| **Western sub-Saharan Africa** |      |      |
| Benin            | 97   | 114  |
| Burkina Faso     | 116  | 156  |
| Cameroon         | 158  | 196  |
| Cape Verde       | 349  | 509  |
| Chad             | 83   | 93   |
| Côte d’Ivoire    | 195  | 259  |
| The Gambia       | 162  | 158  |
| Ghana            | 208  | 349  |
| Guinea           | 110  | 149  |
| Guinea-           | 142  | 168  |
| Bissau           | 74   | 130  |
| Liberia          | 32   | 85   |
| Mauritania       | 61   | 80   |
| Niger            | 26   | 33   |
| Nigeria          | 78   | 85   |

### Total health spending per GDP, %

| Country          | 2017 | 2030 |
|------------------|------|------|
| **Sub-Saharan Africa** |      |      |
| Botswana         | 5.9  | 7.5  |
| eSwatini         | 7.1  | 6.9  |
| Lesotho          | 10.5 | 12.0 |
| Namibia          | 9.4  | 10.1 |
| South Africa     | 8.6  | 10.5 |
| Zambia           | 9.0  | 8.3  |
| Zimbabwe         | 9.0  | 8.3  |
| **Western sub-Saharan Africa** |      |      |
| Benin            | 7.9  | 12.4 |
| Burkina Faso     | 10.1 | 18.7 |
| Cameroon         | 8.9  | 18.7 |
| Cape Verde       | 11.1 | 11.7 |
| Chad             | 7.2  | 15.7 |
| Côte d’Ivoire    | 11.3 | 15.7 |
| The Gambia       | 7.2  | 15.7 |
| Ghana            | 8.3  | 11.7 |
| Guinea           | 10.6 | 16.7 |
| Guinea-           | 8.3  | 11.7 |
| Bissau           | 10.6 | 16.7 |
| Liberia          | 3.4  | 5.3  |
| Mauritania       | 3.4  | 5.3  |
| Niger            | 5.3  | 5.3  |
| Nigeria          | 3.4  | 5.3  |

### Total government health spending and prepaid private spending per total health spending, %

| Country          | 2017 | 2030 |
|------------------|------|------|
| **Sub-Saharan Africa** |      |      |
| Botswana         | 89.6 | 93.0 |
| eSwatini         | 59.2 | 58.9 |
| Lesotho          | 53.4 | 58.4 |
| Namibia          | 83.8 | 84.7 |
| South Africa     | 89.5 | 91.4 |
| Zambia           | 54.1 | 51.1 |
| Zimbabwe         | 44.6 | 67.0 |
| **Western sub-Saharan Africa** |      |      |
| Benin            | 27.8 | 33.0 |
| Burkina Faso     | 47.3 | 54.7 |
| Cameroon         | 15.9 | 17.9 |
| Cape Verde       | 67.1 | 70.8 |
| Chad             | 24.9 | 27.3 |
| Côte d’Ivoire    | 445.5| 49.3 |
| The Gambia       | 20.3 | 20.5 |
| Ghana            | 16.1 | 28.5 |
| Guinea           | 27.2 | 29.7 |
| Guinea-           | 27.1 | 29.7 |
| Bissau           | 15.6 | 29.7 |
| Liberia          | 10.5 | 14.1 |
| Mauritania       | 17.8 | 20.7 |
| Niger            | 31.1 | 40.2 |
| Nigeria          | 16.0 | 17.4 |

(Continued from previous page)
prepaid private sources increased from $140·6 million (26·9–430·0) in 2000 to $395·8 million (93·2–1166·8) in 2017. Since 2015, spending in low-income and middle-income countries to prevent and treat HIV/AIDS has increased from $10·6 billion (95% UI 8·3–13·9) to $12·0 billion (9·1–16·2) in 2017, primarily due to increases in government spending. Despite this growth, increases in spending levels have not been even across countries. 39 countries (including Zimbabwe and Kenya) spent less on HIV/AIDS in 2017 than in 2015, primarily because of reductions in DAH; a full list of country estimates is on the Global Health Data Exchange website.

The amount of HIV/AIDS spending per prevalent case for each region in 2017, and the fraction that is from each financing source is shown in figure 1B. Although more was spent in total in sub-Saharan Africa ($7 660·6 million [95% UI 6 736·2–8 883·6]), HIV/AIDS spending per prevalent case was highest in the GBD super-region north Africa and the Middle East ($2 987 [95% UI 1 857–4 589] per prevalent case), followed by Latin American and the Caribbean ($1 702 [1 113–2 640] per prevalent case). Per prevalent case, spending was lowest in south Asia ($297 [216–413] per prevalent case) and sub-Saharan Africa ($296 [263–338] per prevalent case). Although domestic governments contributed the most to spending on HIV/AIDS in most regions, financing was dominated in sub-Saharan Africa by DAH (54·9% [48·0–61·5] of total HIV/AIDS spending; figure 1B).

SDG indicator 3·3.1 is to eliminate HIV/AIDS incidence. Change in HIV/AIDS incidence and HIV/AIDS spending per capita for each low-income and middle-income country for 2000–17 is shown in figure 1C. For all but one (Venezuela) of 135 countries, HIV/AIDS spending per capita has increased since 2000. 73 countries had reductions in HIV/AIDS incidence, while 62 had increases in incidence. While sub-Saharan Africa has had major decreases in HIV incidence and increases in spending per capita, other super-regions have had increases in HIV incidence since 2015.

Table 2: Total health spending, by World bank income group, and GBD super-region, 2017 and 2030

| Health spending per capita, 2019 US$ | Health spending per capita, 2019 purchasing-power parity-adjusted $ | Total health spending per GDP, % | Total government health spending and prepaid private spending per total health spending, % |
|-------------------------------------|-------------------------------------------------|---------------------------------|--------------------------------------------------------------------------------------------|
| 2017                                | 2030                                            | 2017                            | 2030                                                                                       |
| São Tomé and Príncipe               | 113 (100–128)                                  | 136 (103–181)                   | 184 (156–208)                                                                               |
| Senegal                             | 65 (55–78)                                     | 76 (62–92)                      | 170 (142–203)                                                                               |
| Sierra Leone                        | 57 (58–84)                                     | 82 (67–101)                     | 223 (185–268)                                                                               |
| Togo                                | 41 (33–51)                                     | 54 (43–69)                      | 111 (89–127)                                                                               |

Estimates in parentheses are 95% uncertainty intervals. Venezuela estimates are presented as 2014 US$. GBD=Global Burden of Diseases, Injuries, and Risk Factors study. GDP=Gross Domestic Product.
Figure 1: HIV/AIDS spending in low-income and middle-income countries
(A) Total spending on HIV/AIDS by financing source, 2000 to 2017. (B) Breakdown of financing sources of HIV/AIDS spending and total HIV/AIDS spending per prevalent case, by GBD super-region, in 2017. (C) Annualised rates of change in HIV/AIDS prevalence and HIV/AIDS spending per capita, with each arrow showing one country moving from 2000 to 2017. Data are from all World Bank low-income and middle-income countries and spending estimates are presented in 2019 $US. Venezuela’s spending is presented in 2014 $US. Administrative expenses that are only shown in panel A reflect the operational expense of deploying the grant that is accrued in the donor country (eg, salaries of headquarters office staff). AFG=Afghanistan, ARM=Armenia, AZE=Azerbaijan, BFA=Burkina Faso, BLR=Belarus, BWA=Botswana, CHN=China, COM=Comoros, CUB=Cuba, DZA=Algeria, FSM=Federated States of Micronesia, GAB=Gabon, GBD=Global Burden of Diseases, Injuries, and Risk Factors study, GEO=Georgia, GMB=The Gambia, KHM=Cambodia, LBR=Liberia, MHL=Marshall Islands, MMR=Myanmar, MNG=Mongolia, MOZ=Mozambique, MUS=Maldives, MWI=Malawi, NER=Niger, PAK=Pakistan, RUS=Russia, TLS=Timor-Leste, VEN=Venezuela, YEM=Yemen, ZWE=Zimbabwe.
Figure 2: Tuberculosis spending in low-income and middle-income countries
(A) Spending on tuberculosis by financing source, 2000 to 2017. (B) Breakdown of financing sources of tuberculosis spending and total tuberculosis spending for each incident case, by GBD super-region, in 2017, with pie size proportional to spending per prevalent case of tuberculosis. (C) Annualised rates of change in tuberculosis incidence and tuberculosis spending per capita, with each arrow showing one country moving from 2000 to 2017. Data are from all World Bank low-income and middle-income countries and spending estimates are presented in 2019 US$. Venezuela’s spending is presented in 2014 US$. Administrative expenses that are only shown in panel A reflect the operational expense of deploying the grant that is accrued in the donor country (eg, salaries of headquarters office staff). ALB=Albania. ARM=Armenia. AZE=Azerbaijan. BGR=BG. BLR=Belarus. CHN=China. CIV=Côte d’Ivoire. ECU=Ecuador. ERI=Eritrea. GAB=Gambia. GBD=Global Burden of Diseases, Injuries, and Risk Factors study. GNB=Guinea-Bissau. GNT=Guatemala. GRD=Grenada. IRQ=Iraq. JOR=Jordan. KAZ=Kazakhstan. LBY=Libya. LKA=Sri Lanka. LSO=Lesotho. MDA=Moldova. MKD=North Macedonia. MM=Myanmar. MOZ=Mozambique. MRT=Mauritania. NAM=Namibia. NER=Niger. NGA=Nigeria. NIC=Nicaragua. PAK=Pakistan. PER=Peru. PHL=Philippines. PNG=Papua New Guinea. PRK=North Korea. RUS=Russia. RWA=Rwanda. SSD=South Sudan. STP=São Tomé and Príncipe. SWZ=eSwatini. TJK=Tajikistan. TLS=Timor-Leste. TUR=Turkey. VEN=Venezuela. YEM=Yemen.
out-of-pocket spending (42.8% [30.0–56.8]), while in sub-Saharan Africa, governments (39.0% [35.4–42.7]) and DAH (28.8% [26.6–30.7]) are the main sources of funding for tuberculosis.

SDG indicator 3.3.2 is to eliminate tuberculosis incidence. Change in tuberculosis incidence and tuberculosis spending per capita for each low-income and middle-income country for 2000–17 is shown in figure 2C. 122 (90%) of 135 low-income and middle-income countries saw decreases in tuberculosis incidence between 2000 and 2017, with the few exceptions being primarily in sub-Saharan Africa and southeast Asia, east Asia, and Oceania. We saw substantial variation in spending patterns over time, with 113 (84%) of 135 countries increasing spending and 22 (16%) countries decreasing tuberculosis spending per capita. For tuberculosis, in eSwatini, Lesotho, and Nicaragua, we observed a more than 12% annualised rate of change in per capita spending with varying annualised rates of change in incidence (0.89% decrease for eSwatini, 0.04% increase for Lesotho, 2.14% decrease for Nicaragua; figure 2C).

Total malaria spending disaggregated by financing source in 106 countries with local malaria transmission since 2000 is shown in figure 3A. 102 (96%) of 106 countries are low-income or middle-income countries, and 99·98% (95% UI 99·97–99·98) of malaria deaths in 2017 were in these 106 countries. Spending on malaria increased annually by 7.96% (95% UI 8.20–7.74) from $1.4 billion (1.3–1.5) in 2000 to $5.1 billion (4.9–5.4) in 2017. Domestic governments have been a relatively stable source of funding for malaria, with spending changing from $0.8 billion (0.7–0.9) in 2000 to $1.6 billion (1.5–1.8) in 2017. Meanwhile, spending from DAH and out-of-pocket spending have substantially increased, comprising 48.7% (46.3–50.8) and 16.1% (13.4–19.8) of total spending in 2017. DAH contributed $2.5 billion in 2017, while $0.8 billion (0.7–1.0) was contributed by out-of-pocket spending.

Since 2015, spending on malaria increased from $4.8 billion (95% UI 4.6–5.1) to $5.1 billion (4.9–5.4) in 2017, and spending in 63 (59%) of 106 countries increased (figure 3). Increases in prepaid-private spending, out-of-pocket spending, and DAH all contributed to these increases.

The amount of malaria spending per capita for each region in 2017 and the fraction that is from each financing source are shown in figure 3B. The spending per capita in sub-Saharan Africa was $3.21 (95% UI 3.01–3.44), which was much larger than in the other malaria endemic GBD super-regions. The least spending per capita was in central Europe, eastern Europe, and central Asia ($0·01 [0.08–0.13]). Government spending constitutes the most spending on malaria in the super-regions of central Europe, eastern Europe, and central Asia; Latin America and Caribbean; north Africa and the Middle East; and southeast Asia, east Asia, and Oceania. DAH made up a larger share of the spending on malaria for sub-Saharan Africa than the other communicable diseases tracked in this study.

SDG indicator 3.3.3 is to eliminate malaria incidence. Change in malaria incidence and malaria spending per capita for each of 102 malaria endemic low-income and middle-income country for 2000–17 are shown in figure 3C. This figure highlights the 13 of 102 countries that have eliminated malaria since 2000 and relatively constant malaria spending per capita. Additionally, all but three of the remaining 93 remaining malaria endemic low-income and middle-income countries—Djibouti, Niger, and Venezuela—have seen reductions in malaria incidence. Meanwhile, malaria spending per capita has increased in 78 of 106 malaria endemic low-income and middle-income countries with the largest spending increases in sub-Saharan Africa. We observed that in Myanmar and eSwatini, per capita spending increased at an annualised rate of more than 15% from 2000 to 2017, and annualised incidence rate of the disease decreased by more than 10% (figure 3C).

Change in universal health coverage service coverage index and pooled health spending per capita for 2000–17 across all 195 countries and territories is shown in figure 4. We saw a strong association between increases in pooled health spending per capita and progress towards universal health coverage, with countries in the GBD super-regions of sub-Saharan Africa, south Asia, and southeast Asia, east Asia and Oceania making large gains in universal health coverage as pooled spending per capita increased. Since 2015, spending increased in 166 (85%) of 195 countries and universal health service coverage increased in 188 (96%) countries (data not shown).

Although economic development is associated with reducing the domestic health financing burden that is funded by out-of-pocket spending, considerable variation exists in this association (figure 5A). For any one level of GDP per capita, a sizeable range of the fraction of domestic health spending is financed by out-of-pocket spending, suggesting that economic development does not solely determine the transition away from household financing. Additionally, large variation exists across countries in the association between rate of change in the fraction of domestic health spending that is out-of-pocket and the rate of change in the proportion of households with catastrophic health expenditure (figure 5B). A reliance on domestic government, prepaid, and pooled health financing is a means towards achieving universal health coverage and financial risk protection. Globally, this fraction contributing to universal health coverage ranges from 6.7% (95% UI 4.5–9.1) in Afghanistan to 100% (100–100) in Greenland (for more details see the WHO Global Health Data Exchange).

In 2019, $40.6 billion of DAH was disbursed and increased at an annualised rate of 1.74% since 2015 (figure 6A). Over 1990 to 2019, reproductive and
Figure 3: Malaria spending in 106 malaria endemic countries
(A) Total spending on malaria by financing source, 2000 to 2017. (B) Breakdown of financing source of malaria spending and the total malaria spending for each incident case, by GBD super-region, in 2017, with pie size proportional to spending per prevalent case of malaria. (C) Annualised rates of change in malaria incidence and malaria spending per capita, with each arrow showing one country moving from 2000 to 2017. Data are from all malaria-endemic World Bank low-income and middle-income countries and spending estimates are presented in 2019 US$. Venezuela’s spending is presented in 2014 US$. Administrative expenses are only shown in panel A reflect the operational expense of deploying the grant that is accrued in the donor country (eg, salaries of headquarters office staff). In panel C, dashed lines indicate countries that have eliminated malaria. World Bank low- and middle-income countries that have eliminated malaria since 2000 are Argentina, Armenia, Azerbaijan, Costa Rica, Georgia, Iraq, Kyrgyzstan, Morocco, Paraguay, Sri Lanka, Syna, Tajikistan, Turkey, and Uzbekistan. AFG=Afghanistan. BGD=Bangladesh. BTN=Bhutan. BWA=Botswana. CHN=China. COL=Colombia. COM=Comoros. CPV=Cape Verde. DZI=Djibouti. GMB=The Gambia. MMR=Myanmar. NPL=Nepal. PHL=Philippines. PRK=North Korea. SOM=Somalia. STP=São Tomé and Príncipe. SWZ=eSwatini. THA=Thailand. TLS=Timor-Leste. VEN=Venezuela. YEM=Yemen.
maternal health has consistently received substantial contributions, starting from $1·7 billion in 1990 to $4·8 billion in 2019. This change constitutes an annualised rate of change of 3·65%. However, since in 2004, DAH for HIV/AIDS has received the highest contributions of all health focus areas, peaking at $12·0 billion in 2012.

The annualised rate of change across the health focus areas for the time periods associated with the Millennium Development Goals (MDGs) and the SDGs are shown in figure 6B. Between 2000 and 2015, DAH increased by 7·75%, with disbursements for malaria increasing by 18·32%, for tuberculosis by 16·18%, and for HIV/AIDS by 13·02%. For the period 2015–19, the annualised growth rate for tuberculosis spending is 5·75%, for HIV/AIDS is 2·18%, and for malaria is 1·43%. Other key health focus areas that are funding progress on specific SDG indicators have had annual rates of change for 2015–19 of 4·25% for non-communicable diseases, 2·53% for reproductive and maternal health, and 0·66% for newborn and child health. The annualised growth rate of DAH for other infectious diseases has decreased for the period 2015–19, which is driven by the increased contributions that went towards the Ebola outbreak in 2014–15 and the subsequent re-alignment of resources after the Ebola crisis.

Based on past trends and associations, we estimate that an additional $238 (95% UI 209–267) per capita will be available for health globally in 2030 compared with 2017, with persistent disparities in spending between countries and across income groups (table 2). The proportion of health spending from pooled sources is expected to increase from 81·6% (81·6–81·7) in 2015 to 83·1% (82·8–83·3) in 2030. In high-income countries, health spending is expected to continue to increase, with expected annualised growth rates of 1·93% (1·77–2·10), reaching $6596 (6482–6708) per capita in 2030. For high-income countries, government and prepaid private spending as the financing sources of health is expected to increase to 87·8% (87·5–88·1) of total health spending. Health spending growth is expected to be fastest in lower-middle-income countries, where the
annual growth rate is expected to be 4·38% (4·13–4·66) between 2018 and 2030, with per-capita spending reaching $127 (114–141). In these countries, government spending is also expected to be the financing source with the fastest growth (5·12% [4·73–5·54]), with government and prepaid private health spending making up 45·7% (40·1–51·0) of overall spending. For countries currently considered to be low income by The World Bank, resources for health are expected to grow annually by 4·13% (3·75–4·55) between 2018 and 2030, although in per capita terms, annualised health spending growth is expected to be only 1·52% (1·15–1·93), reaching $45 (42–48) per capita in 2030.

Discussion

Disease-specific spending studies are valuable because they can provide policy makers and planners with insights into the financial burden created by specific diseases. This knowledge can subsequently be used in prioritisation, planning, budgeting, and evaluation of programmes; programme and policy interventions and development; and ultimately in better management of health systems. Our analysis quantified health sector spending and health spending on HIV/AIDS, tuberculosis, and malaria relative to outcomes, which are all priorities under SDG3. We also examined future availability of resources for health. Our results highlight that, globally, total health spending has increased since the state of the SDGs in 2015, reaching $7·9 trillion (7·8–8·0) in 2017, and is expected to increase to $11·0 trillion (10·7–11·2) by 2030, although with substantial disparity across countries. In 2017, in low-income and middle-income countries, an estimated $20·2 billion was spent on HIV/AIDS, $10·9 billion was spent on tuberculosis, and $5·1 billion was spent on malaria in endemic countries. Although both domestic government and DAH spending, has increased across these three diseases, the accompanied changes in outcomes have varied. We found that malaria had the most consistent decreases in outcomes across countries as spending has increased.

These health spending estimates enable further examination of the existing publicly available estimates of the financing required to achieve the SDG3 targets. Existing

![Figure 5: Out-of-pocket spending for health](https://www.thelancet.com/cmmsites/thelancet/downloads/figure5.png)

(A) Out-of-pocket spending as a share of total health spending, in 2017. (B) Change in proportion of households with catastrophic health spending versus change in proportion of domestic health spending that is out-of-pocket, 2000–17. Spending estimates are presented in 2019 US$. In panel A, estimates are plotted against GDP per capita with a loess regression line (span=0·95) and 95% uncertainty intervals shaded in grey. Timor-Leste is excluded from panel B because the World Bank estimates for 2000–17 showed that no households in the country had catastrophic health spending. BLR=Belarus. GBD=Global Burden of Diseases, Injuries, and Risk Factors study. GDP=Gross Domestic Product. HTI=Haiti. IRL=Ireland. JOR=Jordan. LAO=Laos. MDV=Maldives. MNG=Mongolia. NER=Niger. RWA=Rwanda. SRB=Serbia. THA=Thailand. ZMB=Zambia.
estimates suggest that the additional annual financing required to achieve SDG3 in 67 low-income and middle-income countries is $274 billion (progress scenario in which the attainment of goals is limited by countries’ health systems existing absorptive capacity), and to reach health system targets for SDG3 including scale-up of health workforce and infrastructure is $371 billion.\(^n\) Stenberg and colleagues estimated that to achieve SDG3 in 67 low-income and middle-income countries, the corresponding per capita spending would need to increase to $249 per year (progress scenario) or $271 per year (ambitious scenario)\(^n\) by 2030.\(^n\) Another study by the Sustainable Development Solutions Network that included 59 low-income countries estimated that to achieve SDG3 would cost, approximately $225 billion between 2019 and 2030, with a per capita cost of $86 for low-income countries and $134 for lower-middle-income countries as the minimum needed to provide care consistent with basic human rights.\(^n\) A few other studies have also generated estimates of the resources needed using different methods.\(^n\) Our estimates suggest that 81 (60%) of 135 low-income and middle-income countries have not yet reached health spending of $249 per capita, and our projections suggest that 75 countries might still not reach these goals by 2030.\(^n\)

Although these financing goals can be benchmarks to encourage more spending and increased health system efficiency, they do not ensure that SDG3 will be achieved. Ultimately, costing estimates like these need to be continuously improved to make them locally relevant and price appropriate, with realistic assumptions about health system inefficiency and the distribution of spending in a country, and to incorporate any challenges associated with preventing and treating disease in difficult to reach contexts.

For all three diseases for which a complete and comparable series of spending estimates exist in low-income and middle-income countries—HIV/AIDS, tuberculosis, and malaria—comparing the relative contributions from the different financing sources highlights interesting patterns. Governments contribute substantially across all three diseases. This observation is important because domestic resource mobilisation has received renewed interest as a key strategy for generating resources to finance the SDGs.\(^n\) While DAH contributions to malaria and HIV/AIDS are substantial, contributions to tuberculosis are smaller. This pattern brings into light long-standing concerns and debate regarding the allocation of DAH especially across health focus areas.\(^n\) These concerns and debate include whether the current criteria that rely mainly on a country’s level of development are the most appropriate to use for allocation, donor preference for implementing vertical programmes with short-term measurable effects, and prioritisation of such diseases to broader health system challenges. Also, the relative dependence on household out-of-pocket spending across the three diseases is notable, with the proportion of out-of-pocket spending for tuberculosis and malaria being much larger than the proportion for HIV/AIDS. Changes in policy, such as making HIV treatment available and free to all, has transformed management of care for HIV/AIDS and its by-source

![Figure 6: Development assistance for health](image-url)
funding distribution. Previous studies have shown that high out-of-pocket spending promotes health impoverishment.\(^a\)\(^b\)\(^c\)\(^d\) Hence, targeted efforts, such as public education campaigns on enrolment in national health insurance or free provision of services where appropriate, aimed at increasing the share of national health spending that is financed through pooled resources might improve financial protection.

The distribution of health spending by source across different regions also highlights heterogeneous health financing patterns for the three diseases globally. For some geographical regions (eg, Central Europe, eastern Europe, and central Asia, and sub-Saharan Africa), governments carry the primary burden of providing resources for these diseases, while in other regions (eg, southeast Asia, east Asia, and Oceania, and south Asia) the pattern of financing changes with the type of disease. Similarly, health spending globally has distinct patterns. In the high-income GBD super-region, spending by governments dominates, while in other super-regions, such as south Asia and sub-Saharan Africa, DAH and out-of-pocket spending are prominent. Preferably, resources for financing health care should be pooled to restrict the risk of health impoverishment for the population and delays in accessing needed care. Resources for financing health care could be pooled through government facilitation of the development of viable prepaid mandatory insurance programmes.

The association between spending on health and health outcomes is of interest to many audiences, especially because of the increases in spending on health that have been observed in the past two decades with the adoption of the MDGs and now the SDGs. Our results highlight a nuanced and complex picture regarding the link of the MDGs and now the SDGs. Our results highlight been observed in the past two decades. Although donor contributions will be important, the need to efficiently use existing resources should be highlighted. The comparison of the annualised rates of change of pooled spending per capita and universal health coverage index highlighted some of the best performers at each level of development. For example, Myanmar and Georgia show annualised growth in per-capita-pooled spending of more than 13%, which was associated with 2.14% annualised growth in universal health coverage index in Myanmar and 0.05% in Georgia. Peer-to-peer country learning might facilitate the transfer of best practices in both the delivery and administration of the health sector in countries that are not yet performing optimally with their available resources. The second annual Universal Health Coverage Financing Forum organised by the World Bank highlighted strategies such as strategic purchasing, improvement in data management systems, and organisational management that can be adopted to promote better efficiency for health.\(^e\)\(^f\)\(^g\) However, while important health gains can probably be made by increasing efficiency and investing in allied sectors, our future health spending estimates indicate that spending is expected to remain low in many countries, which raises concerns about the viability of reaching crucial SDG3 goals in those countries. In such countries, additional efforts to mobilise revenue, such as tax reforms where appropriate, are needed to ensure that adequate resources are available to support the achievement of the SDG3 goals.

Furthermore, the nuanced evidence on the scale-up of spending and improvements in health outcomes suggest a complex association between spending and health outcomes. This complexity highlights that, although more resources are likely to be needed to achieve SDG3, other constraints such as inefficient resource allocation, weak governance systems, drug shortages, and inadequate health workforce and management systems for health information in the broader health system that constrain
improvements in health outcomes will need to be addressed to achieve the SDG3 targets.

Finally, this study has also shown the gaps in current resource tracking efforts as they relate to the health-related SDGs. Most comparative data are available for the three diseases we studied but little comparable data on financing for most of the remaining indicators are available. This pattern might reflect funding priorities spurred by the MDGs. Given the broader orientation of the goals under the SDGs, a need exists for increased understanding on the financing for the other SDG3 targets.

Future research areas might include efforts targeted at financing health-related SDGs, such as hepatitis B, neglected tropical diseases, and non-communicable diseases, including substance abuse, alcohol use, road injury, adolescent birth, hazardous chemicals, and air, water, and soil pollution. Additionally, studies that aim to determine the types of spending that promote improvements in outcomes are needed to guide resource investments.

This study has several limitations. First, the data we used reported using different research units for each SDG3 indicator. HIV/AIDS, tuberculosis, and malaria spending estimates were available for a subset of total countries. As such, although the available data is meaningful and contributes to our knowledge of spending on the SDGs, a directly comparable analysis of global spending inclusive of all countries on these indicators is currently constrained by gaps in the available data. Also, multiple competing cost estimates exist, and so the existing financing targets that we found for comparison with our spending estimates often differed in geographical scope, methods, and currency. These comparisons require precise and context-specific costing estimates that incorporate realistic levels of efficacy. Second, some of the input data on global health spending used to generate total health spending estimates had questionable annual growth trends or did not provide direct information about the sources of the data. We used modelling methods to enable incorporation of these data but we acknowledge that challenges exist in terms of the quality of the available global health spending data. Additionally, we provided UIs for the estimates to provide information on the quality and precision of the estimates generated. Third, while the use of keywords to isolate relevant health focus and programme areas for our DAH analysis is the best existing strategy for a comprehensive effort, it relies heavily on the project description provided in the databases and in some instances might not accurately reflect what the funds actually contributed to. Fourth, presenting spending at disease level might not be the level of aggregation that is most relevant for ministries of health and disaggregating at facility level (primary, secondary, and tertiary) or at expenditure-item level (staff, commodities) might be more readily useful to them. We plan to provide estimates that include these levels of disaggregation in the near future. Notably, our analysis of spending and outcomes was not designed to detect causality, but was primarily a descriptive analysis of the associations between these two metrics. Therefore, our findings should not be interpreted as causal. Fifth, when forecasting health expenditures, we are unable to incorporate fundamentally new and different policies or innovations that are outside of the bounds of the observed data. Current estimates do not directly account for mass migration due to conflict and are only able to be incorporated on the basis of these events being reflected in the underlying covariates.

Furthermore, due to data availability, our analyses mainly covered four SDG priority areas. Spending on several SDG3 targets, including hepatitis B incidence, substance abuse, chemical and environmental pollution do not yet have a comparable set of spending estimates, which would prohibit analyses. Ideally, estimates on DAH and domestic spending on all the priority areas under SDG3 will provide a more comprehensive picture. Nonetheless, we believe that the data and estimates we have provided are an adequate first step in monitoring the spending for these key SDG3 areas.

Finally, while each set of spending estimates is consistent and comparable on its own, the input data vary enough between diseases that the spending estimates between diseases are not perfectly comparable. For example, the HIV/AIDS and malaria government spending estimates are modelled on the basis of tabulated data, generally reporting total spending or budgets, while government spending estimates for tuberculosis and for out-of-pocket malaria and tuberculosis spending were based on taking the product of unit cost and service coverage estimates. These distinct estimation strategies will drive some differences, with unit cost and service coverage estimates not comprehensively including inefficient spending that does not yield increases in service coverage.

As of publication of this Article, health systems throughout the world are stretched thin addressing the effects of coronavirus disease 2019 (COVID-19). Over the past 5 months it has become increasingly clear that, although not yet fully realised, both the health and economic losses caused by this novel coronavirus will be immense. Because these costs are not yet known in full and because the pandemic is ongoing, the effects of COVID-19 have not been considered in the financing projections reported in this Article. If these costs lead to reductions in health spending as nations focus inward on economic woes or if these costs can be a catalyst for investment in robust public health systems and in shared vision of global health security remains to be seen.

The link between spending and changes in outcomes remains complex, and realistic country-specific spending targets for most SDG3 indicators do not exist. Understanding how much is being spent and where crucial gaps exist are the first steps in providing evidence for a global dialogue about how much investment is needed for health, where it should come from, and where and on whom it should be spent. Using the resources...
available more efficiently and addressing broader health system constraints to service delivery, such as inadequate health information management systems, weak governance systems, shortages in health workforce and pharmaceuticals, are crucial if substantial progress is to be made towards achieving the health-related SDGs. A key tenet underlying the SDG era is that “no one is left behind”. To achieve this goal by 2030, current efforts must expand to include the tracking of spending in all of these areas, increasing resources, and spending those resources more efficiently.

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Declaration of interests

C A T Antonio reports personal fees from Johnson & Johnson (Philippines) outside of the submitted work. A E Berman reports personal fees from Biosense Webster outside of the submitted work. S L James reports grants from Sanoft Pasteur and future employment with Genentech/Roche outside of the submitted work. J J Jóźwiak reports personal fees from VALEANT, ALAB Laboratara, and AMGEN outside of the submitted work. M J Postma reports grants and personal fees from MSD, GlaxoSmithKline (GSK), Pfizer, Boehringer Ingelheim, Novavax, Bristol-Myers Squibb, AstraZeneca, Sanoft, Seqirus, and IQVIA; grants from Bayer, BioMerieux, WHO, the European Union? FIND, Antilope, DRTI, LDPD, and BUD; personal fees from Novartis, Pharmert, and Quintiles; holds stocks in Ingress Health and Pharmacoeconomics Advice Groningen; and is advisor to Asc Academics outside of the submitted work. M Savic reports employment with the GSK group of companies and hold restricted shares in the GSK group of companies. M G Shrome reports grants from Mercy Ships and Dannon Runyon Cancer Research Foundation outside of the submitted work. J A Singh reports personal fees from Crealta/Horizon, Medisys, Fidia, UBM LLC, Trio health, Medscape, WebMD, Clinical Care Options, Clearview Healthcare Partners, Putnam Associates, Spherix, Practice Point communications, the National Institutes of Health and the American College of Rheumatology, and is simply speaking and then participating in the Speaker’s Bureau at Simply Speaking; owning stock options in Amarin Pharmaceuticals and Viking Pharmaceuticals; membership in the FDA Arthritis Advisory Committee, Veterans Affairs Rheumatology Field Advisory Committee, and in the Steering Committee of Outcome Measures in Rheumatology (OMERACT), and acting as Editor and the
Director of the UAB Cochrane Musculoskeletal Group Satellite Center on Network Meta-analysis outside of the submitted work. All other authors declare no competing interests.

Data sharing
Data used for this study were extracted from publicly available sources that are listed in the appendix. Further details are available on the Global Health Data Exchange website.

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