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GLOBAL HEALTH**



# Estimating Chinese bilateral aid for health: an analysis of AidData's Global Chinese Official Finance Dataset

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Working Paper • March 2021

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## SUGGESTED CITATION

McDade KK, Kleidermacher P, Mao W, Yamey G. *Estimating Chinese bilateral aid for health: an analysis of AidData's Global Chinese Official Finance Dataset*. The Center for Policy Impact in Global Health. Duke Global Working Paper Series: number 38, March 2021. Available at: <https://centerforpolicyimpact.org/estimating-chinese-bilateral-aid-for-health-an-analysis-of-aiddatas-global-chinese-official-finance-dataset/>

## ACKNOWLEDGEMENTS

The authors would like to thank the Margolis internship program for its funding for this research work and Heather Hille for copyediting and designing this paper.

## KEY WORDS

Aid for health, bilateral aid, China, emerging donors, health aid, development assistance for health, foreign aid for health

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## ● ACRONYMS

<b>CRS</b> .....	Creditor Reporting System
<b>DAC</b> .....	Development Assistance Committee
<b>DAH</b> .....	Developmental Assistance for Health
<b>HSS</b> .....	Health systems strengthening
<b>IATI</b> .....	International Aid Transparency Initiative
<b>IHME</b> .....	Institute for Health Metrics and Evaluation
<b>ODA</b> .....	Official development assistance
<b>OECD</b> .....	Organization for Economic Co-operation and Development
<b>OOF</b> .....	Other official flow
<b>TUFF</b> .....	Tracking Underreported Financial Flows

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## ● EXECUTIVE SUMMARY

**Background:** China's annual global health aid has increased substantially since the 2000s. Unlike many donors, China has no official aid reporting obligations, nor does it voluntarily disclose detailed aid information. Because of this, several third parties have attempted to estimate China's health aid footprint. Unfortunately, current estimates use varied definitions of health aid, geographic regions, and time spans. These distinct and differing methodological approaches make it difficult to compare Chinese aid to aid from other donors. Our study builds on previous tracking efforts and takes them further by creating a standardized estimate using commonly accepted definitions of aid and frameworks for categorizing health projects.

**Methods:** We categorize AidData's Chinese Official Finance Dataset health-related projects according to health aid frameworks from the Organization for Economic Co-operation and Development (OECD) and the Institute for Health Metrics and Evaluation (IHME). Only projects that comply with the definition of official development assistance are included. We analyze data by both total project count and financial value to assess priority health aid areas for China. We also provide an updated estimate for projects with missing financial values in AidData's database by applying the median cost of similar projects to projects with missing financial values, allowing for comparison with other donors.

**Findings:** Between 2000 and 2014, China funded 620 health-related aid projects, which made up more than 20% of its total aid project portfolio. Most of these projects were located in Africa. According to the OECD framework, the priority focus areas of these 620 projects were: basic health care, such as medical teams, drugs, and, medicine (n=244, 36%); malaria control (118, 19%); medical services, such as specialty equipment, infrastructure, and services (108, 17%); and basic health infrastructure (78, 13%). According to the IHME framework, health-system strengthening accounted for 70% (n=434) of total projects, primarily due to China's contributions to human resources for health, infrastructure, and equipment. The only other major allocation under the IHME framework was malaria (n=118, 19%). When we estimate missing financial values, we note that China was the fourth largest health aid donor to African countries from 2008-2014, after the US, UK, and Canada.

**Interpretation:** These findings enable a better understanding of Chinese health aid in the absence of transparent aid reporting. We believe such an understanding could lead to better coordination, collaboration, and resource allocation for both donors and recipient countries.

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## 1 INTRODUCTION

Foreign aid, or official development assistance (ODA), has historically come from wealthy western nations that are part of the Organization for Economic Cooperation and Development's (OECD) Developmental Assistance Committee (DAC). Established in 1961, the OECD DAC sets the guidelines for what is, and is not, considered ODA.<sup>1</sup> Members of the DAC commit to reporting their aid statistics in a standardized way via the Creditor Reporting System (CRS). In addition to the OECD platform, other platforms for aid reporting have emerged in recent years, such as the International Aid Transparency Initiative (IATI). However, the OECD remains the primary platform used to track aid flows in a systematic way.

While the OECD CRS is the best reflection of aid flows that is available, it has a major gap: it tracks aid flows only from DAC donors. Flows from donors outside of DAC (the "non-members") are not formally tracked. Although many non-members voluntarily report their aid statistics to the DAC, some key development funders, such as China, do not. Therefore, the figures presented via the CRS underestimate total development assistance contributions.

Although China has intermittently published aggregate foreign aid flows in two white papers, one in 2011 and the other in 2014, these white papers had very little detail and were not comparable to standardized methods of tracking aid.<sup>2,3</sup> Not surprisingly, in 2020 China scored a 1.2/100 on the Aid Transparency Index, the lowest score of any donor.<sup>4</sup> Because of such data gaps and an increasing realization of the important role China plays in financing development, several third parties have attempted to track and/or estimate Chinese aid. In particular, several estimates have tried to capture China's global health footprint.

While such estimation efforts are very useful for gaining insight into China's health aid portfolio, the different methodological approaches taken by different scholars can lead to very different results. In a 2020 analysis, McDade and Mao identified several key differences across five Chinese health aid estimates.<sup>5</sup> Importantly, they noted that each estimate used a different definition of "health aid." The scope of what is or is not considered health aid can either overinflate or underestimate China's contributions. Several studies reviewed did not adhere to commonly used definitions of aid nor did they align their estimates with accepted reporting standards, for example, health sector programmatic focus areas. Additionally, McDade and Mao noted that existing studies vary substantially in terms of geographies covered, time spans included, and underlying data sources.

This study aims to build on previous tracking efforts and advance the field of estimation of China's health aid in several ways. We provide an estimate of Chinese global health aid disaggregated by health sector focus areas in a way that is comparable to health aid from other donors. To do this, we adhere to accepted definitions of aid and we apply two commonly accepted health aid classification frameworks to categorize health aid projects by focus area: the Institute for Health Metrics and Evaluation (IHME) and OECD frameworks. These two frameworks track aid through categorization systems that break down the specific focus of aid projects. We also use different approaches to estimate financial values for projects with missing financial information to understand the total contribution of Chinese global health aid.

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## 2 METHODS

This study expands on the current understanding of China's health aid portfolio. We analyze project-level data using methods consistent with accepted health aid standards and norms. We provide a financial estimate for China's health aid portfolio (2000-2014) based on our standardized methods for counting and categorizing health aid. Below, we include our data sources, inclusion and exclusion criteria, the frameworks used to categorize health aid, our coding process, estimation methods, and methods for comparing China's aid with aid from other donors.

### Data sources

This study uses AidData's Global Chinese Official Finance Dataset (2000-2014, 1.0) to analyze health-related aid projects. AidData uses the Tracking Underreported Financial Flows (TUFF) method to identify officially funded Chinese development projects.<sup>6</sup> The TUFF methodology identifies projects for its database using four sources: 1) English and Chinese language news reports; 2) documents from Chinese ministries, embassies, and economic and commercial counselor offices; 3) aid and debt information management systems of finance and planning ministries in counterpart countries; and 4) case study and field research undertaken by scholars and non-governmental organizations.<sup>7</sup> AidData then triangulates identified data for consistency. It also performs a quality control process to prevent double counting.<sup>6</sup>

### Inclusion and exclusion criteria

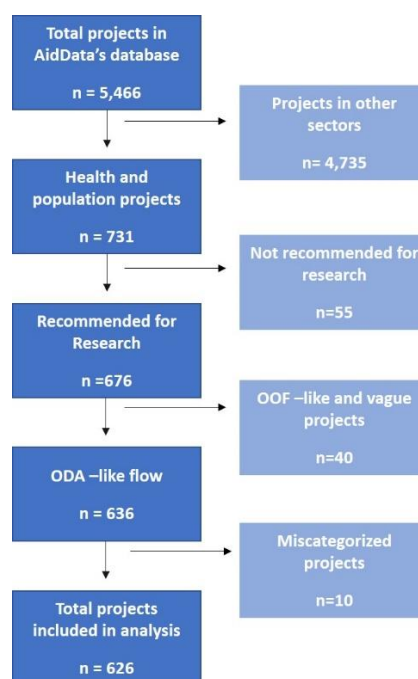
Our inclusion criteria for projects in AidData's database are based on the below criteria:

- 1) Health aid projects are those labeled with sector codes 'health' (120) or 'population policies/programmes & reproductive health' (130). We used this measure of health aid since it is standard practice among the literature for tracking health aid in the OECD CRS, as outlined in Grépin et al.<sup>8</sup> Health aid does not include allied sectors that may still impact health, such as water, sanitation, and hygiene.
- 2) Only projects that are labelled 'recommended for research' within AidData's dataset were included. AidData uses this measure to mark projects that have either been completed, are in the implementation phase, or are pipeline commitments (i.e., a firm commitment in writing with proof of backed funds.)<sup>7</sup> While AidData's 'recommended for research' projects are not the exact same as disbursements, using projects that meet this criterion can be considered a proxy for aid disbursements. The 'recommended for research' label also ensures that projects that are linked together are not inadvertently double counted.<sup>6</sup>
- 3) Only projects that meet the requirements for ODA (referred to as ODA-like) are reported, unless otherwise noted. AidData used the OECD criteria for classifying flows to ensure its definition of aid is consistent with commonly accepted standards.

Figure 1 presents a flow chart to illustrate the number of projects screened, included, and excluded for analysis according to the above criteria. We reviewed all projects that met the criteria for inclusion for accuracy prior to conducting our analysis. Specifically, we sought to identify any projects that may have been miscategorized as a health aid project. For example, in the database, a project entitled 'China funds construction of childcare center in Djibouti' (ID# 431) was classified as a health project. However, since the project's primary focus was to provide childcare and library services, this seems more fitting as an education or other social infrastructure type project. Therefore, we marked this project for exclusion. Through this quality control process, we identified 10 projects that we believed to be miscategorized and therefore we

excluded these 10 from our coding exercise and analysis. We have listed project identifications (IDs), titles, and our rationale for exclusion for these 10 projects in [Appendix 1](#).

**Figure 1. Projects included in analysis**



## Disaggregating health sub-sectors

AidData aims to align its database with OECD CRS standards, which enables more meaningful comparisons across donors. However, one limitation of the AidData database is that it only codes projects at the sector level (e.g., health, education, etc.), rather than the more detailed sub-sector level (e.g., malaria control, tuberculosis control, etc.). While the sector level codes are useful, this high-level categorization limits one's understanding of the priorities or scope of projects that make up aid in the health sector.

To disaggregate health sector coded projects further to understand China's global health priorities, we apply two common frameworks for analyzing health aid projects: the OECD CRS purpose code system and IHME's development assistance for health (DAH) classification structure:

The OECD CRS purpose code classification uses five-digit purpose codes that identify the "specific areas of the recipient's economic or social development the transfer intends to foster."<sup>9</sup> Purpose codes within the health sector include activities such as malaria control, medical research, and family planning. See [Appendix 2](#) for the full list of health-aid related purpose codes in the OECD CRS framework.

The IHME database exclusively tracks DAH. IHME's classification system categorizes health aid by health focus or program area.<sup>10</sup> See [Appendix 3](#) for an overview of IHME's classification system. Due to limited project descriptions in the AidData database, we only coded projects according to IHME's highest level of categorization (e.g., HIV, malaria) and not according to its more disaggregated program area fields (e.g., HIV treatment, HIV care and support). However, we were able to code projects at a more disaggregated level for 'health system strengthening and sector-wide approaches.' For example, a substantial number of projects, such as those related to medical teams, fall under 'human resources for health' while some infrastructure projects fall under 'other health systems strengthening.' Distinguishing between these two subcategories is useful due to the wide scope of the category as a whole.



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We have opted to analyze all health projects using both frameworks for several reasons. First, IHME is broader in nature, with only 10 focus areas, while OECD has 23 narrower categories. Second, these two frameworks are the most common ways to classify and report health aid and we wanted our findings to be comparable with accepted standards and reporting. While these two categorization systems differ in what types of focus areas are tracked, they each use a mutually exclusive coding system, meaning that a project cannot be considered in more than one category.

## Coding process

All coded projects were independently reviewed by two team members for quality control. We conducted a pilot test to ensure the coding methodology for relevant health sub-sectors/focus areas (i.e., the IHME and OECD frameworks) could be consistently applied. 10% of all projects eligible for inclusion were part of the pilot process. Once the team was satisfied that i) all pilot coded projects were coded appropriately, and ii) the codebook reflected all of our underlying assumptions, all remaining projects were then coded. If a project's description was unclear, the coder would visit the additional sources cited in the project description when available. While most projects in AidData have short descriptions with active hyperlinks to their underlying sources, the level of detail available for projects can be inconsistent.

To code a project, we first read the project description noting any keywords such as "hospital," "staffing," "equipment," "malaria," etc. These keywords, along with overall descriptions, provide context on the project's purpose. After analyzing the project description, each project was assigned to its most relevant OECD and IMHE code. Although a project may focus on many dimensions of the health system, each project can only be assigned to one category within each framework (i.e., categories are mutually exclusive.) According to OECD guidelines, "within each sector, care should be taken to allocate supplies, equipment and infrastructure to the most specific code available."<sup>9</sup> Therefore, each project should be coded based on the project's primary focus. For example, if a project is related to building hospitals for malaria, this project would be categorized under the CRS classification as 'malaria control' rather than 'medical services' or 'basic health infrastructure' since malaria control is the primary purpose of the of the project. See [Appendix 4](#) for a sample project entry that would be categorized under malaria control (OECD CRS) and malaria (IHME).

There are a few OECD CRS codes that are fairly similar in nature and require additional nuance to determine the most appropriate code. Therefore, we developed a clear approach for navigating these types of projects to ensure consistency in our coding methods. Details on our approach, assumptions, and resources used to make such determinations can be found in [Appendix 5](#). Additionally, although these two frameworks are fairly different, we found considerable overlap between many of the codes. We outline this overlap in [Appendix 6](#).

## Estimating missing financial values

AidData lacks financial values for many health projects in the database: of the 626 projects included in our analysis, only 36% had an assigned financial value. We did not know if these data were missing at random. To estimate missing financial values, we took several approaches.

First, we calculated the median and average values for projects that had financial data according to a project's sub-sector and flow type. Average values are likely to overestimate financial resources for a project given the skewed nature of the available data while median values may underestimate project values. Ultimately, we opted to use median project values in our analysis since this is the most conservative approach. More details on our approach to using median values is outlined below.

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The median value for projects was determined by two key factors: sub-sector (e.g., malaria control) and flow type (e.g., grant). Our rationale for choosing these two dimensions is that a malaria grant is more likely to be similar to another malaria grant than it is to be similar to something such as a loan for a tertiary hospital. We identified median values based on available financial data according to the sub-sectors from each framework and came up with very similar results.

Occasionally, there was no financial data available for a particular flow type. In this circumstance, we used the median value for a similar flow type within the same sub-sector (e.g., median for a malaria grant in place of a free-standing technical assistance project for malaria.) If no financial data was available for an entire sub-sector, we used the median value for that particular flow type agnostic of sub-sector (e.g., if no health personnel projects had any financial data, the median value for each project's flow type was used.) Overall, 46 projects required this type of correction under the OECD framework while only 13 projects for the IHME framework required this correction.

Then we conducted a regression analysis. The advantage of this method is that we can predict values for missing projects based on several key factors that could affect a project's value, such as year disbursed, recipient region, sub-sector, and flow type. However, there are several factors that might reduce the reliability of regression models including the skewed distribution of the available financial data, using a relatively small dataset to predict a larger one, and the limited number of control variables. Although we did not ultimately use this regression analysis in the main body of our paper, we provide details on the output of this analysis in [Appendix 7](#).

## **Comparing China's aid to aid from other bilateral donors**

To compare China's aid against aid from other bilateral donors, we used data from the OECD CRS database. AidData's database does not account for disbursements by bilateral donors to multilateral funds and therefore our estimate and comparisons reflect bilateral aid directly to countries only. ODA bilateral disbursements to countries for sector codes 'health' (120) or 'population policies/programmes & reproductive health' (130) were summed to ensure no multilateral support was included. Disbursement data is only available after 2002 and therefore our cross-donor comparisons span a shorter time horizon (2002-2014) than the rest of the analysis.

All financial values are shown in millions of constant 2014 \$US. For financial data related to donors other than China, we downloaded data in current prices and converted to constant 2014 \$US using the same deflators included in the AidData database.

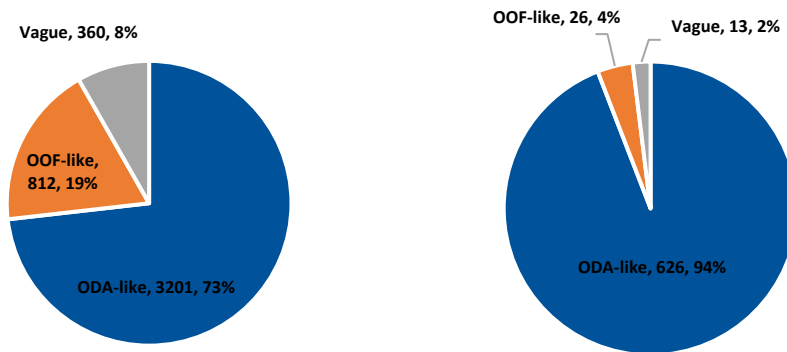
### 3 RESULTS

We present our findings in three parts. First, we present an analysis of China’s health aid portfolio based on project counts to show areas of focus and priority within China’s aid portfolio. Second, we supplement our project count analysis with an estimation of China’s health aid portfolio from a financial standpoint, using median values for projects with missing financial data. Finally, we compare China’s health aid portfolio to that of other DAC donors.

#### China’s health aid portfolio by project count

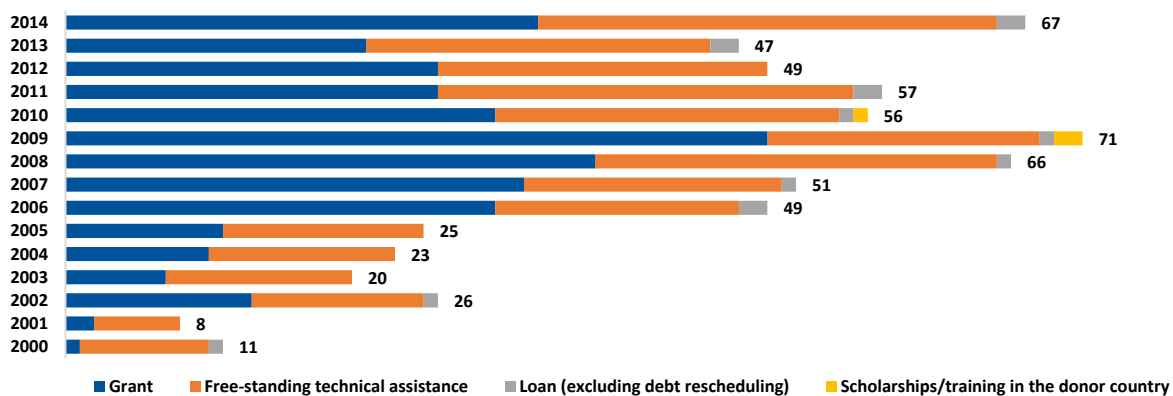
Over the period 2000-2014, health projects were substantially more aid-based (i.e., ODA-like in nature) than China’s broader portfolio (Figure 2). Over this time period, 94% of health projects met criteria of ODA-like whereas only 73% of projects for China’s total portfolio met aid criteria. Among China’s ODA-like projects, one-fifth were related to the health sector. The health sector had the most ODA-like projects out of any sector: government and civil society and education followed closely behind at 13% and 11%, respectively.

Figure 2. All sector projects (left) compared to health sector projects (right) by flow class, 2000-2014



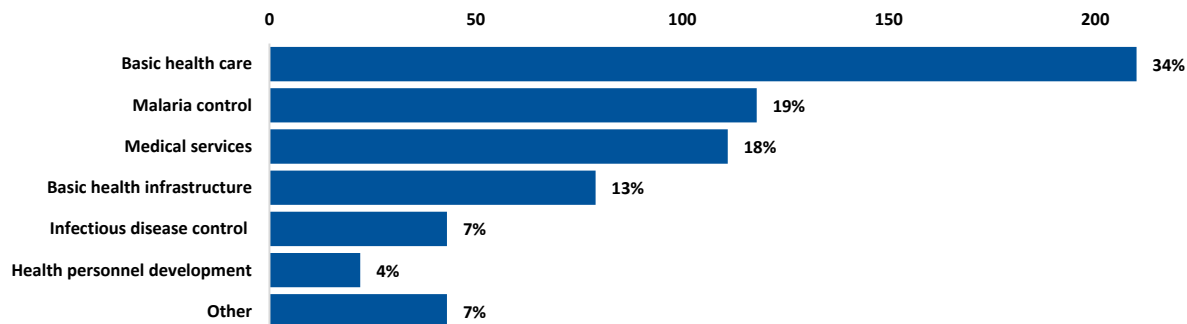
The volume of health projects increased over time from 2000 to 2014 (Figure 3). In particular, there was a substantial uptick in projects beginning in 2006. Over 80% of all health aid projects occurred in 2006 or later. These projects were overwhelmingly in the form of grants (52%) and technical assistance (45%). Loans, although they generally have higher financial value than grants or technical assistance, made up a very small portion of the overall project portfolio (2%).

Figure 3. Health projects over time, 2000-2014



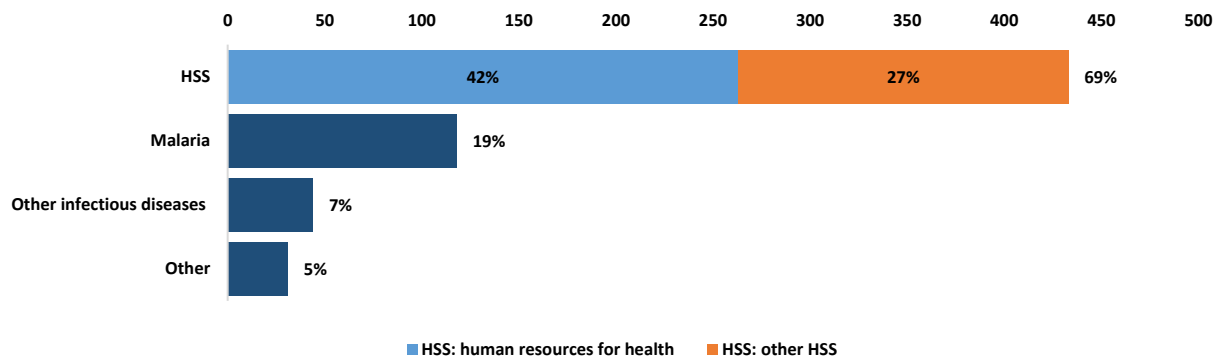
There are very clear areas of focus for China’s health aid portfolio. Using the OECD CRS framework, 90% of all projects fell into just five sectors: basic health care, malaria control, medical services, basic health infrastructure, and infectious disease control (Figure 4). These priority areas have shifted over time. For example, although basic health care has consistently been a top sub-sector, as the number of projects in other sub-sectors have increased over time its total share of projects has declined (from 73% of all health projects in 2000 to 31% in 2014.) Priority sub-sectors also differ by region. In Africa, basic health care is the primary focus area (37% of all projects) while in Asia and the Pacific, medical services (i.e., tertiary level) make up the largest share.

**Figure 4. Priority sub-sectors according to the OECD framework, 2000-2014**



Looking at health focus areas from the IHME framework shows an even more concentrated area of focus. Three sub-sectors alone made up 95% of all health aid: health system strengthening (HSS), (69%), malaria (19%), and other infectious diseases (7%) (Figure 5). HSS focused on human resources for health via Chinese medical teams and infrastructure-related investments (i.e., other HSS). While HSS made up most of all projects from 2000-2014, its share of total projects declined over time due to the increase in projects in other sub-sectors, particularly malaria (from 82% of total health aid projects in 2000 to 42% in 2014.) HSS was the top sub-sector for each region. However, in Africa and Asia, HSS focused primarily on human resources for health while in the Pacific, projects were predominately in other forms of HSS, such as infrastructure.

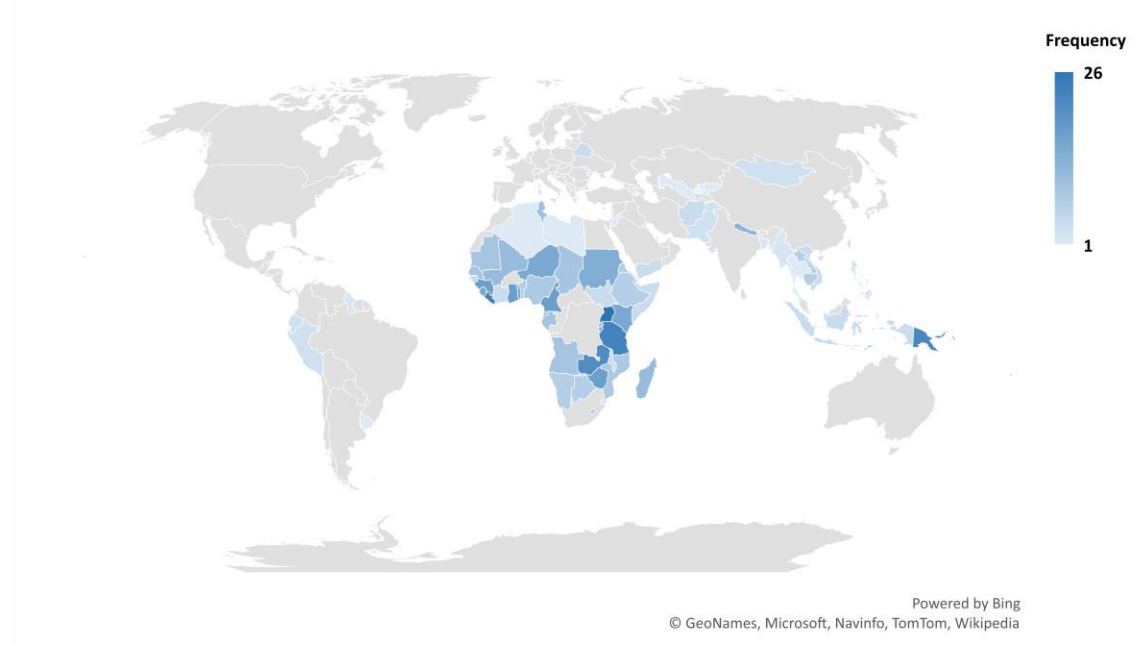
**Figure 5. Priority sub-sectors according to the IHME framework, 2000-2014**



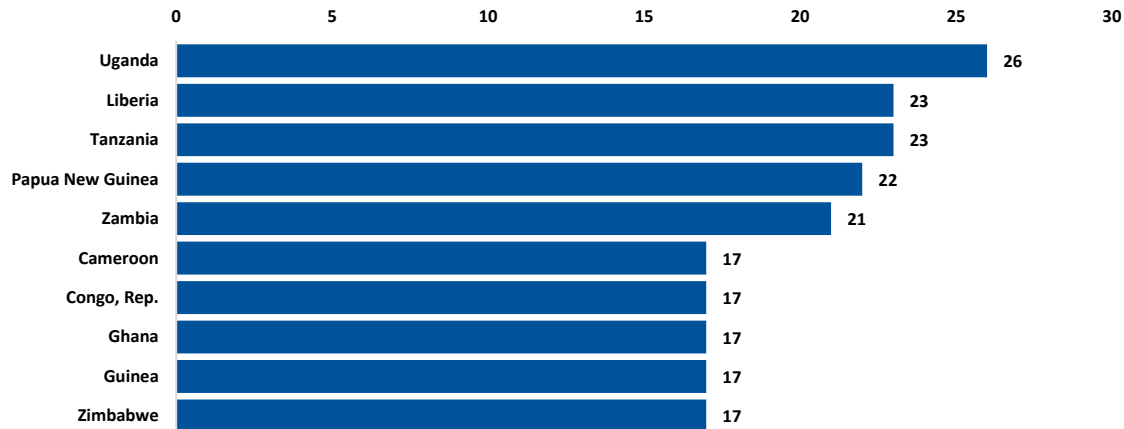
All regions had a Chinese health aid project (Figure 6). However, African countries had most of these projects (80%), followed by Asia (11%) and the Pacific (5%). Among the top health aid recipients, only one country lies outside of Africa (Papua New Guinea) (Figure 7).

Chinese health aid projects in Africa dramatically increased beginning in 2006. Before 2006, the average annual number of health aid projects in Africa was 14. After 2006, that number rose to 47.

**Figure 6. Distribution of health aid projects, 2000-2014**



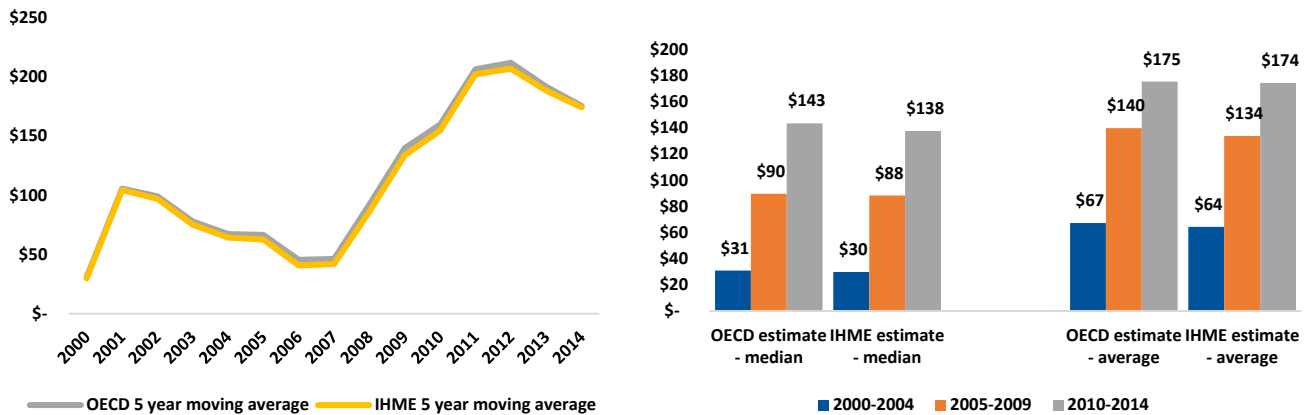
**Figure 7. Top recipients of Chinese health aid projects, 2000-2014**



### Financial estimates of China's health aid portfolio

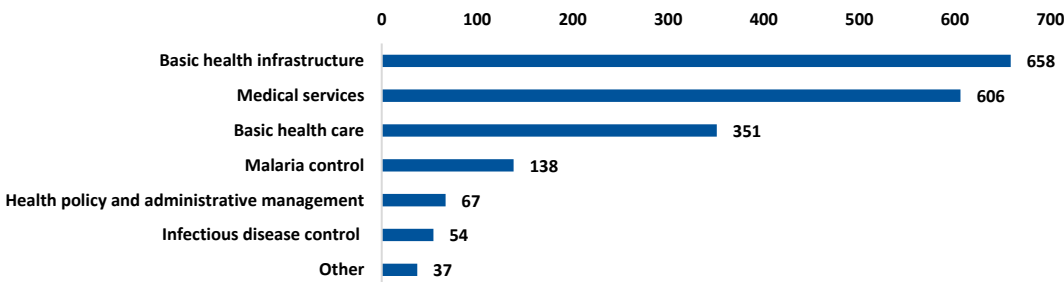
Chinese health aid reached nearly \$2 billion over the 15-year period of 2000-2014: this figure was slightly higher using the medians for the OECD framework (\$1.91 billion) than for the IHME framework (\$1.86 billion). As mentioned, annual Chinese health aid increased since 2000, although year to year estimates have been erratic. [Figure 8](#) shows a five-year moving average of both OECD and IHME estimates (left) and a breakdown of the median and average annual values according to each estimation method (right).

**Figure 8. Chinese health aid estimates, 2000-2014**



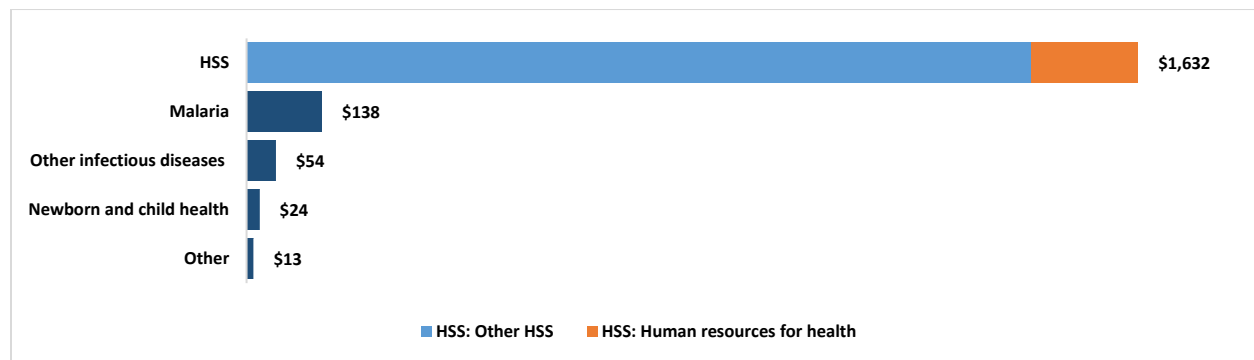
Financial estimates using the OECD framework show concentration in three key sub-sectors (Figure 9). The top three sectors contributed to 85% of total aid from 2000-2014: basic health infrastructure (34%), medical services (32%), and basic health care (18%). These sub-sectors are also among the top when it comes to total project counts, although infrastructure-related projects, despite being fewer in number, are more costly per project.

**Figure 9. Priority sub-sectors, OECD framework, 2000-2014 (\$US millions)**



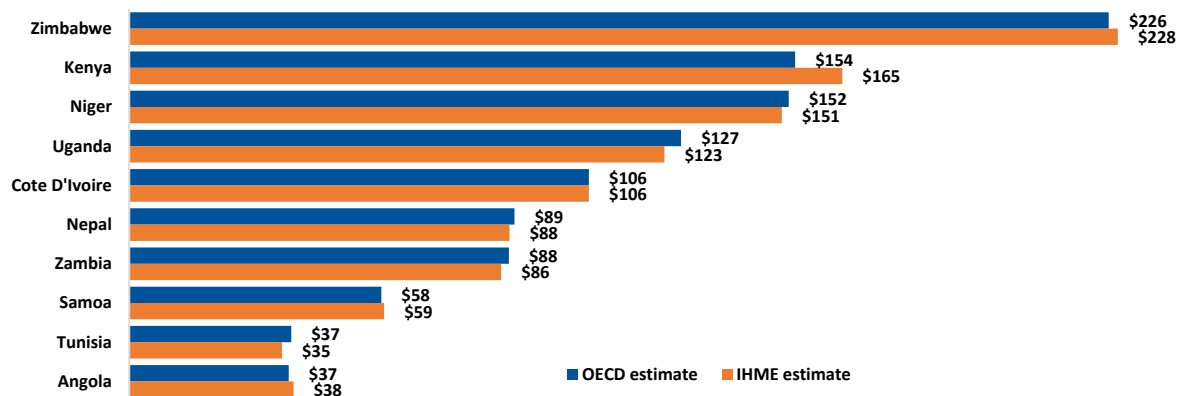
Financial estimates using the IHME framework reinforce that HSS is the primary sub-sector for health aid, making up 88% of the total (Figure 10). However, despite making up fewer projects, other infrastructure makes up 77% of the total financial estimate, likely due to health-related infrastructure projects being included in this category. Malaria was also a priority area, but made up only 7% of total health aid.

**Figure 10. Priority sub-sectors, IHME framework, 2000-2014**



Africa received the most financial health aid of any region (82% of the total), followed by Asia (9%) and the Pacific (4%). Overall, Africa, Asia, and the Pacific received an increasing amount over time while the distribution varies for the Middle East, Latin America and the Caribbean, and Central and Eastern Europe. All but one of the top ten recipient countries is located in Africa (Samoa) (Figure 11).

**Figure 11. Top recipients of Chinese health aid, 2000-2014**

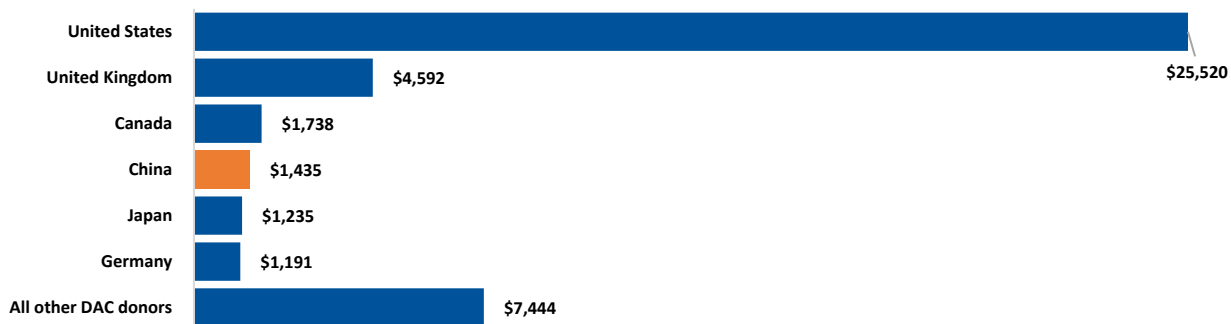


### Comparison with bilateral health aid from DAC donors

From 2002-2014, China was not a top contributor to global health aid compared with other donors. Although substantial, its financial investments would place it behind 13 other DAC donors. China contributed similar levels to Ireland, Denmark, Korea, Italy, and Switzerland.

However, given China’s strong geographic focus in Africa, if we restrict our comparison to bilateral health aid in Africa, the picture changes dramatically. Compared with DAC donors, China was the fourth largest health aid donor in Africa from 2002-2014 (Figure 12). This ranking holds true using estimations for both the OECD and IHME frameworks. The US is by far the largest bilateral health donor in African countries, followed by the United Kingdom. However, China had very similar levels of health aid to Canada, Japan, and Germany.

**Figure 12. Cumulative bilateral aid to African countries, 2002-2014**



Values shown in millions, \$US constant 2014. China estimate is based on OECD framework (\$1,435). However, the estimate using the IHME framework would still hold the same ranking (\$1,390). All other DAC donors includes 23 donors.

**Note:** AidData’s database does not account for disbursements to multilateral funds and therefore, our estimate and comparisons reflect bilateral aid to countries only

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## 4 DISCUSSION

This study aims to build upon previous tracking efforts and create a more disaggregated and standardized account of China's global health aid footprint. Our analysis found that health is a major focus area of China's aid portfolio, making up the largest share of projects out of all sectors. Chinese health aid increased over time, from 2000-2014, with a particularly sharp uptick after 2006. This increase is primarily due to China's health aid to Africa, which makes up most of its support (over 80% of both projects and financial support from 2000-2014.) This increased focus on health in Africa coincides with China's first white paper on "China's African Policy," which highlights China's intention to increase its support to the region, including health-related support.<sup>11</sup> Specifically, the white paper highlights China's intention to continue sending medical teams, provide medicines and equipment, train medical personnel, assist with treatment and control of infectious diseases, and train personnel on how to use traditional Chinese medicines.<sup>11</sup> The Forum on China-Africa Cooperation (FOCAC), established in 2000, is another regularly occurring platform where China pledges its support and highlights its intended health assistance for the succeeding years.<sup>12</sup> Health aid has played a major role in previous FOCAC summits and continues to do so today.<sup>12</sup>

We use two different methods for assessing health sub-sectors and focus areas: the OECD CRS framework and the IHME framework ([Appendix 2](#) and [Appendix 3](#)). Although these two frameworks have important differences, when we used them for our analysis they told similar stories: infrastructure support and medical teams are primary areas of focus for China's health aid. These focus areas are distributed across several OECD codes depending on the type of infrastructure project (e.g., a primary care facility or a tertiary hospital) or the level of services provided (e.g., basic health care or specialized services) (see [Appendix 5](#) for details.) However, these same infrastructure and medical team projects are focused on one IHME code: HSS. Infrastructure-related projects are fewer in number, but are more expensive per project, and therefore rank higher when we look at China's health aid portfolio from a financial point of view than a project count point of view.

Using both frameworks to estimate missing project values gives fairly similar estimates of nearly \$US2 billion in cumulative total Chinese health aid across the 15-year time period we assessed. However, this similarity between the results of using the two different frameworks may be due to the method we used to estimate missing values, using sub-sector and flow type as our primary inputs. We recognize that this is an imperfect solution and could underestimate or overinflate aid flows. However, we know that missing financial data dramatically underestimates the Chinese health aid footprint and we consider our approach an improvement on the currently available estimates. We also present findings according to project counts as another way to measure Chinese health aid priorities and trends decoupled from financial values.

When compared with other donors, China's global health footprint is not substantial. However, given China's geographic concentration in Africa, when compared to bilateral flows of DAC donors in the region, China emerges as a major health aid provider. China provided similar levels of support to Africa as other top donors of the Millennium Development Goals era, such as Canada, Japan, and Germany. Year on year comparisons are challenging when looking at Chinese aid and DAC donor aid. AidData does not track disbursements in the same manner as the OECD CRS. However, we used the best proxy available for disbursements (i.e., only projects that have a formal commitment, are being implemented, or are completed.) Therefore, we focus our assessment on cumulative aid rather than on a single snapshot in time.

Our study has similar findings to the results of other studies of Chinese health aid, which also show that China is clearly becoming an emerging donor in health with increasing health aid commitments<sup>13,14,15,16</sup> particularly concentrated in the African region.<sup>16,17</sup> Within China's unique health aid portfolio, our study showed that there is a strong focus on HSS and malaria, a finding seen in other studies.<sup>16</sup> Both our study



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and a study by Liu et al. found that the proportion of loans out of China's total support was lower for health aid compared with the proportion to other sectors.<sup>14</sup> However, our financial estimates of China's health aid are generally lower than estimates by other studies, mainly because we restrict our analysis to the bilateral health ODA that excludes multilateral support, and we exclude broader health related support such as water, sanitation, and hygiene.<sup>16,17</sup> Grépin and colleagues used "average" for missing values while we used median which would be less affected by outliers.<sup>16</sup>

A major value of this paper is that we restrict the scope to adhere to commonly accepted standards of aid (health ODA, exclusive of allied sectors for health and non-ODA flows) and we classify projects in a systematic way that aligns with other aid tracking efforts (OECD and IHME). Our paper also has the longest time span (15 years) of any existing health-specific analyses and has a global geographic scope.

## 5 CONCLUSION

Chinese health aid generally increased from 2000-2014 with some fluctuations, and most Chinese health aid projects were in Africa. Infrastructure projects and medical teams were the primary focus of China's health aid. Our estimate of total health aid from China between 2000 and 2014, of around \$US2 billion, represents an attempt to account for projects in the AidData database that were missing financial values. China is estimated to be the fourth largest health aid donor to African countries from 2008-2014, after the US, UK, and Canada. These findings enable a better understanding of Chinese health aid in the absence of transparent aid reporting. We believe that such an understanding could lead to better coordination, collaboration, and resource allocation for both fellow donors and recipient countries.

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## ● APPENDIX 1. PROJECTS EXCLUDED FROM ANALYSIS AFTER QUALITY CONTROL MEASURES

Although these projects fit our inclusion criteria (recommended for research and ODA-like), after careful review, we did not deem that they were appropriately categorized within the health sector. We have provided project ID numbers, titles, and rationale for exclusion in [Table 1](#). We excluded these projects from our final counts and estimates.

**Table 1. Projects excluded from our analysis**

Project ID	Title	Rationale for exclusion
431	China funds construction of childcare center in Djibouti	More appropriate in education sector
35226	Chinese embassy aids Vietnam 90 million VND for AO/dioxin victims	More appropriate in humanitarian sector
33231	Chinese medical team goes to Sri Lanka for tsunami relief	More appropriate in humanitarian sector
38918	Chinese embassy donates US\$5000 to victims of Agent Orange in Vietnam	More appropriate in humanitarian sector
38401	China donates 16 million RMB waste handling equipment to Nepal	More appropriate in water supply and sanitation sector
34590	China donates 4 million Baht to fire victims in Thailand	More appropriate in humanitarian sector
34310	Chinese medics donate medical equipment and expertise to Myanmar for cyclone relief	More appropriate in humanitarian sector
34816	Chinese medical teams assist Thailand tsunami victims	More appropriate in humanitarian sector
32661	China Donates 900,000 RMB of Medicine to Niger (Linked to Project #32660)	The title and description do not match. Description does not indicate any health focus.
37904	China assists Indonesia in the second phase of natural medicine plant research and development	More appropriate in agriculture sector

## ● APPENDIX 2. OECD CODING FRAMEWORK

The OECD tracks ODA, which is defined as "government aid designed to promote the economic development and welfare of developing countries".<sup>18</sup> ODA includes grants, "soft loans", and technical assistance.

The OECD classification system assigns each aid project to its most relevant sector, such as 'health'. Within each sector, more specific classifications, called 'purpose codes', are assigned to a project. Each purpose code is mutually exclusive. A list of the purpose codes that are included in this study's definition of 'health aid' (i.e., those categorized as either 'health' or 'population policies/programmes & reproductive health') are shown below.

**Table 2. OECD CRS purpose code classification system**

DAC 5 code	CRS code	Voluntary code	Description	Clarifications / Additional notes on coverage
<b>120</b>			<b>Health</b>	
<b>121</b>			<b>Health, General</b>	
	12110		Health policy and administrative management	Health sector policy, planning and programmes; aid to health ministries, public health administration; institution capacity building and advice; medical insurance programmes; including health system strengthening and health governance; unspecified health activities.
		12196	Health statistics and data	Collection, production, management and dissemination of statistics and data related to health. Includes health surveys, establishment of health databases, data collection on epidemics, etc.
	12181		Medical education/training	Medical education and training for tertiary level services.
	12182		Medical research	General medical research (excluding basic health research and research for prevention and control of NCDs (12382)).
	12191		Medical services	Laboratories, specialised clinics and hospitals (including equipment and supplies); ambulances; dental services; medical rehabilitation. Excludes noncommunicable diseases (123xx).
<b>122</b>			<b>Basic Health</b>	
	12220		Basic health care	Basic and primary health care programmes; paramedical and nursing care programmes; supply of drugs, medicines and vaccines related to basic health care; activities aimed at achieving universal health coverage.
	12230		Basic health infrastructure	District-level hospitals, clinics and dispensaries and related medical equipment; excluding specialised hospitals and clinics (12191).
	12240		Basic nutrition	Micronutrient deficiency identification and supplementation; Infant and young child feeding promotion including exclusive breastfeeding; Non-emergency management of acute malnutrition and other targeted feeding programs (including complementary feeding); Staple food fortification including salt iodization; Nutritional status monitoring and national nutrition surveillance; Research, capacity building, policy development, monitoring and evaluation in support of these interventions. Use code 11250 for school feeding and 43072 for household food security.
	12250		Infectious disease control	Immunisation; prevention and control of infectious and parasite diseases, except malaria (12262), tuberculosis (12263), HIV/AIDS and other STDs (13040). It includes diarrheal diseases, vector-borne diseases (e.g., river blindness and guinea worm), viral diseases, mycosis, helminthiasis, zoonosis, diseases by other bacteria and viruses, pediculosis, etc.
	12261		Health education	Information, education and training of the population for improving health knowledge and practices; public health and awareness campaigns; promotion of improved personal hygiene practices, including use of sanitation facilities and handwashing with soap.
	12262		Malaria control	Prevention and control of malaria.
	12263		Tuberculosis control	Immunisation, prevention and control of tuberculosis.
	12281		Health personnel development	Training of health staff for basic health care services.
<b>123</b>			<b>Non-communicable diseases (NCDs)</b>	
	12310		NCDs control, general	Programmes for the prevention and control of NCDs which cannot be broken down into the codes below.
	12320		Tobacco use control	Population/individual measures and interventions to reduce all forms of tobacco use in any form. Includes activities related to the implementation of the WHO Framework Convention on Tobacco Control, including specific high-impact demand reduction measures for effective tobacco control.

	12330		Control of harmful use of alcohol and drugs	Prevention and reduction of harmful use of alcohol and psychoactive drugs; development, implementation, monitoring and evaluation of prevention and treatment strategies, programmes and interventions; early identification and management of health conditions caused by use of alcohol and drugs [excluding narcotics traffic control (16063)].
	12340		Promotion of mental health and well-being	Promotion of programmes and interventions which support mental health and well-being resiliency; prevention, care and support to individuals vulnerable to suicide. Excluding treatment of addiction to tobacco, alcohol and drugs (included in codes 12320 and 12330).
	12350		Other prevention and treatment of NCDs	Population/individual measures to reduce exposure to unhealthy diets and physical inactivity and to strengthen capacity for prevention, early detection, treatment and sustained management of NCDs including: Cardiovascular disease control: Prevention, screening and treatment of cardiovascular diseases (including hypertension, hyperlipidaemia, ischaemic heart diseases, stroke, rheumatic heart disease, congenital heart disease, heart failure, etc.). Diabetes control: Prevention, screening, diagnosis, treatment and management of complications from all types of diabetes. Exposure to physical inactivity: Promotion of physical activity through supportive built environment (urban design, transport), sports, health care, schools and community programmes and mass media campaign. Exposure to unhealthy diet: Programmes and interventions that promote healthy diet through reduced consumption of salt, sugar and fats and increased consumption of fruits and vegetables e.g., food reformulation, nutrient labelling, food taxes, marketing restriction on unhealthy foods, nutrition education and counselling, and settings-based interventions (schools, workplaces, villages, communities). Cancer control: Prevention (including immunisation, HPV and HBV), early diagnosis (including pathology), screening, treatment (e.g., radiotherapy, chemotherapy, surgery) and palliative care for all types of cancers. Implementation, maintenance and improvement of cancer registries are also included. Chronic respiratory diseases: Prevention, early diagnosis and treatment of chronic respiratory diseases, including asthma. Excludes: Tobacco use control (12320), Control of harmful use of alcohol and drugs (12330), research for the prevention and control of NCDs (12382).
	12382		Research for prevention and control of NCDs	Research to enhance understanding of NCDs, their risk factors, epidemiology, social determinants and economic impact; translational and implementation research to enhance operationalisation of cost-effective strategies to prevent and control NCDs; surveillance and monitoring of NCD mortality, morbidity, risk factor exposures, and national capacity to prevent and control NCDs.
<b>130</b>			<b>Population Policies/Programmes &amp; Reproductive Health</b>	
	13010		Population policy and administrative management	Population/development policies; demographic research/analysis; reproductive health research; unspecified population activities. (Use purpose code 15190 for data on migration and refugees. Use code 13096 for census work, vital registration and migration data collection.)
		13096	<i>Population statistics and data</i>	<i>Collection, production, management and dissemination of statistics and data related to Population and Reproductive Health. Includes census work, vital registration, migration data collection, demographic data, etc.</i>
	13020		Reproductive health care	Promotion of reproductive health; prenatal and postnatal care including delivery; prevention and treatment of infertility; prevention and management of consequences of abortion; safe motherhood activities.
	13030		Family planning	Family planning services including counselling; information, education and communication (IEC) activities; delivery of contraceptives; capacity building and training.
	13040		STD control including HIV/AIDS	All activities related to sexually transmitted diseases and HIV/AIDS control e.g., information, education and communication; testing; prevention; treatment, care.
	13081		Personnel development for population and reproductive health	Education and training of health staff for population and reproductive health care services.

Source: Purpose Codes: sector classification<sup>9</sup>

## ● APPENDIX 3. IHME CODING FRAMEWORK

The IHME tracks DAH. The IHME compiles its data from that of the OECD CRS and other sources such as tax filings or financial statements, thus creating a broader estimate of aid than ODA. The IHME disaggregates data into health focus areas (e.g., HIV) and program areas (e.g., treatment). The relevant DAH tracking codes for IHME’s framework can be found in [Table 3](#) below.

While IHME has very detailed program areas, such as HIV prevention, the project descriptions available in AidData’s database did not usually have sufficient information to enable coding at this this level. Therefore, we only coded projects to the highest level of the focus area (e.g., HIV), which corresponds to the leftmost column category in the table below. The only category we were able to disaggregate by program area was health systems strengthening.

**Table 3. IHME DAH focus areas**

Focus area	Variables	Description
<b>HIV</b>	hiv_dah_18 hiv_care_dah_18 hiv_ct_dah_18 hiv_hss_other_dah_18 hiv_hss_hrh_dah_18 hiv_treat_dah_18 hiv_ovc_dah_18 hiv_pmtct_dah_18 hiv_prev_dah_18 hiv_amr_dah_18 hiv_other_dah_18	Funds for health disbursed from source to channel to recipient country for HIV/AIDS, disaggregated by care and support, counseling & testing, other health system strengthening, human resources, treatment, orphans & vulnerable children, prevention of mother to child transmission, prevention, drug resistance, and other.
<b>Malaria</b>	mal_dah_18 mal_comm_con_dah_18 mal_con_nets_dah_18 mal_con_irs_dah_18 mal_con_oth_dah_18 mal_diag_dah_18 mal_hss_other_dah_18 mal_hss_hrh_dah_18 mal_treat_dah_18 mal_amr_dah_18 mal_other_dah_18	Funds for health disbursed from source to channel to recipient country for malaria, disaggregated by community outreach, bednets, indoor spraying, other control, diagnosis, other health system strengthening, human resources, treatment, drug resistance, and other
<b>Reproductive and maternal health</b>	rmh_dah_18 rmh_fp_dah_18 rmh_hss_other_dah_18 rmh_hss_hrh_dah_18 rmh_mh_dah_18 rmh_other_dah_18	Funds for health disbursed from source to channel to recipient country for reproductive and maternal health, disaggregated by family planning, other health system strengthening, human resources, other maternal health, and other
<b>Newborn and child health</b>	nch_dah_18 nch_cnn_dah_18 nch_cnv_dah_18 nch_hss_hrh_dah_18 nch_hss_hrh_dah_18 nch_other_dah_18	Funds for health disbursed from source to channel to recipient country for newborn and child health, disaggregated by nutrition, vaccines, other health system strengthening, human resources, and other
<b>Non-communicable diseases</b>	ncd_dah_18	Funds for health disbursed from source to channel to recipient country for non- communicable diseases,

	ncd_mental_dah_18 ncd_hss_other_dah_18 ncd_hss_hrh_dah_18 ncd_tobac_dah_18 ncd_other_dah_18	disaggregated by mental health, other health system strengthening, human resources, tobacco initiatives, and other
<b>Other infectious diseases</b>	oid_dah_18 oid_hss_other_dah_18 oid_hss_hrh_dah_18 oid_ebz_dah_18 oid_zika_dah_18 oid_amr_dah_18 oid_other_dah_18	Funds for health disbursed from source to channel to recipient country for other infectious diseases, disaggregated by other health system strengthening, human resources, Ebola, Zika, antimicrobial resistance, and other
<b>Tuberculosis</b>	tb_dah_18 tb_diag_dah_18 tb_hss_other_dah_18 tb_hss_hrh_dah_18 tb_treat_dah_18 tab_amr_dah_18 tb_other_dah_18	Funds for health disbursed from source to channel to recipient country for tuberculosis, disaggregated by diagnosis, other health system strengthening, human resources, treatment, drug resistance, and other
<b>Health systems strengthening and sector-wide approaches*</b>	swap_hss_total_dah_18 swap_hss_hrh_dah_18 swap_hss_pp_dah_18 swap_hss_other_dah_18	Funds for health disbursed from source to channel to recipient country for health systems strengthening and sector-wide approaches, disaggregated by human resources, pandemic preparedness, and other
<b>Other</b>	other_dah_18	Funds for health distributed from source to channel to recipient country for which we have health focus area information but which is not identified as being allocated to any of the other health focus areas listed
<b>Unallocated</b>	unalloc_dah_18	Funds for health disbursed from source to channel to recipient country for which we have no health focus area information

Source: IHME DAH Database User Guide (2018)<sup>10</sup>

Note: Table adapted from content to be more reader-friendly

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## ● APPENDIX 4. CODING EXAMPLE

Table 4 shows an example of a project included in our analysis. Based on the information available, this project would be coded as follows: malaria control 12262 (OECD) and malaria (IHME).

**Table 4. Coding example**

Project ID	Rec. for research	Project title	Project description	Flow class	CRS sector	Status
319	TRUE	Malaria Treatment Center	At the Beijing Summit of the Forum on China-Africa Cooperation (FOCAC) in November 2006, China pledged to construct a malaria prevention and treatment center later designated to be built for Burundi. The opening ceremony was held on March 27, 2008. According to Burundi's Development Assistance Database, China has disbursed 439,811 USD in funding for the center.	ODA-like	Health	Completion



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## ● APPENDIX 5. CODEBOOK FOR PROJECTS RELATED TO INFRASTRUCTURE AND MEDICAL TEAMS

Medical teams and infrastructure-related projects are commonly found in the AidData database. When the primary purpose of these types of projects focused on a particular disease, it was coded as such. However, identifying the most appropriate code for these types of projects in the absence of a particular disease focus was particularly challenging while using the OECD framework since several purpose codes relate to infrastructure and human resources. In addition, many projects had fairly limited descriptions or sources available for further investigation. To ensure consistency and transparency in our coding, we developed a codebook to clearly outline when these types of projects should go into particular categories. We have included our rationale and assumptions below.

### Coding infrastructure projects under the OECD framework

Infrastructure projects that are not linked to a particular disease focus area have the potential to fall under one of two categories: basic health infrastructure and medical services. Two key pieces of information were used to determine which category was best suited: the size/type of hospital and the type of services/equipment offered.

**Basic health infrastructure** (purpose code 12230) is defined as “district-level hospitals, clinics and dispensaries and related medical equipment; excluding specialized hospitals and clinic.”<sup>9</sup> Infrastructure projects were coded under ‘basic health infrastructure’ if the project description mentioned district hospitals or fell under the definition of a district-level hospital; using definitions from Disease Control Priorities (see [Table 5](#)).<sup>19</sup> As needed, we searched sources provided in the ‘sources’ column of AidData’s database to see if the hospital or equipment in question meets the criteria of a district hospital. In particular, we looked for mentions of things such as the number of beds and specialty services available at a given facility.

**Medical services** (purpose code 12191) are defined as “laboratories, specialized clinics and hospitals (including equipment and supplies); ambulances; dental services; medical rehabilitation excluding noncommunicable diseases.”<sup>9</sup> If an infrastructure project does not meet the criteria for a district-level hospital and is not linked to a particular disease focus area, it will likely fit the description of medical services. Second-level and third-level hospitals fall under the medical services category because the nature of these hospitals is more specialized (see [Table 5](#)). A specialized hospital is a hospital admitting primarily patients suffering from a specific disease or affection of one system, or reserved for the diagnosis and treatment of conditions affecting a specific age group or of a long-term nature.<sup>19</sup>

If it remained uncertain to which category an infrastructure project should be coded, then we defaulted to coding the project to basic health infrastructure. We selected this approach after pilot coding several infrastructure projects. We noticed that if specialty services were provided, these services were often referenced in the project description or in the additional sources column. Therefore, if there is no direct mention to some degree of specialization, we coded the infrastructure project to basic health infrastructure.

**Table 5. Definitions of levels of hospital care**

Terminology and definitions	Alternative terms commonly found in the literature
<p>First-level hospital</p> <p>Few specialties—mainly internal medicine, obstetrics and gynecology, pediatrics, and general surgery</p> <p>Often only one general practice physician or a nonphysician clinician</p> <p>Limited laboratory services available for general analysis but not for specialized pathological analysis</p> <p>50–250 beds</p>	<p>Primary-level hospital</p> <p>District hospital</p> <p>Rural hospital</p> <p>Community hospital</p> <p>General hospital</p>
<p>Second-level hospital</p> <p>More differentiated by function, with as many as 5 to 10 clinical specialties</p> <p>200–800 beds</p>	<p>Regional hospital</p> <p>Provincial (or equivalent administrative area, such as county) hospital</p> <p>General hospital</p>
<p>Third-level hospital</p> <p>Highly specialized staff and technical equipment—for example, cardiology, intensive care unit, and specialized imaging units</p> <p>Clinical services highly differentiated by function</p> <p>Teaching activities in some facilities</p> <p>300–1,500 beds</p>	<p>National hospital</p> <p>Central hospital</p> <p>Academic, teaching, or university hospital</p>

Source: Definitions of Levels of Hospital Care<sup>19</sup>

## Coding infrastructure and equipment under the IHME framework

When a project included equipment, infrastructure, and/or medical products, we used the same approach IHME applied in their 2020 paper.<sup>15</sup> Specifically, when these types of projects were not specific to a health focus area (e.g., building a hospital versus a malaria treatment center), they were included as ‘other HSS’.

## Coding medical teams under the OECD framework

Medical team-related projects are very commonly found in AidData’s database. If a medical team is provided for a very specific purpose, such as malaria control, then the project should be coded under malaria control. However, in the absence of a specific disease focus, the OECD framework has four potential codes where medical teams could fit: medical education and training (purpose code 12181), health personnel development (purpose code 12281), basic health care (purpose code 12220), or medical services (purpose code 12191). The key distinction that must be made for medical team-related projects is whether or not the medical teams provided education and training to local health care providers or if the medical teams provided services without any training or knowledge transfer components. Once such a distinction has been made, then we coded according to the following methods.

### For medical teams with an education/knowledge transfer component

Medical teams that provide some degree of education, training, or knowledge transfer could fit into one of two potential codes: medical education/training (purpose code 12181) or health personnel development (purpose code 12281).

**Medical education/training** (purpose code 12181) is defined as ‘medical education and training for tertiary level services.’<sup>9</sup>

**Health personnel development** (purpose code 12281) is defined as ‘training of health staff for basic health care services.’<sup>9</sup>

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The key difference between these two codes is that one focuses on basic health care (12281) and one focuses on tertiary care (12181). To determine whether or not the focus of education is on tertiary services or basic health care services, we referred to the WHO definitions of primary and tertiary healthcare services.<sup>20</sup> Specifically, the WHO defines these as follows:

1. **Primary services** are usually the first point of contact within a health system and may be provided by general health care workers; they represent a link to more specialized care. Primary services are usually provided locally in a range of settings (typically communities).
2. **Tertiary services** include specialized consultative health care, usually based at national level and provided in hospitals on an inpatient basis.

Essentially if the medical team's training activities fall under primary services, then the project was coded as health personnel development. If the services appear more specialized, then the project was coded under medical education/training.

If the description was unclear whether a medical team project involves a training component, then additional sources were consulted. If after consulting the additional sources linked in the database it remained unclear whether or not there was a training component, the project should not be classified as having a training component and should be categorized under another more relevant code (see next section.)

If the project descriptions and additional sources were insufficient to make a conclusive decision on whether or not the training was focused on primary or tertiary services, then we defaulted to code the project as health personnel development, which focuses on basic health care services. This code was selected using a similar assumption we made for medical infrastructure projects: if the projects involved tertiary services, it is likely that these services would be referenced.

### For medical teams focused on service delivery only

Some Chinese medical teams provide direct care to recipients in host countries without any training components for local personnel. Therefore, these projects should not be coded under either of the two previously mentioned codes (12181 or 12281). We coded medical teams without training elements under basic health care (purpose code 12220) or medical services (purpose code 12191).

- **Basic health care** (purpose code 12220) is defined as 'basic and primary health care programmes; paramedical and nursing care programmes; supply of drugs, medicines and vaccines related to basic health care; activities aimed at achieving universal health coverage.'<sup>9</sup>
- **Medical services** (12191) are defined as 'Laboratories, specialised clinics and hospitals (including equipment and supplies); ambulances; dental services; medical rehabilitation. Excludes noncommunicable diseases.'<sup>9</sup>

For medical teams where there was inadequate information to distinguish between 'medical services' or 'basic health care,' we used 'basic health care' as the default code.

### Coding medical teams under the IHME framework

The IHME framework only has one applicable code for each (under health system strengthening and sector-wide approaches), 'human resources', and 'other'. Therefore, all infrastructure projects with no other primary disease focus are coded under other, and medical team projects are coded under human resources. Additionally, some projects may involve infrastructure or team components, yet they are coded under different categories because their overall purpose is best suited for another code. For example, if an infrastructure or medical team's primary purpose was to support a particular disease such as malaria, these projects would be considered under malaria codes ('malaria control' or 'mal\_dah\_18').

## ● APPENDIX 6. COMPARISON OF IHME AND OECD CRS FRAMEWORKS

After the coding was complete, we looked to see where there was alignment or divergence between the two health focus area frameworks. Table 6 and Table 7 show how these frameworks aligned.

**Table 6. Alignment between OECD and IHME health focus areas**

OECD	Count	IHME	Count	%
<b>Basic health care</b>	210	HSS: human resources for health	196	93%
		HSS: other health systems strengthening	14	7%
<b>Malaria control</b>	118	Malaria	118	100%
		HSS: other health systems strengthening	73	66%
<b>Medical services</b>	111	HSS: human resources for health	36	32%
		Newborn and child health	2	2%
<b>Basic health infrastructure</b>	79	HSS: other health systems strengthening	77	97%
		Reproductive and maternal health	2	3%
<b>Infectious disease control</b>	43	Other infectious diseases	43	100%
<b>Health personnel development</b>	22	HSS: human resources for health	22	100%
<b>Other prevention/treatment of NCDs</b>	9	Non-communicable diseases	9	100%
<b>Medical training/ education</b>	8	HSS: human resources for health	8	100%
<b>Health policy and administrative management</b>	8	HSS: other health systems strengthening	4	50%
		Other DAH	3	38%
		HSS: human resources for health	1	13%
<b>STD control including HIV/AIDS</b>	7	HIV/AIDS	6	86%
		Other infectious diseases	1	14%
<b>Reproductive health care</b>	5	Reproductive and maternal health	5	100%
<b>Control of harmful use of drugs and alcohol</b>	1	Non-communicable diseases	1	100%
<b>Family planning</b>	1	Reproductive and maternal health	1	100%
<b>Health statistics and data</b>	1	HSS: other health systems strengthening	1	100%
<b>Personnel development for population and reproductive health</b>	1	Reproductive and maternal health	1	100%
<b>Population statistics and data</b>	1	HSS: other health systems strengthening	1	100%
<b>Tuberculosis control</b>	1	Tuberculosis	1	100%

**Table 7. Alignment between IHME and OECD focus areas**

IHME	Count	OECD	Count	%
<b>HSS: human resources for health</b>	263	Basic health care	196	75%
		Medical services	36	14%
		Health personnel development	22	8%
		Medical training/ education	8	3%
		Health policy and administrative management	1	0%

		Basic health infrastructure	77	45%
		Medical services	73	43%
<b>HSS: other health systems strengthening</b>	170	Basic health care	14	8%
		Health policy and administrative management	4	2%
		Health statistics and data	1	1%
		Population statistics and data	1	1%
<b>Malaria</b>	118	Malaria control	118	100%
<b>Other infectious diseases</b>	44	Infectious disease control	43	98%
		STD control including HIV/AIDS	1	2%
<b>Non-communicable diseases</b>	10	Other prevention/treatment of NCDs	9	90%
		Control of harmful use of drugs and alcohol	1	10%
<b>Reproductive and maternal health</b>	9	Reproductive health care	5	56%
		Basic health infrastructure	2	22%
		Family planning	1	11%
		Personnel development for population and reproductive health	1	11%
<b>HIV/AIDS</b>	6	STD control including HIV/AIDS	6	100%
<b>Other DAH</b>	3	Health policy and administrative management	3	100%
<b>Newborn and child health</b>	2	Medical services	2	100%
<b>Tuberculosis</b>	1	Tuberculosis control	1	100%

## ● APPENDIX 7. PREDICTING MISSING VALUES USING REGRESSION ANALYSIS

We conducted multiple linear regression analysis to predict the missing value of projects. We first used projects without missing value to explore the association between financial values of projects with other project information, including year, status, flow, regions and sectors. We operated regression models for OECD CRS category and IHME category separately. Considering the limited sample size, we combined categories with small size. Variables and findings are presented in [Table 8](#).

**Table 8. Regression analysis**

Variables	Model 1 (OECD model)			Model 2 (IHME model)		
	$\beta$	Std. Error	P value	$\beta$	Std. Error	P value
<b>(Constant)</b>	486.278	649.533	0.455	514.695	640.278	0.422
<b>Year</b>	-0.236	0.324	0.467	-0.250	0.318	0.432
<b>Status: completion as reference</b>						
<b>Implementation</b>	-2.116	4.204	0.615	-2.152	4.210	0.610
<b>Pipeline</b>	1.073	3.007	0.722	1.416	3.010	0.639
<b>Flow type: grant as reference</b>						
<b>Free-standing technical assistance/ scholarships</b>	0.654	6.374	0.918	1.292	7.778	0.868
<b>Loan(excluding debt rescheduling)</b>	35.678	4.790	0.000	35.820	4.754	0.000
<b>CRS sector name: Health as reference</b>						
<b>Population Policies / Programmes and Reproductive Health</b>	-2.780	9.227	0.764	2.208	9.716	0.820
<b>Recipient region: Africa as reference</b>						
<b>Asia and The Pacific</b>	-3.833	3.122	0.221	-3.784	3.008	0.210
<b>Others (Central and Eastern Europe, Latin America and the Carribbean, Middle East)</b>	-13.269	5.064	0.009	-13.828	5.006	0.006
<b>OECD code: Basic Health Care as reference</b>						
<b>Basic Health Infrastructure</b>	-4.531	5.513	0.412			
<b>Infectious Diseases Control</b>	-10.077	5.776	0.082			
<b>Malaria Control</b>	-11.113	5.457	0.043			
<b>Medical services</b>	-2.412	5.372	0.654			
<b>All others</b>	-9.876	6.469	0.128			
<b>IHME code: HSS: Human Resources for Health as reference</b>						
<b>Other HSS</b>				-1.430	8.283	0.863
<b>Malaria</b>				-9.763	8.304	0.241
<b>Other Infectious Diseases</b>				-8.705	8.602	0.313
<b>Reproductive and Maternal Health, Newborn and Child Health</b>				-14.675	10.628	0.169
<b>All others</b>				-9.684	9.838	0.326

Model parameters: for model 1,  $R^2 = 0.276$ ,  $F = 6.242$ ,  $P < 0.001$ ; for model 2,  $R^2 = 0.283$ ,  $F = 6.479$ ,  $P < 0.001$ .

Using the findings from the regression models, we predicted the missing values of financial value for the rest of the projects. The financial estimates of Chinese health aids totals to \$US4.5 billion under OECD framework and \$US5.8 billion under IHME framework.

The results were significantly higher than the findings we presented in the main report for the following reasons. First, due to a small sample size and limited variables included in the models,  $R^2$  was relatively low for both models, indicating they were only able to captured small proportion of the variations. Second, while comparing and applying average or median numbers for missed values, some of the predicted values from this approach were higher than any single project. We decided to report financial estimates based on median numbers for an approach because we found it easier to follow.