

# Funding AIDS programmes in the era of shared responsibility: an analysis of domestic spending in 12 low-income and middle-income countries



Stephen Resch, Theresa Ryckman, Robert Hecht



## Summary

**Background** As the incomes of many AIDS-burdened countries grow and donors' budgets for helping to fight the disease tighten, national governments and external funding partners increasingly face the following question: what is the capacity of countries that are highly affected by AIDS to finance their responses from domestic sources, and how might this affect the level of donor support? In this study, we attempt to answer this question.

**Methods** We propose metrics to estimate domestic AIDS financing, using methods related to national prioritisation of health spending, disease burden, and economic growth. We apply these metrics to 12 countries in sub-Saharan Africa with a high prevalence of HIV/AIDS, generating scenarios of possible future domestic expenditure. We compare the results with total AIDS financing requirements to calculate the size of the resulting funding gaps and implications for donors.

**Findings** Nearly all 12 countries studied fall short of the proposed expenditure benchmarks. If they met these benchmarks fully, domestic spending on AIDS would increase by 2.5 times, from US\$2.1 billion to \$5.1 billion annually, covering 64% of estimated future funding requirements and leaving a gap of around a third of the total \$7.9 billion needed. Although upper-middle-income countries, such as Botswana, Namibia, and South Africa, would become financially self-reliant, lower-income countries, such as Mozambique and Ethiopia, would remain heavily dependent on donor funds.

**Interpretation** The proposed metrics could be useful to stimulate further analysis and discussion around domestic spending on AIDS and corresponding donor contributions, and to structure financial agreements between recipient country governments and donors. Coupled with improved resource tracking, such metrics could enhance transparency and accountability for efficient use of money and maximise the effect of available funding to prevent HIV infections and save lives.

**Funding** US Centers for Disease Control and Prevention.

**Copyright** © Hecht et al. Open Access article distributed under the terms of CC BY-NC-ND.

## Introduction

Flows of aid earmarked for AIDS programmes have increased dramatically in the past decade,<sup>1</sup> fuelling a rapid scale-up of services with widely documented positive effects, including the prevention of millions of deaths and falling rates of new infections in many low-income and middle-income countries.<sup>2,3</sup> However, the unprecedented growth in international financing of the AIDS response in the past decade seems to have stalled just as compelling evidence of the potential of antiretroviral therapy to accelerate the decline in new infections<sup>4</sup> and further advances in prevention such as pre-exposure prophylaxis are motivating increasingly ambitious goals for programme scale-up.<sup>5,6</sup> Projected funding falls short of what is needed to meet even the most conservative goals that predated the recent push to accelerate treatment expansion as a prevention strategy.<sup>6-8</sup> In 2011, the Joint United Nations Programme on HIV and AIDS (UNAIDS) set targets for increasing AIDS funding to US\$22–24 billion by 2015.<sup>7,8</sup> Most recently,

UNAIDS has estimated that a more ambitious “fast track” response will require increases to US\$35 billion per year by 2020,<sup>8</sup> yet only \$19 billion was available in 2012, nearly half of which was provided by international donors.<sup>9</sup> Of these donors, the US President’s Emergency Plan for AIDS Relief (PEPFAR) contributed the largest share, representing 49% of all international contributions,<sup>9</sup> followed by the Global Fund to Fight AIDS, Tuberculosis, and Malaria, which provided 22%.<sup>10</sup>

In recognition of the long-term financial obligations associated with scaled-up programmes,<sup>11</sup> many stakeholders, including external funding organisations, low-income and middle-income countries, and advocacy groups, are concerned about the extent to which external funders will be willing and able to sustain existing AIDS programmes, and the corresponding degree to which low-income and middle-income countries will be able to allocate additional financial resources to fight the pandemic. Many policy makers have focused on broadening the base of financial support, with a particular

*Lancet Glob Health* 2015;

3: e52–61

See [Comment](#) page e8

Harvard School of Public Health, Boston, MA, USA (S Resch PhD); and Results for Development Institute, Washington, DC, USA (T Ryckman BA, R Hecht PhD)

Correspondence to: Dr Robert Hecht, Results for Development Institute, 1100 15th Street NW, Suite 400, Washington, DC 20005, USA  
rhecht@rdi.org

emphasis on increasing domestic funding from government budgets.<sup>9,12–16</sup> At the United Nations General Assembly in 2011, UNAIDS called for “shared responsibility to meet investment needs” through increased long-term domestic and international funding, and proposed that recipient governments be held accountable for increasing domestic investment.<sup>17</sup> Subsequently, the African Union embraced a new concept of shared responsibility and global solidarity that emphasises an increased role for domestic financing of AIDS programmes and domestic leadership in defining AIDS priorities and directing resources.<sup>15</sup> This priority is echoed in the Global Fund’s policies on country graduation and counterpart financing, which are designed to encourage countries to play a larger part in financing their AIDS programmes as their economies grow.<sup>18</sup> Similarly, PEPFAR’s multi-year partnership framework agreements and partnership framework implementation plans promote a transition of programmatic ownership to partner governments, including increased responsibility for the financial support of programmes.<sup>19</sup> Simultaneously, countries affected by AIDS have shown an interest in having a greater role in directing and financing their AIDS programmes than they have had in the past decade. Between 2006 and 2012, low-income and middle-income countries as a group have doubled their domestically sourced financing for AIDS programmes from about \$5 billion to \$10 billion, such that domestic spending exceeded international disbursements.<sup>8</sup>

The increasing focus on domestic financial support creates a demand for new approaches and metrics to evaluate the intensity and adequacy of domestic effort, and to assess the potential for additional domestic financing. UNAIDS has developed an indicator called the Domestic Investment Priority Index, which measures government AIDS expenditures relative to country income level and HIV prevalence.<sup>20</sup> The index is useful to rank countries and identify low performers. Similarly, Galárraga and colleagues<sup>21</sup> recently used a peer approach, in which they compared AIDS spending per person living with HIV against an expected level estimated from a median regression model with gross national income per person, health spending as a proportion of gross national income, and debt service per person as predictors. Their study is useful to describe and compare the efforts of countries to finance their AIDS programmes and to show the effect on financing gaps if countries with quite weak efforts were to perform more like their peers.

In this paper, we contribute a related, but different, approach to the examination of government AIDS expenditures, with a focus on 12 sub-Saharan African countries that have historically been the largest recipients of PEPFAR funding, with recent combined allocations of more than \$3 billion annually.<sup>22</sup> We propose a set of benchmarks that could be used to assess whether present levels of domestic contributions are aligned with

countries’ fiscal capacity and disease burdens. On the basis of these benchmarks, we estimate the extent to which governments might make a greater domestic contribution, the effect of such increased domestic effort on AIDS financing gaps, and the implications for donors. A key difference from previous work is that the benchmarks are not tied to the historical past performance of countries, but rather are intended to be normative standards, based on existing statements of political commitment and notions of fair allocation. A second difference is that we used a more diverse and up-to-date set of sources for AIDS spending than those in previous work by Galárraga and colleagues<sup>21</sup> and Ávila and colleagues.<sup>23</sup>

In reality, the practicality of any proposed scale-up of domestic financial effort in the AIDS response depends on many country-specific factors. Forging of agreements regarding funding targets will need consideration of these factors in bilateral or multilateral negotiations. Our aim in this report is to propose a set of reference points, constructed from publicly available data and based on normative goals, to help focus these discussions.

## Methods

We reviewed available information in National AIDS Spending Assessments, National Health Accounts HIV Sub-Accounts, Public Expenditure Reviews, United Nations General Assembly Country Progress Reports, and other country reports about domestically sourced public financing of AIDS programmes since 2006 in 12 African countries and constructed several indicators to compare these countries’ levels of domestic effort, in which we considered epidemic size, resource needs, fiscal capacity, and amount of external assistance for AIDS. The countries—Botswana, Côte d’Ivoire, Ethiopia, Kenya, Mozambique, Namibia, Nigeria, Rwanda, South Africa, Tanzania, Uganda, and Zambia—account for 52% of AIDS cases worldwide,<sup>3</sup> 56% of total development assistance targeted to AIDS,<sup>24</sup> and 83% of PEPFAR’s historical bilateral spending.<sup>22</sup>

## Individual country data

Table 1 presents the key country characteristics used in the analysis. According to UNAIDS-compiled data,<sup>26</sup> adult HIV prevalence in 2013 ranged from 1·2% in Ethiopia to 22% in Botswana, and the number of people living with HIV varied from 200 000 in Rwanda to 6·3 million in South Africa. The contribution of AIDS to the national disease burden measured in disability-adjusted life-years (DALYs) for 2005 ranged from 6% in Ethiopia to 46% in South Africa.<sup>25</sup> The 12 focus countries vary greatly in per-person income amounts, from US\$540 in Ethiopia to \$7140 in Botswana,<sup>27</sup> but, to obtain a more refined picture of the governments’ abilities to pay for AIDS programmes in the short-to-medium term, we considered the subsets of resources from which domestically sourced public funding for AIDS programmes is drawn. Total government

expenditures, measured as a share of gross domestic product (GDP), ranged from 17% in Ethiopia to 37% in Namibia.<sup>27</sup> Although the AIDS response is usually multisectoral, most public funding for AIDS programmes flows through the health sector. The proportions of government expenditures devoted to health varied from 6% in Kenya to 22% in Rwanda.<sup>28</sup>

### Indicators of domestic financial contribution to the AIDS response

We obtained estimates of past AIDS expenditure (total and domestic) from a review of publicly available country AIDS spending reports (appendix p 3). No widely accepted normative standard exists for what level of domestic spending represents a fair, affordable, or reasonable share of AIDS programme financing. To assess existing levels of domestic public financing of AIDS programmes and estimate how much money a country might be able to allocate to these programmes, we used several reference points. Key among them were the Abuja target for government health spending (ie, 15% of the budget),<sup>29</sup> which emphasises adequate priority for health generally, and the share of a country's disease burden that is caused by AIDS—here referred to as the DALY share—which takes the current level of health expenditure as a given and restricts the focus to health expenditure on AIDS relative to other health priorities. The original Abuja pledge in 2001 has been reaffirmed and remains a well-recognised development target, although most countries have not yet achieved its proposed level for health spending.<sup>6,30</sup>

Within the health sector, one indicator of adequate priority for AIDS is the ratio of its share of domestic health expenditure to its share of the total disease burden measured in DALYs. Although the share of the health budget allocated to AIDS is expected to be positively and consistently associated with the disease's DALY share across a similar set of countries, allocation of health resources solely in proportion to disease burden will not necessarily maximise the health effect because it does not consider the cost-effectiveness of available interventions targeting AIDS and other health priorities.<sup>31</sup> To be conservative, and to avoid the risk of over-allocation of resources to AIDS, we assumed that the benchmark ratio of AIDS's share of domestic government health expenditure (government expenditure on AIDS as a proportion of government expenditure on health overall) to AIDS's share of disease burden (AIDS DALYs as a proportion of total DALYs) is 0.5. In other words, a country in which 10% of the total disease burden is attributable to AIDS would be expected to spend at least 5% of its health budget on AIDS programmes. This benchmark value is consistent with empirical data that suggest that this level of spending is achievable in low-income and middle-income countries that have moderate to severe AIDS epidemics. For example, of the 30 countries reporting to UNAIDS since 2008 that have

AIDS burdens greater than 3500 AIDS DALYs per 100 000 population (to match the 12 countries in our sample), ten had ratios higher than 0.5, including seven low-income countries and five in which AIDS represents more than 10% of total DALY burden.<sup>25</sup>

In addition to the benchmarks discussed previously, Williams and Gouws<sup>32</sup> constructed an affordability index for universal antiretroviral therapy in which less than 1% of GDP is affordable, between 1% and 2% is marginal, and more than 2% is viewed as onerous and unaffordable, since it draws funds away from other domestic priorities. Haacker<sup>33</sup> also suggests an affordability threshold for AIDS spending of 1% of GDP. We calculated government AIDS expenditure as a share of GDP to enable comparisons against this reference point.

### Forward-looking financial projections

We applied the Abuja target and DALY share benchmarks for domestic financing effort to the 12 countries to establish what level of spending they would generate in the next 5 years, and to what extent this increased effort would fill resource gaps and affect the need for external assistance. These calculations are based on financial resource needs estimates from the UNAIDS investment framework (appendix p 1).<sup>7</sup>

We considered scenarios based on four ways in which a country's domestic expenditure on AIDS might grow: (1) a minimum increase through expanded government revenue and spending driven by expected macroeconomic

See Online for appendix

	AIDS disease burden			Ability to pay for AIDS programmes		
	Adult HIV prevalence in 2013*	People living with HIV in 2013*	AIDS's share of total disease burden in 2005 <sup>25</sup>	GDP per person (US\$) in 2013†	Government expenditure as share of GDP (GGE/GDP) in 2013†	Health share of government expenditure (GHE/GGE) in 2012‡
<b>Low-income countries</b>						
Ethiopia	1%	790 000	6%	540	17%	11%
Kenya	6%	1 600 000	22%	1020	31%	6%
Mozambique	11%	1 600 000	18%	590	36%	9%
Rwanda	3%	200 000	12%	700	28%	22%
Tanzania	5%	1 400 000	20%	700	27%	10%
Uganda	7%	1 600 000	14%	630	18%	10%
<b>Lower-middle-income countries</b>						
Côte d'Ivoire	3%	370 000	13%	1180	24%	8%
Nigeria	3%	3 200 000	7%	1690	24%	7%
Zambia	13%	1 100 000	28%	1540	30%	16%
<b>Upper-middle-income countries</b>						
Botswana	22%	320 000	44%	7140	33%	8%
Namibia	14%	250 000	39%	5670	37%	14%
South Africa	19%	6 300 000	46%	6620	33%	13%

AIDS's share of total disease burden is measured in disability-adjusted life-years. GDP=gross domestic product. GGE=general government expenditure. GHE=government expenditure on health. \*UNAIDS GAP Report 2014.<sup>26</sup> †International Monetary Fund World Economic Outlook April 2014.<sup>27</sup> ‡WHO National Health Accounts.<sup>28</sup>

Table 1: Indicators of AIDS disease burden and ability to pay for AIDS programmes

trends (economic trends scenario); and larger rises linked to (2) increasing government health expenditure to the Abuja target level, in addition to gains from economic trends (Abuja target scenario); (3) allocation of the national health budget such that the portion of budget for AIDS is set equal to 0·5 times AIDS's share of disease burden, in addition to gains from economic trends (DALY share scenario); and (4) a combination of all three of these methods, resulting in a maximum effort scenario. We also calculated government AIDS expenditure under the Abuja target and DALY share scenarios without economic trends, holding total government expenditure constant in the Abuja target calculations, and holding government health expenditure constant in the DALY share calculations.

For each scenario, we calculated the implied domestic fiscal contribution and its share of total projected AIDS resource needs for the country in 2014–18. We then calculated the amount by which donors could reduce their support in each country. We calculated overall savings under the assumption that savings are reallocated to fill the remaining funding gaps in the 12 countries and assuming that donors do not reallocate savings. The former scenario is especially relevant in light of a new analysis showing that the three upper-middle-income countries analysed here (Botswana, Namibia, and South Africa) have historically received more donor AIDS

funding than expected based on their disease burden and income levels,<sup>1</sup> and that reallocated development assistance for health and AIDS could lead to improved resource allocation.<sup>1</sup> Baseline PEPFAR support was based on 2012 country operating plans (\$3·3 billion annually) and our estimate of support from other donors in 2012 (\$1·1 billion annually) was based on the ratio of PEPFAR to other donors in the most recent (2010) reported estimates of development assistance for health targeting HIV/AIDS.<sup>24</sup>

### Role of the funding source

The funder selected the set of 12 countries that were the focus of the analysis. The funder had no other role in study design, data collection, data analysis, data interpretation, or writing of the report. The corresponding author had final responsibility for the decision to submit for publication.

### Results

Table 2 summarises the most recent available data about national AIDS expenditure per country and presents four comparative metrics: the domestic share of total AIDS expenditure; the share of government health expenditure devoted to AIDS relative to AIDS's share of the disease burden (ratio of government AIDS expenditure/government health expenditure to AIDS DALYs/total DALYs); government AIDS expenditure as a fraction of

	Most recent AIDS spending estimate year*	Total amounts (millions of US\$)			Amounts per person living with HIV† (US\$)			GAE indicators‡			
		RNE	EAE	GAE	RNE per person living with HIV	(GAE+EAE) per person living with HIV	GAE per person living with HIV	GAE/(GAE+EAE)	GAE/GHE	Ratio of GAE/GHE to AIDS DALYs/total DALYs	GAE/GDP
<b>Low-income countries</b>											
Ethiopia	2012	349	350	55	426	494	67	13·6%	7·0%	1·16	0·13%
Kenya	2010	564	314	84	376	265	56	20·5%	14·7%	0·67	0·26%
Mozambique	2011	307	247	13	205	173	9	5·1%	3·8%	0·21	0·11%
Rwanda	2013	129	224	20	647	1220	100	8·2%	4·2%	0·35	0·27%
Tanzania	2011	362	432	8	258	314	6	1·2%	1·2%	0·06	0·03%
Uganda	2011	278	446	53	199	356	38	10·6%	14·7%	1·05	0·29%
<b>Lower-middle-income countries</b>											
Côte d'Ivoire	2012	244	93	12	643	276	32	11·8%	3·0%	0·23	0·05%
Nigeria	2012	759	451	123	230	174	37	21·4%	2·6%	0·37	0·05%
Zambia	2013	320	229	38	291	243	35	14·4%	3·7%	0·13	0·17%
<b>Upper-middle-income countries</b>											
Botswana	2012	178	106	267	556	1166	834	71·5%	61·6%	1·40	1·85%
Namibia	2012	108	136	175	449	1296	729	56·1%	26·3%	0·67	1·33%
South Africa	2010	1553	265	1218	255	243	200	82·1%	8·3%	0·18	0·33%

GAE=government expenditure on AIDS. RNE=resource needs estimate. EAE=external AIDS expenditure. DALY=disability-adjusted life-year. GDP=gross domestic product. GHE=government expenditure on health. \*Sources of AIDS expenditure data are shown in appendix p 3. †Population of people living with HIV corresponds to year of GAE estimate and was obtained from UNAIDS GAP Report 2014.<sup>25</sup> RNE is from the UNAIDS Investment Framework<sup>26</sup> and corresponds to year of GAE estimate. ‡DALYs are for year 2005 as estimated in the 2010 Global Burden of Disease study,<sup>25</sup> GDP is from International Monetary Fund World Economic Outlook April 2014,<sup>27</sup> and GHE is from WHO National Health Accounts.<sup>28</sup>

**Table 2: Recent government and external AIDS expenditure**

GDP; and government AIDS expenditure per person living with HIV.

The three upper-middle-income countries (Botswana, Namibia, and South Africa) are the only ones to fund most of their AIDS programmes from domestic sources. Nigeria and Kenya contribute about 20% of their total national AIDS spending, whereas all other countries account for less than 15% of the total. Excluding the three upper-middle-income countries, external funding covers an average of 87% of all AIDS spending, which emphasises the heavy dependence of the high-burden, low-income African countries on donor aid.<sup>34</sup>

Botswana's domestic spending on AIDS amounts to 1.9% of GDP, and Namibia is the only other country that allocates more than 1% of GDP to AIDS through its government budget (table 2). Four countries (Kenya, Rwanda, South Africa, and Uganda) have domestic outlays for AIDS that constitute 0.25–0.5% of GDP. Ethiopia, Mozambique, and Zambia devote between 0.1% and 0.2%, and the remaining countries (Côte d'Ivoire, Nigeria, and Tanzania) spend less than 0.05% of their GDP on AIDS. These results suggest that ten of these 12 countries are well below the Williams-Gouws threshold of 1–2% of GDP.<sup>32</sup>

The ratio of AIDS's share of government health spending to AIDS's share of disease burden varies widely from 0.06 to 1.40 (table 2). The average ratio is 0.75 for the three upper-middle-income countries, although South Africa is well below the other two countries (ratio of 0.18). The average is 0.48 for the remaining nine low-income and lower-middle-income countries, but only in five of the 12 countries (Ethiopia, Kenya, Uganda, Botswana, and Namibia) does AIDS's share of government health expenditure exceed the benchmark of 0.5 times AIDS's share of total disease burden.

Table 3 shows the estimated level of government expenditure on AIDS under the four scenarios on an average annual basis during 2014–18, and table 4 shows these same values as a proportion of the total number of people living with HIV. Table 5 builds on tables 3 and 4 by presenting aggregate results for all countries and also showing the potential implications for donors. Appendix pp 6–14 display year-by-year results at national level and also results from the Abuja target and DALY share scenarios without combining these targets with economic trends. In most scenarios, the benchmark government AIDS expenditure levels for the three upper-middle-income countries exceed the resource needs estimate projected by the UNAIDS investment framework, suggesting that these countries would be able to finance their entire AIDS response without external aid. Our main results in tables 3, 4, and 5 constrain government AIDS expenditure so that it does not exceed the resource needs estimate, but appendix pp 5–14 include the unrestricted results.

Under the most conservative scenario—the economic trends scenario—average annual domestic AIDS spending

for the 12 countries would rise 16% from \$2.1 billion to \$2.4 billion (table 3), with South Africa accounting for more than half of this increase. The projected aggregate domestic effort from this scenario would meet just 30% of the total AIDS resource needs of the 12 countries (table 5). Only Botswana and Namibia would have spending levels high enough to cover their full programme requirements and only two other countries (South Africa and Kenya) would cover more than 25% of their needs (table 5).

Under the Abuja target scenario, total domestic AIDS spending would increase by more than half to reach an average of \$3.2 billion per year for 2014–18, representing 40% of the 12 countries' entire AIDS funding needs (table 5). South Africa would account for 38% of this increase in national outlays, with Kenya accounting for 32% and Nigeria 19%. Kenya, Mozambique, and Côte d'Ivoire would more than triple their government expenditure on AIDS. No additional countries would become self-sufficient, but two additional countries

	UNAIDS Investment Framework resource needs estimate (2013 US\$ millions)*	Government expenditure (2013 US\$ millions) on AIDS, by scenario†				
		Baseline government expenditure on AIDS in 2013‡	Economic trends scenario	Abuja target scenario§	DALY share scenario§	Maximum effort scenario§
Low-income countries						
Ethiopia	\$455	\$55	\$75	\$103	\$75	\$103
Kenya	\$670	\$84	\$177	\$441	\$177	\$441
Mozambique	\$554	\$13	\$26	\$44	\$62	\$105
Rwanda	\$131	\$20	\$27	\$27	\$38	\$38
Tanzania	\$527	\$8	\$15	\$22	\$129	\$186
Uganda	\$411	\$53	\$73	\$117	\$73	\$117
Lower-middle-income countries						
Côte d'Ivoire	\$328	\$12	\$24	\$46	\$51	\$96
Nigeria	\$1092	\$123	\$161	\$327	\$218	\$440
Zambia	\$375	\$38	\$51	\$51	\$191	\$191
Upper-middle-income countries						
Botswana	\$215	\$267	\$215	\$215	\$215	\$215
Namibia	\$141	\$175	\$141	\$141	\$141	\$141
South Africa	\$3003	\$1218	\$1416	\$1635	\$3003	\$3003
Total	\$7901	\$2066	\$2402	\$3169	\$4373	\$5077
Percentage increase compared with baseline	NA	NA	16%	53%	112%	146%

NA=not applicable. \*Average annual resource needs estimates from the UNAIDS Investment Framework 2014–18. †Projected government expenditure on AIDS is constrained not to exceed UNAIDS Investment Framework resource needs. Values in italics indicate that the projected expenditure was capped by resource need. ‡The latest estimate of government AIDS expenditure found in country AIDS spending report. Most are from years 2010–13 (see table 2). Older estimates are carried forward to 2013 as a constant spending level. §These scenarios also include expected increases in government expenditure on AIDS because of economic trends.

**Table 3: Average annual government AIDS expenditures in 2014–18 under alternative scenarios**



	UNAIDS Investment Framework resource needs estimate per person living with HIV (2013 US\$)*	Government expenditure (2013 US\$) on AIDS per person living with HIV, by scenario†				
		Baseline government expenditure on AIDS in 2013‡	Economic trends scenario	Abuja target scenario§	DALY share scenario§	Maximum effort scenario§
<b>Low-income countries</b>						
Ethiopia	\$563	\$67	\$92	\$128	\$92	\$128
Kenya	\$413	\$84	\$109	\$272	\$109	\$272
Mozambique	\$322	\$9	\$15	\$26	\$36	\$61
Rwanda	\$655	\$89	\$134	\$134	\$189	\$189
Tanzania	\$363	\$6	\$11	\$15	\$89	\$128
Uganda	\$262	\$35	\$46	\$75	\$46	\$75
<b>Lower-middle-income countries</b>						
Côte d'Ivoire	\$886	\$39	\$66	\$123	\$139	\$261
Nigeria	\$329	\$39	\$49	\$98	\$66	\$133
Zambia	\$327	\$14	\$44	\$44	\$166	\$166
<b>Upper-middle-income countries</b>						
Botswana	\$653	\$653	\$653	\$653	\$653	\$653
Namibia	\$565	\$565	\$565	\$565	\$565	\$565
South Africa	\$438	\$195	\$207	\$239	\$438	\$438

\*Average annual resource needs estimates from the UNAIDS Investment Framework 2014–18. †Projected government AIDS expenditure is constrained not to exceed UNAIDS Investment Framework resource needs. Values in italics indicate that the projected expenditure was capped by resource need. ‡The latest estimate of government AIDS expenditure found in country AIDS spending report. Most are from years 2010–13 (see table 2). Older estimates are carried forward to 2013 as a constant spending level. §These scenarios also include expected increases in government expenditure on AIDS because of economic trends.

**Table 4: Average annual government AIDS expenditures per person living with HIV in 2014–18 under alternative scenarios**

(Kenya and South Africa) would cover more than 50% of their resource needs estimate, and two additional countries (Nigeria and Uganda) would generate more than 25% of their needs (table 5).

In the DALY share scenario, aggregate government expenditure on AIDS for the 12 countries would grow to \$4.4 billion per year—about double the baseline amount (table 3). South Africa alone would account for more than three-quarters of this increase. This amount of spending would be sufficient to cover 55% of total AIDS programme needs in the 12 countries, and all three upper-middle-income countries would fully cover their resource needs estimates. Rwanda and Nigeria would almost double their spending. Mozambique, Tanzania, Côte d'Ivoire, and Zambia would increase their government expenditure on AIDS by between 4.2 and 16 times the most recent estimates of spending. Still, without external aid, only one country (Zambia) besides the three upper-middle-income countries would be able to cover more than 50% of the resource needs estimate, and six countries (Côte d'Ivoire, Tanzania, Ethiopia, Mozambique, Nigeria, and Uganda) would still be contributing less than 25% of the resource needs estimate.

Under the maximum effort scenario, in which countries meet both the Abuja and the DALY share targets (in addition to building on the effects of projected macroeconomic growth), total average annual government expenditure on AIDS would increase by 2.5 times, reaching \$5.1 billion, which is sufficient to cover 64% of total AIDS financial needs. All three upper-middle-income countries would fully cover their AIDS programmes' resource needs estimate, five countries (Botswana, Namibia, South Africa, Kenya, and Zambia) would cover more than half of their resource needs, and all countries except Ethiopia and Mozambique would domestically fund at least 25% of their resource needs estimate.

The implications of increased domestic spending for donors' funding levels depend on what is assumed regarding the donors' willingness to reallocate savings in one country to other countries in which resource need estimate gaps persist. We estimate that the potential annual reduction in donor support in 2014–18 could be \$0.7 billion (16%) in the economic trends scenario, \$1.0 billion (24%) in the Abuja target scenario, \$1.4 billion (31%) in the DALY share scenario, and \$1.8 billion (41%) in the maximum effort scenario (table 5). If we assume that donors reallocate these savings to fill remaining gaps in these 12 countries, net reductions in donor outlays would occur only under the DALY share (\$0.8 billion [18%]) and maximum effort (\$1.5 billion [35%]) scenarios. We estimate that about three-quarters of the reductions would accrue to PEPFAR (table 5).

## Discussion

By applying benchmarks for health spending and AIDS's share of the health budget to a set of high-burden countries, and also factoring in projected macroeconomic trends, we show that in general the 12 countries will be able to finance a greater share of the costs of their AIDS programmes in the next 5 years. Nevertheless, in several countries, even if a maximum domestic effort is undertaken, support from donors will still be needed. Our analysis of resource gaps and implications for residual donor funding might help to outline the possibilities for shared financial responsibility between governments and donors in the future. The findings could also be useful to shape national policy dialogue and target-setting in partnership frameworks and other similar compacts and agreements between countries with large AIDS burdens and their donor partners.

Our analysis contributes to, and is largely consistent with, the recent effort to provide policy makers with information to assess levels of domestic financing for AIDS programmes and inform discussions between AIDS donors and recipient governments (panel). Ávila and colleagues<sup>23</sup> identified significant factors associated with increased domestic AIDS expenditure, isolating GDP per person and HIV prevalence as positive correlates of government expenditure on AIDS. The benchmarks we studied are constructed so that AIDS

	Economic trends scenario	Abuja target scenario*	DALY share scenario*	Maximum effort scenario*
Resource needs estimate	\$7.9 billion	\$7.9 billion	\$7.9 billion	\$7.9 billion
Flat PEPFAR funding level†	\$3.3 billion	\$3.3 billion	\$3.3 billion	\$3.3 billion
Flat non-PEPFAR external funding level‡	\$1.1 billion	\$1.1 billion	\$1.1 billion	\$1.1 billion
Government AIDS expenditure, uncapped	\$2.5 billion	\$3.5 billion	\$5.4 billion	\$7.0 billion
Government AIDS expenditure, capped by resource needs estimate	\$2.4 billion	\$3.2 billion	\$4.4 billion	\$5.1 billion
Capped government AIDS expenditure/resource needs estimate§	30%	40%	55%	64%
Number of countries that would cover >75% of resource needs estimate	2	2	3	3
Number of countries that would cover >50% of resource needs estimate	2	4	4	5
Number of countries that would cover >25% of resource needs estimate	4	6	6	10
Number of countries in which donors could reduce funding§	8	8	9	9
Potential donor reduction without redistribution¶	\$0.7 billion (16%)	\$1.0 billion (24%)	\$1.4 billion (31%)	\$1.8 billion (41%)
Potential donor reduction after redistribution¶	\$0 (0%)	\$0 (0%)	\$0.8 billion (18%)	\$1.5 billion (35%)
PEPFAR share of reductions	75%	78%	73%	75%

Monetary amounts are in billions of US\$. PEPFAR=US President's Emergency Plan for AIDS Relief. \*These scenarios also include expected increases in government AIDS expenditure due to economic trends. †Based on 2012 country operational plans for individual countries, which totalled \$3.3 billion, and does not account for already negotiated partnership framework implementation plans in South Africa and Nigeria that have built-in reductions over the next 5 years. ‡Based on 2010 development assistance for health for HIV/AIDS for individual countries (source: IHME<sup>24</sup>). §Assumes that reductions in one country are not redistributed to other countries in the group that have remaining resource gaps. ¶Assumes that donors would redistribute funds to countries in the group with remaining resource gaps. ||Assumes the PEPFAR share of reductions in each country is proportional to its 2010 level share of external support for AIDS, which ranges from 51% in Ethiopia to 96% in Botswana (76% overall).

**Table 5: AIDS resource needs, domestic and external shares, potential external funding reductions, and residual gaps: average annual values for 2014–18 under alternative scenarios**

spending targets are larger, with all other factors remaining equal, in higher-income countries, and in countries with a larger disease burden. Also consistent with previous work by others, we report a large amount of variation in AIDS spending that is not explained by countries' income level or AIDS epidemic size. Galárraga and colleagues<sup>21</sup> compared AIDS spending per person living with HIV against an expected level estimated from a median regression model with gross national income per person, health spending as a proportion of gross national income, and debt service per person as predictors.<sup>21</sup> In their analysis, Galárraga and colleagues concluded, for the countries we studied in common, that Uganda, Nigeria, Namibia, Côte d'Ivoire, and South Africa were spending less on AIDS than expected, and Botswana, Kenya, Mozambique, Zambia, and Rwanda were spending more than expected. Although the results of the two studies generally agree, Galárraga's findings suggest that Mozambique is making quite a strong effort whereas our analysis suggests the country might be able to do much more. Likewise, Galárraga's findings show Namibia as an under-spender, whereas in our analysis it is the only country apart from Botswana to budget more than 1% of GDP to AIDS expenditure, and it is already covering its full resource needs estimate.

The benchmarks we propose have several limitations. First, our work was restricted to countries with relatively high-burden generalised epidemics. The benchmarks might be less useful for assessments of AIDS spending in settings with concentrated epidemics. Second, the available data about government health expenditure and government AIDS expenditure remain imperfect. Even

when different countries use similar methods to estimate government AIDS expenditure, substantial uncertainty persists regarding the reported point estimates for each country. Moreover, variation across countries in the application of government AIDS expenditure measurement methods, such as the proportionate allocation of shared health-care resources to AIDS programmes, could also generate inconsistencies in the reported spending levels. In some countries, subtracting external funds for health that are channelled through the government's budget system to generate domestically sourced funds is challenging. These limitations make it more difficult to assess whether or not a country is meeting the proposed benchmarks for AIDS spending.

A third limitation is that the share of national health budget allocated to AIDS might reasonably depend on other factors in addition to AIDS's share of disease burden, such as the cost-effectiveness of available interventions to address each category of disease burden in a country and the amount of money spent on these interventions at full scale. For example, if more DALYs can be averted by a set of non-AIDS interventions that exhaust the health budget before AIDS interventions with favourable cost-effectiveness are funded, then it might be reasonable for AIDS programmes to have quite low domestic funding. Conversely, other resource allocation algorithms that consider objectives beyond pure maximisation of DALYs averted, such as schemes ensuring a basic set of services of reasonable value in all disease areas, can also affect the share of national health budgets devoted to AIDS. Unless countries have an explicit, transparent process for allocation of health resources, and without comprehensive

**Panel: Research in context****Systematic review**

We did a systematic review of published studies related to HIV and AIDS expenditure and domestic contributions. We searched PubMed and Google Scholar for English-language articles published between 2008 and October, 2014, using the search terms “HIV” or “AIDS” and “financing”, “funding”, “spending”, “resources”, or “expenditure” in the article title. We then reviewed the articles to establish whether they discussed benchmarks for AIDS spending or assessed current AIDS spending levels. Relevant findings included UNAIDS’ Domestic Investment Priority Index and several recent studies.<sup>11,21,23,32,33,35,36</sup> Several of these recent works have rigorously assessed the dispersion of domestic AIDS spending patterns, to categorise and analyse prevailing practices. However, most of the existing studies judge countries’ recent past performance relative to peers rather than against normative reference points. Existing studies are also limited in how far they explore the implications of future changes in domestic financing for both countries and donors. Those that did were focused on scenarios in which only the lower performers improve or were several years old.

**Interpretation**

This study adds to the existing published literature by applying a range of benchmarks to domestic AIDS spending and by creating a policy-oriented foundation for the analysis by projecting future funding scenarios, calculating their implications on remaining resource gaps, and quantifying the reduced role for external financing. In this study, we compare levels of domestic spending on AIDS with four normative benchmarks, based on expected economic growth, health spending as a share of total government spending, AIDS spending as a share of health spending compared with AIDS’s share of the disease burden, and a combination of all three. We calculate future domestic spending under the assumption that countries meet each benchmark and compare these spending levels with estimated resource needs and expected donor financing. We find that AIDS spending varies greatly, even after we account for income level and epidemic size, which is consistent with previous work. We also note heavy dependence on donor funds from the low-income and lower-middle-income countries, which would be unable to cover their full resource needs even if they met the most ambitious of the four scenarios. Conversely, upper-middle-income countries would be able to cover their full resource needs under several spending scenarios. These findings suggest that donor funding could be reduced in the upper-middle-income countries, if spending were to increase in line with our targets, to free up resources that could potentially be reallocated to cover persisting gaps in the lower-income countries.

data about how government expenditure on health is allocated across diseases and the cost-effectiveness of related interventions, whether or not the extant allocation for a given disease area is consistent with country priorities is difficult to judge.

A further limitation concerns the estimation of AIDS resource gaps. Resource needs estimates in AIDS national strategic plans, where available, are often much higher than UNAIDS investment framework estimates. Since the resource needs estimate per person living with HIV is not correlated with income, we have presented projections of government expenditure on AIDS that are both capped by resource needs estimates and uncapped. Efforts are currently underway at UNAIDS to revise and improve estimates of national resource needs.

Our analysis suggests that, across these 12 sub-Saharan African countries, total and domestic AIDS spending varies widely after factoring in each country’s

ability to pay and the size of its AIDS burden. The reasons for this variation remain unclear, but possible causes include political commitment, quality and efficiency of services, degree of integration within the overall health system, population density and the presence of difficult-to-reach populations, and competing health and social sector priorities, in addition to other spending priorities (including external debt and defence). Future research could explore the significance of these factors for AIDS spending.

Although our analysis suggests that most of the countries studied here could feasibly increase their domestic spending on AIDS, it will be challenging for these and other countries with large AIDS burdens to rapidly increase financing in line with the benchmarks explored in this report. Many obstacles exist against a rapid increase in national funding, including tight budgets, limited fiscal space, and competing priorities in many countries, insufficient political commitment in others, and, in some cases, an ingrained donor dependency mentality. Countries might be able to generate expanded revenues through innovative mechanisms such as earmarked levies and so-called sin taxes (such as those on tobacco and sugary drinks), or through universal health coverage schemes with guaranteed packages of services including HIV prevention and AIDS treatment and care.<sup>36</sup> Additional analysis, including historical assessment of the strategies used by countries and the pace with which they have been able to raise domestic budgets both for health generally and for specific health priorities such as AIDS, would help to inform the development of realistic timelines for countries to pursue to reach benchmark AIDS funding levels.

As PEPFAR, the Global Fund, and the governments of low-income and middle-income countries advance in designing and negotiating AIDS financing agreements, such as partnership framework implementation plans, country health partnerships, and Global Fund grant agreements, the approaches developed in this Article could be used by all parties to agree on monitorable financial targets. Ultimately, however, the setting of funding targets must be done at the national level, through a collaborative process involving the government and donors. In this way, the fiscal flexibility and potential of each country can be explored fully, improving the chances that the adopted spending targets will be owned by the government and donors and thus implemented in practice. The benchmarks proposed here, along with data about AIDS expenditures and resource needs, can be further refined as they are used in future country-level exercises to establish the appropriate levels of financial burden sharing between national governments and donors.

Resource mobilisation and spending commitments for AIDS will continue to need negotiation and dialogue, both within countries and between countries and donors, that consider contextual factors. Nevertheless, the type of benchmarking done in this analysis can add



useful reference points on which to base these discussions and resulting agreements, which will have a major effect on the lives of tens of millions of people in developing countries.

#### Contributors

SR led the data analysis and writing of this report. He analysed all data, led the development of the relevant benchmarks and targets, interpreted the data, wrote the first draft of the report, and contributed to subsequent versions. TR helped with data collection (including synthesis of country financing data from country AIDS spending reports and inputting necessary data facts), wrote some sections and edited drafts of the report, and helped with tables, figures, and formatting. RH coordinated the overall development of the report, and provided guidance and leadership, especially on the interpretation of the analysis for policy. He led decision making about what data, analysis, and conclusions to focus on, wrote some sections and helped to revise the report.

#### Declaration of interests

SR, TR, and RH have received funding from the US Centers for Disease Control and Prevention through a subcontract with ICF Macro, which enabled the conduct of this study. We declare no other competing interests.

#### Acknowledgments

This study is funded by the US Centers for Disease Control and Prevention through the Results for Development Institute's subcontract to ICF Macro, under subcontract agreement number 110632-11S-1679 to prime contract GS-23F-9777H/200-2011-F-40334. We thank Richard Skolnik for his contributions to earlier work that created foundations for the report and Julia Levinson for her help with final revisions.

#### References

- Dieleman J, Graves C, Templin T, et al. Global health development assistance remained steady in 2013 but did not align with recipients' disease burden. *Health Aff* 2014; **33**: 878–86.
- Joint United Nations Programme on HIV/AIDS (UNAIDS). AIDS at 30: nations at the crossroads. Geneva, Switzerland: UNAIDS, 2011. <http://www.unaids.org/unaidresources/aidsat30/aids-at-30.pdf> (accessed Aug 19, 2013).
- Joint United Nations Programme on HIV/AIDS (UNAIDS). 2012 UNAIDS report on the global AIDS epidemic. Geneva, Switzerland: UNAIDS, 2012. [http://www.unaids.org/en/resources/documents/2012/20121120\\_UNAIDS\\_Global\\_Report\\_2012](http://www.unaids.org/en/resources/documents/2012/20121120_UNAIDS_Global_Report_2012) (accessed Aug 19, 2013).
- Granich R, Kahn JG, Bennett R, et al. Expanding ART for treatment and prevention of HIV in South Africa: estimated cost and cost-effectiveness 2011–2050. *PLoS One* 2012; **7**: e30216.
- WHO. Consolidated guidelines on general HIV care and the use of antiretroviral drugs for treating and preventing HIV infection: recommendations for a public health approach; Geneva, Switzerland: World Health Organization, 2013. <http://www.who.int/hiv/pub/guidelines/arv2013/download/en/> (accessed Aug 19, 2013).
- Joint United Nations Programme on HIV/AIDS (UNAIDS). Treatment 2015. Geneva, Switzerland: UNAIDS, 2013. [http://www.unaids.org/en/media/unaids/contentassets/documents/unaidspublication/2013/JC2484\\_treatment-2015\\_en.pdf](http://www.unaids.org/en/media/unaids/contentassets/documents/unaidspublication/2013/JC2484_treatment-2015_en.pdf) (accessed Aug 19, 2013).
- Schwartzlander B, Stover J, Hallett T, et al. Towards an improved investment approach for an effective response to HIV/AIDS. *Lancet* 2011; **377**: 2031–41.
- Joint United Nations Programme on HIV and AIDS (UNAIDS). Fast-track—ending the AIDS epidemic by 2030. Geneva, Switzerland: UNAIDS, 2014. [http://www.unaids.org/sites/default/files/media\\_asset/JC2686\\_WAD2014report\\_en.pdf](http://www.unaids.org/sites/default/files/media_asset/JC2686_WAD2014report_en.pdf) (accessed Dec 1, 2014).
- Joint United Nations Programme on HIV/AIDS (UNAIDS). Global report: UNAIDS report on the global AIDS epidemic 2013. Geneva, Switzerland: UNAIDS, 2013. [http://www.unaids.org/en/media/unaids/contentassets/documents/epidemiology/2013/gr2013/UNAIDS\\_Global\\_Report\\_2013\\_en.pdf](http://www.unaids.org/en/media/unaids/contentassets/documents/epidemiology/2013/gr2013/UNAIDS_Global_Report_2013_en.pdf) (accessed Feb 2, 2014).
- The Kaiser Family Foundation and Joint United Nations Programme on HIV/AIDS (UNAIDS). Financing the response to HIV in low- and middle-income countries. Geneva, Switzerland: UNAIDS, 2013. [http://www.unaids.org/en/media/unaids/contentassets/documents/document/2013/09/20130923\\_KFF\\_UNAIDS\\_Financing.pdf](http://www.unaids.org/en/media/unaids/contentassets/documents/document/2013/09/20130923_KFF_UNAIDS_Financing.pdf) (accessed March 7, 2014).
- Lule E, Haacker M. The fiscal dimensions of HIV/AIDS in Botswana, South Africa, Swaziland, and Uganda. Washington, DC: World Bank, 2011. <http://elibrary.worldbank.org/doi/book/10.1596/978-0-8213-8807-5> (accessed Aug 9, 2013).
- Buse K, Martin G. AIDS: ushering in a new era of shared responsibility for global health. *Global Health* 2012; **8**: 26.
- Dybul M. Learning from Africa. The Global Fund to Fight AIDS, Tuberculosis, and Malaria. Nov 11, 2013. [http://www.theglobalfund.org/en/blog/2013-11-11\\_Learning\\_from\\_Africa/](http://www.theglobalfund.org/en/blog/2013-11-11_Learning_from_Africa/) (accessed Jan 22, 2014).
- The United States President's Emergency Plan for AIDS Relief (PEPFAR). Ninth annual report to congress on PEPFAR. Washington, DC: PEPFAR, 2013. <http://www.pepfar.gov/press/c57496.htm> (accessed Jan 22, 2014).
- African Union. Roadmap on shared responsibility and global solidarity for AIDS, TB and malaria response in Africa. Addis Ababa, Ethiopia: African Union, 2013. [http://www.au.int/en/sites/default/files/Shared\\_Res\\_Roadmap\\_Rev\\_F%5B1%5D.pdf](http://www.au.int/en/sites/default/files/Shared_Res_Roadmap_Rev_F%5B1%5D.pdf) (accessed Aug 19, 2013).
- Friends of the Global Fight against AIDS, Tuberculosis, and Malaria. Domestic financing: shared responsibility, mutual accountability. Washington, DC: Friends of the Global Fight against AIDS, Tuberculosis, and Malaria, 2014. <http://theglobalfight.org/domestic-financing-shared-responsibility-mutual-accountability/> (accessed Oct 9, 2014).
- United Nations. Panel 1: shared responsibility—a new global compact for HIV. New York: USA: United Nations General Assembly, 2011. [http://www.unaids.org/en/media/unaids/contentassets/documents/document/2011/06/20110601\\_HLM\\_Pannell.pdf](http://www.unaids.org/en/media/unaids/contentassets/documents/document/2011/06/20110601_HLM_Pannell.pdf) (accessed Sept 16, 2014).
- The Global Fund to Fight AIDS, TB, and Malaria. Counterpart financing and willingness to pay. Geneva, Switzerland: Global Fund, 2013. <http://www.theglobalfund.org/en/fundingmodel/counterpartfinancingwtp/> (accessed March 7, 2014).
- The United States President's Emergency Plan for AIDS Relief (PEPFAR). Guidance for PEPFAR partnership frameworks and partnership framework implementation plans version 2.0. Washington, DC: PEPFAR, 2013. <http://www.pepfar.gov/reports/guidance/framework/index.htm> (accessed Dec 21, 2013).
- Joint United Nations Programme on HIV/AIDS (UNAIDS). 2010 Global report chapter 6: HIV investments. Geneva, Switzerland: UNAIDS, 2010. [http://www.unaids.org/documents/20101123\\_GlobalReport\\_Chap6\\_em.pdf](http://www.unaids.org/documents/20101123_GlobalReport_Chap6_em.pdf) (accessed Feb 4, 2014).
- Galárraga O, Wirtz V, Santa-Ana-Tellez Y, Korenromp E. Financing HIV programming: how much should low- and middle-income countries and their donors pay? *PLoS One* 2013; **8**: e67565.
- Fan V, Silverman R, Duran D, Glassman A. Data Set for the financial flows of PEPFAR: a profile. Washington, DC: Center for Global Development, 2013. <http://www.cgdev.org/publication/data-set-financial-flows-pepfar-profile> (accessed Feb 4, 2014).
- Ávila C, Loncar D, Amico P, De Lay P. Determinants of government HIV/AIDS financing: a 10-year trend analysis from 125 low- and middle-income countries. *BMC Public Health* 2013; **13**: 673.
- Institute for Health Metrics and Evaluation (IHME). Development Assistance for health country and regional recipient level database 1990-2010. Seattle, WA: IHME, 2012. <http://ghdx.healthmetricsandevaluation.org/record/development-assistance-health-country-and-regional-recipient-level-database-1990-2010> (accessed Feb 4, 2014).
- Institute for Health Metrics and Evaluation (IHME). Global burden of disease: GBD compare. Seattle, WA: IHME, 2013. <http://viz.healthmetricsandevaluation.org/gbd-compare/> (accessed Jan 22, 2014).
- Joint United Nations Programme on HIV/AIDS (UNAIDS). The Gap Report. Geneva, Switzerland: UNAIDS, 2014. [http://www.unaids.org/en/resources/documents/2014/20140716\\_UNAIDS\\_gap\\_report](http://www.unaids.org/en/resources/documents/2014/20140716_UNAIDS_gap_report) (accessed Oct 9, 2014).
- International Monetary Fund. World Economic Outlook Database. Washington, DC: International Monetary Fund, July 2014. <http://www.imf.org/external/pubs/ft/weo/2014/01/weodata/index.aspx> (accessed Oct 9, 2014).
- World Health Organization. Global Health Expenditure Database. Geneva, Switzerland: WHO, 2014. <http://apps.who.int/nha/database> (accessed Oct 7, 2014).

- 29 African Union. Abuja declaration on HIV/AIDS, tuberculosis, and other related infectious diseases. Addis Ababa, Ethiopia: African Union, 2001. [http://www.un.org/ga/aids/pdf/abuja\\_declaration.pdf](http://www.un.org/ga/aids/pdf/abuja_declaration.pdf) (accessed Aug 19, 2013).
- 30 Govenda V, McIntyre D, Loewenson R. Progress towards the Abuja target for government spending on health care in east and southern Africa. EQUINET 2008; series 57. <http://www.equinet africa.org/bibl/docs/DIS60finABUJA.pdf> (accessed Aug 19, 2013).
- 31 Williams A. Calculating the global burden of disease: time for a strategic reappraisal? *Health Econ* 1999; **8**: 1–8.
- 32 Williams BG, Gouws E. Affordability, cost and cost-effectiveness of universal anti-retroviral therapy for HIV. Cornell University Library. June, 2012. <http://arxiv.org/abs/1206.6774> (accessed Aug 19, 2013).
- 33 Haacker M. Financing HIV/AIDS programs in sub-Saharan Africa. *Health Aff* 2009; **28**: 1606–16.
- 34 Hecht R, Stover J, Bollinger L, Muhib F, Case K, de Ferranti D. Financing of HIV/AIDS programme scale-up in low-income and middle-income countries, 2009–31. *Lancet* 2010; **376**: 1254–60.
- 35 Vassall A, Remme M, Watts C, et al. Financing essential HIV services: a new economic agenda. *PLoS Med* 2013; **10**: e1001567.
- 36 Katz I, Routh S, Bitrán R, Hulme A, Ávila C. Where will the money come from? Alternative mechanisms to HIV donor funding. *BMC Public Health* 2014; **14**: 956.