

# Financing HIV/AIDS Programs In Sub-Saharan Africa

Some countries will need substantial support from external donors to maintain the fight.

by **Markus Haacker**

**ABSTRACT:** This paper offers an analysis of the costs and the financing of HIV/AIDS programs for countries in sub-Saharan Africa. The rate of external financing varies with gross domestic product (GDP) per capita, but not much at all with HIV prevalence. In six of the thirty-four countries examined, the costs of HIV/AIDS programs will exceed 3 percent of GDP by 2015. Most of these are low-income countries. Considerable external support at current rates in these countries would help contain the fiscal costs to around 1 percent of GDP. But if that support dwindles, countries would have to borrow money or cut back on their own spending for HIV/AIDS. [Health Aff (Millwood). 2009;28(6):1606–16]

**A**S WITH THE CHALLENGES OF FINANCING HIV/AIDS programs at the global level, the response to HIV/AIDS poses major and complex fiscal challenges at the national level. In developing national (and, by extension, global) responses to HIV/AIDS, it is necessary for policymakers to understand the nature and scale of these fiscal challenges and the way issues in financing the global response play out in individual countries.

To explicate these challenges, this paper first reviews available data on countries' HIV/AIDS-related spending and on the respective roles of external and domestic financing. Next, it offers a forward-looking analysis of the projected costs of HIV/AIDS programs across sub-Saharan Africa and of the implied domestic financing needs. Limitations of the analysis and conclusions follow.

## HIV/AIDS-Related Spending Across Countries

The most comprehensive data on HIV/AIDS-related spending across countries are collected as part of the United Nations (UN) progress reports prepared by or on behalf of national governments following the 2001 Declaration of Commitment on HIV/AIDS. These so-called UNGASS progress reports are the basis of data on HIV/AIDS-related spending published with UNAIDS Reports on the Global AIDS Epidemic (data for thirty-four African countries are summarized in Exhibit 1).

For low-income countries (as defined by the World Bank<sup>1</sup> and corresponding to

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*Markus Haacker (markus.haacker@lshtm.ac.uk) is an economist in the Health Policy Unit, London School of Hygiene and Tropical Medicine, in London, England.*

**EXHIBIT 1**  
**HIV/AIDS Spending And External Financing Across Thirty-Four African Countries,**  
**2005–2007**

Country	Year	GDP per capita (\$US)	HIV prevalence (ages 15–49)	HIV/AIDS spending as percent of GDP	External financing as percent of HIV/AIDS spending
Angola	2007	3,756	2.1%	0.08%	17.9%
Benin	2007	709	1.2	0.47	– <sup>a</sup>
Botswana	2007	7,933	23.9	1.85	11.2
Burkina Faso	2006	431	1.7	0.75	77.7
Cameroon	2007	1,097	5.1	0.18	74.6
Central African Rep.	2006	353	6.3	0.99	95.7
Chad	2007	734	3.5	0.07	– <sup>a</sup>
Rep. of Congo	2007	2,159	3.5	0.21	68.9
Côte d'Ivoire	2006	941	4.2	0.23	88.0
Dem. Rep. of Congo	2006	149	1.25	0.47	– <sup>a</sup>
Eritrea	2007	271	1.3	0.59	90.3
Gabon	2007	8,085	5.9	0.08	41.1
Gambia	2007	405	0.9	2.63	7.3
Ghana	2006	594	2.0	0.18	78.6
Guinea-Bissau	2007	213	1.8	0.79	100.0
Lesotho	2006	634	23.3	1.64	81.3
Madagascar	2007	392	0.1	0.22	81.8
Malawi	2005	222	12.3	1.98	67.7
Mali	2006	487	1.5	0.43	67.7
Mauritius	2006	5,037	1.7	0.02	29.3
Mozambique	2006	362	12.3	1.32	85.0
Namibia	2007	3,671	15.3	1.75	49.2
Niger	2006	277	0.8	0.60	47.6
Nigeria	2007	1,161	3.1	0.01	43.8
Rwanda	2006	312	2.9	2.96	94.9
Senegal	2007	915	1.0	0.16	52.2
Sierra Leone	2007	290	1.7	0.34	95.8
South Africa	2007	5,916	18.1	0.22	22.7
Swaziland	2006	2,633	26.2	1.84	60.2
Togo	2007	387	3.3	0.47	86.7
Uganda	2005	320	6.1	2.19	93.9
Tanzania	2006	376	6.3	2.25	59.4
Zambia	2006	917	15.0	1.74	84.7
Zimbabwe	2006	417	17.2	2.65	51.0

**SOURCES:** Author's calculations; International Monetary Fund, World Economic Outlook Database, April 2009 ed.; UNAIDS, 2008 Report on the Global AIDS Epidemic; and UNAIDS, Annual Estimates of HIV Prevalence, People Living with HIV/AIDS, and HIV/AIDS-Related Deaths, 1990–2007.

**NOTE:** GDP is gross domestic product.

<sup>a</sup> Not available.

those with annual per capita gross domestic product, or GDP, below US\$1,000 in Exhibit 1),<sup>1</sup> there is a wide dispersion of HIV/AIDS-related spending, 0–3 percent of GDP. Three middle-income countries report HIV/AIDS-related spending close to 2 percent of GDP. For others, HIV/AIDS-related spending is lower than 0.3 percent of GDP.

Looking at spending in relation to HIV prevalence, countries with HIV preva-

lence greater than 10 percent of the population ages 15–49 typically report HIV/AIDS-related spending in a range of 1.5–2.0 percent of GDP. Outliers in this group are Zimbabwe (2.6 percent of GDP) and South Africa (0.2 percent of GDP).<sup>2</sup> Among the other countries, many are clustered at an HIV prevalence rate below 5 percent and HIV/AIDS-related spending of less than 0.5 percent of GDP. Major outliers are Rwanda and Gambia, with levels of spending of 2.9 percent and 2.6 percent of GDP, respectively.

The data summarized in Exhibit 1 also illustrate the prominent role of external support in financing national HIV/AIDS programs.<sup>3–5</sup> In twelve of twenty-one low-income countries examined, external financing plays a dominant role, accounting for 80–100 percent of the total costs of national HIV/AIDS spending. The extent of external financing tapers off as GDP per capita increases, and it generally accounts for less than 30 percent of HIV/AIDS-related spending for countries with annual GDP per capita exceeding US\$5,000.<sup>6</sup>

There are several points worth making about the pattern of HIV/AIDS-related spending across countries. First, some low-income countries apparently face a very large burden (as measured by actual spending relative to GDP), whereas the burden faced by certain middle-income countries—even those with high HIV prevalence—appears lower relative to their economic capacities. Two factors appear to be playing a role. The unit costs of many HIV/AIDS interventions (such as medical supplies) in countries with lower income may be lower in absolute terms but may be higher relative to GDP per capita (that is, they decline or increase less than proportionally with income), and external financing enables low-income countries to meet the disproportionately large burden of HIV/AIDS-related spending. Indeed, external financing appears to be driving most of the dispersion in HIV/AIDS-related spending among low-income countries.

Meanwhile, domestically financed HIV/AIDS spending appears to increase with HIV prevalence, whereas no clear correlation is apparent between the extent (percentage of total) of external financing and HIV prevalence. Thus, at first sight it appears that the extent of external financing follows a similar pattern as overall development assistance, as disbursements predominantly accrue to low-income countries and the disease burden of HIV/AIDS plays a subordinate role.

This impression, however, is misleading. The shares of external financing of HIV/AIDS spending in middle-income countries are higher than the role of external support in financing the overall public health expenditures.<sup>7</sup> For example, if the extent of external financing in countries with high HIV prevalence, such as Botswana and South Africa, is “only” 10–20 percent, this needs to be interpreted against the role of external aid in these countries overall (essentially, zero except for aid for HIV/AIDS). Along similar lines, the rates of external financing of HIV/AIDS spending in low-income countries (unweighted average of 76 percent, frequently 80–100 percent of total spending) compare to an average rate of external financing of 28 percent for health expenditures overall.<sup>8</sup>

For the poorest countries in our sample (annual per capita GDP around US\$300), external financing accounts for about 80 percent of recorded HIV/AIDS-related spending.<sup>9</sup> The share of external financing declines by ten percentage points for each additional US\$1,000 in GDP per capita. Thus, donors complement each dollar of domestically financed spending with up to four dollars of external financing (for the countries with very low per capita GDP). This “markup” then declines steadily to about zero when per capita GDP reaches US\$8,000. An alternative interpretation, with somewhat different implications, is that donors demand a certain amount of “collateral” financing from domestic governments as a condition for support.<sup>10</sup>

Regarding the link between HIV prevalence and external financing, some weak evidence<sup>11</sup> indicates that higher HIV prevalence (controlling for GDP per capita) translates into a higher share of external financing. The coefficient, however, is small (an additional 10 percent of HIV prevalence translating into an extra 2 percent of external financing) and insignificant.

To summarize, (1) countries with high HIV prevalence also spend more to contain and respond to the epidemic, and (2) donors complement the domestic efforts in line with a country’s level of economic development.

### **Fiscal Dimensions Of HIV/AIDS—A Cross-National Perspective**

The fiscal analysis was designed to achieve wide country coverage, drawing on summary data on the state of the HIV/AIDS epidemic across countries<sup>12</sup> and available data on HIV/AIDS-related spending,<sup>3</sup> as well as other data on the costs and unit costs of HIV/AIDS programs across countries. Below, I first summarize the structure of the model and its key parameters. This is followed by a discussion of the fiscal costs of HIV/AIDS programs in 2007–2025, and an analysis of how they relate to country characteristics such as GDP per capita or HIV prevalence.

■ **Assumptions underlying the projections.** The analytical framework, focusing on the costs of treatment, has been designed to be compatible with cross-national data available in the public domain or readily accessible. Specifically, the analysis built on summary estimates of HIV incidence such as those published by UNAIDS.<sup>3,12</sup> Additionally, I used data on underlying mortality from the UN Population Division.<sup>13,14</sup> Broadly distinguishing between first-line and second-line treatment, this model resembles more complete epidemiological and demographic models such as the Spectrum model developed by John Stover and others.<sup>15</sup> However, unlike the more sophisticated models, this one cannot differentiate people by age or sex (because the analysis draws on the aggregate summary data available across countries).

The transitions to first-line treatment need, second-line treatment need, and HIV/AIDS-related deaths were modeled using Weibull distributions.<sup>16</sup> I assumed that HIV/AIDS-related parameters were the same across countries. However, countries in these projections differ by underlying (non-HIV/AIDS) mortality. Be-

cause the cross-national data on HIV incidence do not differentiate infections by age group, I created underlying survival curves based on age-specific estimates from the “no-AIDS” counterfactual estimates from the UN Population Division,<sup>13</sup> using a broad assumption about the age profile of people newly infected.<sup>17</sup>

Estimates of the number of people receiving treatment were based on the assumption that all countries eventually attain a treatment coverage rate of 80 percent for patients newly requiring treatment. This may be less than what can be achieved in some countries and overly ambitious in others. However, the main objective was to assess the extent of the challenges of scaling up from a fiscal angle. Thus, applying a common benchmark—without prejudging how individual countries respond to fiscal or capacity bottlenecks—is useful.

Regarding the projections of the costs of HIV/AIDS programs, I distinguished among the costs of antiretroviral treatment, other costs of care, and spending not related to treatment and care. The assumptions regarding the costs of treatment were motivated by the analysis by Owen McCarthy and Mead Over,<sup>18</sup> which were also used in another report by Over,<sup>19</sup> based on the variation of drug prices observed across countries, assuming that the costs of treatment increase (although less than proportionally) with the level of GDP per capita.<sup>20</sup>

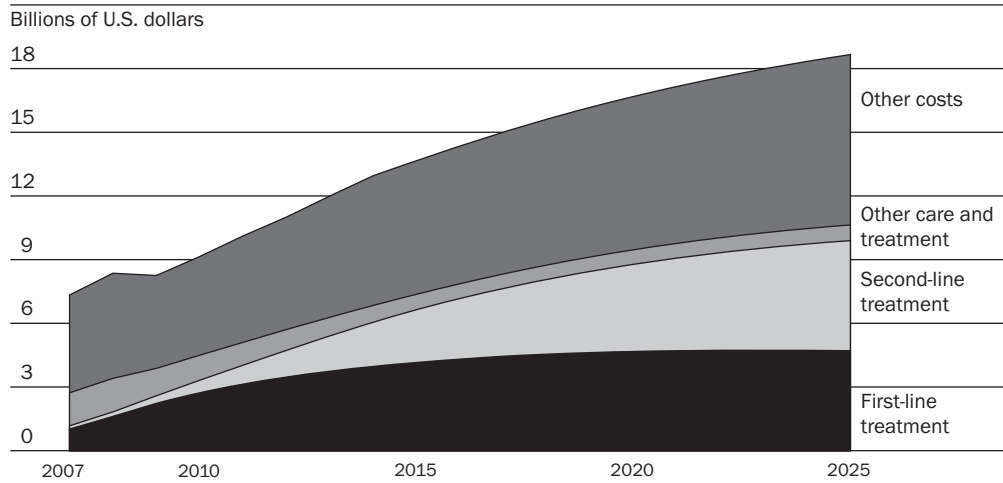
Little concrete material is available to inform the estimates of the costs of treatment and care other than antiretroviral treatment across countries. I assumed that the lifetime fiscal costs of non-antiretroviral therapy care and treatment amount to 0.5 times GDP per capita and that these costs are incurred during the last two years of a patient’s life.<sup>21</sup>

In addition to accounting for the costs of care and treatment, which were modeled based on estimates of the numbers of people needing and receiving treatment, the estimates capture the costs of prevention programs, overhead, and certain social expenditures. For these costs, there are no obvious scale variables. In line with the limited cross-national data available,<sup>22</sup> it was assumed that other HIV/AIDS-related spending is equal to a flat component of 0.22 percent of GDP, plus a variable component of 0.042 percent of GDP for each percentage point of HIV prevalence. This implies, for example, spending equivalent to 1.1 percent of GDP at an HIV prevalence rate of 20 percent.

■ **Projections.** Exhibit 2 summarizes the projections of the costs of HIV/AIDS programs for thirty-four African countries through 2025.<sup>23</sup> The costs of national HIV/AIDS programs increase almost continuously, from about US\$8 billion in 2008 to US\$19 billion in 2025, largely driven by the increasing costs of antiretroviral treatment, which rise from 20 percent of the total to about 50 percent. The increase in the costs of treatment also reflects the increasing role of more expensive lines of treatment. Although the overall number of people receiving treatment increases from 2.7 million to 11.5 million, the share of people receiving second-line therapy in this group increases from less than 5 percent to more than 25 percent.

These projections are useful to assess global financing needs or the consistency

**EXHIBIT 2**  
**Projected Costs Of HIV/AIDS Programs In Thirty-Four African Countries, 2007–2025**



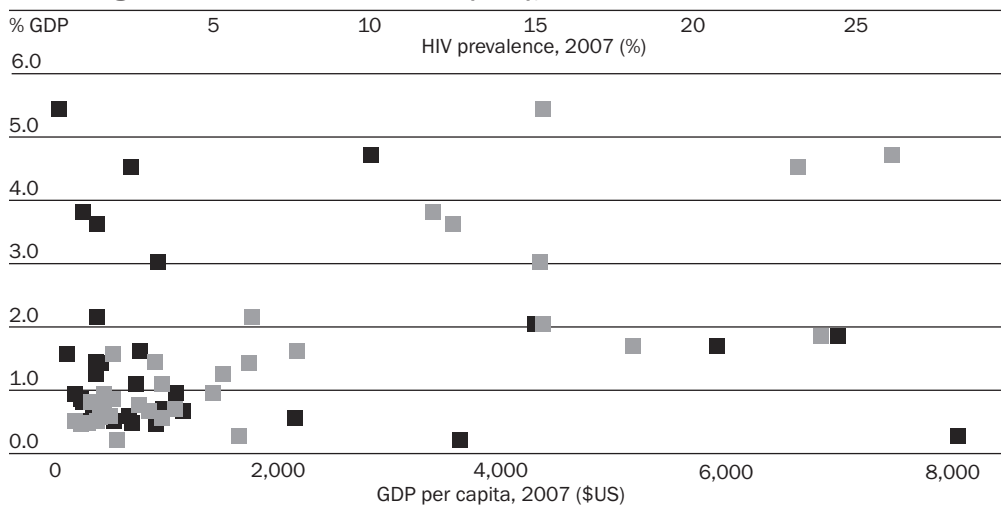
**SOURCE:** Author's projections.

of the projections with other global estimates and projections. However, they are not immediately relevant from a fiscal perspective, because the scale of the epidemic and the fiscal and economic context differ very considerably across countries. The remainder of the paper therefore explores the fiscal dimension of HIV/AIDS programs on the country level, differentiating between countries according to HIV prevalence and the level of GDP per capita.

Exhibit 3 provides a snapshot of the projected costs of HIV/AIDS programs by country for the year 2015. HIV/AIDS-related spending, as a percentage of GDP, increases (although less than proportionally) with the level of HIV prevalence. However, for any level of HIV prevalence, the level of spending may differ by a factor of about 3. This reflects the fact that, according to the projection's assumptions and reflecting historical patterns, the costs of national HIV/AIDS programs, relative to GDP, are larger in countries with a lower level of GDP per capita.

Because a large share of HIV/AIDS-related spending occurs within the health sector, it is useful to relate these costs to the level to health spending, to understand the scale of the operational challenges involved in scaling up a national response to HIV/AIDS. In particular, the projected costs of care and treatment represent an expansion in services that may compete with other health services for fiscal and other resources (human resources, health facilities). One crude indicator for the dimension of the scaling up of HIV/AIDS-related health services is the ratio of the costs of care and treatment to the level of public health expenditures,<sup>24</sup> exceeding 100 percent for four countries in the sample in 2015, with an unweighted average of 54 percent and a median of 32 percent. If the costs of drugs are excluded, the remaining costs of care and treatment account for 1–134 percent of public health spending, with an average of 19 percent and a median of 12 percent.<sup>25</sup>

**EXHIBIT 3**  
**Projected Costs Of HIV/AIDS Programs In Thirty-Four African Countries, As A Percentage Of Gross Domestic Product (GDP), 2015**



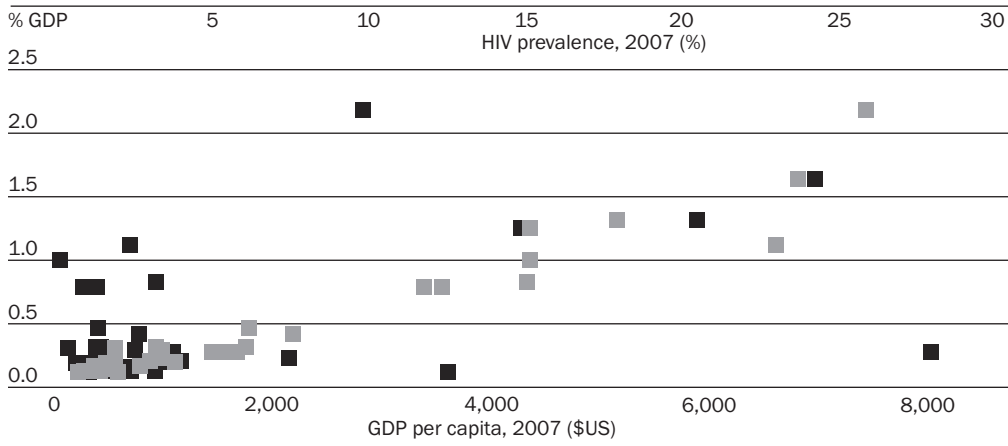
**SOURCE:** Author's projections.

**NOTES:** Black squares represent GDP per capita and relate to the bottom x axis. Gray squares represent HIV prevalence and relate to the top x axis.

The extent to which health services are delivered through the public and private sectors differs considerably across the region. Public health expenditures account for about 40 percent of total health expenditures, on average (unweighted), and they range from 2 percent to 80 percent.<sup>7</sup> Even where HIV/AIDS programs are administered through the public sector, this is an important factor. The government (or an implementing agency) may outsource HIV/AIDS-related services and draw on private-sector capacities. The scale of HIV/AIDS programs relative to total health spending is therefore another useful indicator. A ratio was derived of the costs of (nondrug) HIV/AIDS care and treatment to total health spending: 6 percent, on average (ranging from 1 percent to 19 percent).

The extent to which high costs of a national HIV/AIDS program translate into a large fiscal burden depends on the extent of external financing. To assess the role of external financing, a rule estimated in our analysis<sup>26</sup> was applied as a first step to the projections of the costs of HIV/AIDS programs. Exhibit 4 summarizes the estimates of domestically financed HIV/AIDS-related spending. Compared to Exhibit 3 (showing total spending), two lessons can be drawn. First, the large dispersion of spending at low income levels that was one of the characteristics of the pattern of total spending across countries is no longer evident. Second, there is now a closer correlation between HIV/AIDS-related domestic spending and the level of HIV prevalence.<sup>27</sup> These projections are therefore consistent with the backward-looking analysis described above. This suggests that countries with higher HIV prevalence also shoulder a higher burden in terms of domestically financed spend-

**EXHIBIT 4  
HIV/AIDS Domestically Financed Spending In Thirty-Four African Countries, As A  
Percentage Of Gross Domestic Product (GDP), 2015**



**SOURCE:** Author's projections.

**NOTES:** Black squares represent GDP per capita and relate to the bottom x axis. Gray squares represent HIV prevalence and relate to the top x axis.

ing. It also indicates that donors support a recipient country's domestic effort according to that country's level of economic development.

The large role of external financing, which this analysis extrapolates into the future, also translates into vulnerabilities for the fiscal balance, arising from uncertainties regarding the availability of external financing. The framework discussed here provides some tools for analyzing these vulnerabilities. Overall costs of HIV/AIDS programs are 0.5–4 percent of GDP for most low-income countries, and the rate of external financing is 70–80 percent of the costs of HIV/AIDS programs in these countries. It thus is clear that a withdrawal or reduction of external financing would translate into a large fiscal shock to the recipient country.

Another risk concerns the future availability of external financing for HIV/AIDS programs on the global level. These projections envisage an increase in the total costs of HIV/AIDS programs from US\$7 billion in 2007 to US\$13.7 by 2015, and an increase in external financing from US\$4.1 billion to US\$6.6 billion (in real terms). This equates to an increase of about 60 percent, or more than 6 percent annually. If this increase, exceeding the rate of economic growth in major donor countries, does not materialize (owing to adverse economic developments or a shift in donors' preferences), domestically financed spending in low-income countries would need to increase disproportionately. For example, if current levels of external financing for HIV/AIDS would remain unchanged in absolute terms, this would translate into an additional fiscal burden of 0.5 percent of GDP or higher in six countries in the region by 2015.



## Limitations Of The Analysis

The emphasis here was on the fiscal costs of HIV/AIDS programs across countries. One implication is that it had to rely on summary data on the state of HIV/AIDS and the costs of programs that are less extensive than estimates available for individual countries. The analysis is therefore relatively crude compared to some studies available for individual countries. However, because individual-country studies build on assumptions that are not necessarily consistent across countries, this cross-national approach also provides a useful tool for assessing and comparing such individual studies against a common benchmark.

Another limitation pertains to the governance of HIV/AIDS programs and the mapping of HIV/AIDS-related financial flows. Programs are typically characterized by a number of players cooperating to various degrees, and some financial flows might not pass through the government budget (or even the country that is nominally receiving them). Thus, HIV/AIDS-related spending is treated as quasi-fiscal expenditure. This reflects the consideration that the response to HIV/AIDS is largely financed from public sources (domestic revenues or external grants) and that a national government would have to step in to sustain the response to HIV/AIDS if external financing dried up. However, the analysis clearly misses many of the subtleties and challenges of delivering HIV/AIDS services.

Finally, it is important to recognize that the analysis does not capture the full scope of HIV/AIDS-related spending and the fiscal impact of HIV/AIDS.<sup>28</sup> Certain expenditures (social expenditures, or the costs of the impact on public servants) are not included in the analysis, because these expenditures are highly sensitive to legal provisions in various countries and cannot adequately be captured in a cross-national analysis. More generally, to maintain a clear focus, the paper does not discuss some of the macroeconomic implications of HIV/AIDS explicitly (even though the model could be used to address them).

## Conclusions

Data from a number of low-income countries show historically high levels of HIV/AIDS-related spending as a percentage of GDP (enabled by external financing). It should not be surprising to learn that the fiscal burden of HIV/AIDS tends to increase with the level of HIV prevalence, although there are sizable differences in spending between countries with similar levels of HIV prevalence.

A simple rule emerges: Donors complement domestic spending on HIV/AIDS at a rate that depends on GDP per capita, ranging from 80 percent for some low-income countries to 0 percent for some upper-middle-income countries. Because HIV/AIDS-related domestic spending tends to increase with HIV prevalence, so does external financing, which can be interpreted as providing partial insurance against this health shock, at a higher rate for low-income countries.

Looking ahead, the projections in this paper suggest that the costs of HIV/AIDS

programs will continue to increase, largely driven by the increased costs of treatment (a common theme of global costing estimates). On the country level, the costs of HIV/AIDS programs range from 0.2 percent to 5.0 percent of GDP by 2015. Once external financing is taken into account (using the same rule as estimated for the historical data), domestically financed HIV/AIDS-related spending (as a percentage of GDP) is fairly closely correlated with the level of HIV prevalence.

However, the prominent role of external financing as insurance against differences in the fiscal burden of HIV/AIDS across countries also means that low-income countries, drawing heavily on external financing, are vulnerable to a slowdown in its availability. The estimates indicate that if current levels of external financing for HIV/AIDS remained unchanged in absolute terms, rather than matching domestic spending at historical rates, this would translate into an additional fiscal burden of about 0.5 percent of GDP or higher in six countries by 2015. This is a substantial number, considering that public health expenditures among African low-income countries average only about 2.5 percent of GDP, and domestic government revenues are frequently below 15 percent. A credible policy in support of expanding access to treatment needs to be explicit as to how such shortfalls can be avoided.

*This paper is part of an ongoing project at the World Bank on the fiscal dimension of HIV/AIDS programs. The findings, interpretations, and conclusions expressed in this paper are entirely those of the author. They do not necessarily represent the views of the International Bank for Reconstruction and Development/World Bank and its affiliated organizations, or those of the executive directors of the World Bank or the governments they represent.*

## NOTES

1. World Bank. Country classification [Internet]. Washington: World Bank; 2009 [cited 2009 Sep 23]. Available from: <http://go.worldbank.org/K2CKM78CC0>
2. In South Africa, important cost categories (medical expenditures not related to antiretroviral treatment, certain social expenditures) are not included in the estimates of HIV/AIDS-related spending.
3. UNAIDS. 2008 report on the global AIDS epidemic. Geneva: UNAIDS; 2008.
4. Organization for Economic Cooperation and Development. Creditor reporting system, aid activity database. Paris: OECD; 2009.
5. This analysis was based on data on external financing from UNGASS reports (Note 3). The data in Note 4 are an alternative source of data on external financing, available for a larger number of countries. This paper focuses on the UNGASS data to ensure consistency with spending data.
6. The exception is Gabon, where external financing accounts for about 40 percent of HIV/AIDS-related spending. However, this spending in Gabon is less than US\$10 million, or 0.1 percent of GDP.
7. World Health Organization. WHO statistical information system (WHOSIS). Geneva: WHO; 2009 [cited 2009 Aug 29]. Available from: <http://www.who.int/whosis/en/index.html>
8. (Unweighted) average related to thirty-two African low-income countries for 2006, based on Note 7.
9. Regression analysis to complement the discussion is available in an online appendix at <http://content.healthaffairs.org/cgi/content/full/28/6/1606/DC1>.
10. For example, the Global Fund used to demand a certain proportion of domestic financing of proposals, depending on the income level and the level of HIV prevalence in the applicant country.
11. Equation (1) in the online appendix shows this evidence; see Note 9.
12. UNAIDS. Annual estimates of HIV prevalence, people living with HIV/AIDS, and HIV/AIDS-related deaths, 1990–2007. Geneva: UNAIDS; 2008.

13. United Nations Population Division. World population prospects: The 2008 revision—population database. New York: United Nations; 2009.
14. A visual depiction of this model is available in the online appendix, as in Note 9.
15. Stover J. Spectrum—estimating the need for ART and the resources required. Paper presented at: Department of Health ART Costing Workshop; 2009 Mar; Pretoria, South Africa.
16. The average transition time from infection to first-line treatment need was set at 7.7 years. Without treatment, death occurs 3.5 years after the onset of treatment need (these numbers were set to match UNAIDS summary data). The average time from initiation of first-line treatment to need for second-line treatment was set at eight years, and the average duration of second-line therapy was set at 10.5 years. One complication that this model cannot address is that the approach implies that treatment commences at the time of need, whereas the times may differ individually and on an aggregate level, especially as the criteria applied by UNAIDS for estimating treatment need could be different from national guidelines.
17. For people living with HIV/AIDS but not requiring treatment, this is obtained as an average over survival curves for different ages, based on the assumption that (most) HIV infections occur between ages twenty and thirty-five. For the groups receiving first- and second-line therapy, the survival curves were shifted using average transition times.
18. McCarthy O, Over M. Projecting the future budgetary cost of AIDS treatment in poor countries: a manual for the AIDS cost computer programs. Washington (DC): Center for Global Development; 2009.
19. Over M. Prevention failure: the ballooning entitlement burden of U.S. global AIDS treatment spending and what to do about it. Washington (DC): Center for Global Development; 2008. Working paper no. 144.
20. For these projections, the framework was modified in two directions. First, for the sample of countries, the upper limit of the costs of second-line therapy used by McCarthy and Over (Note 18)—just below US\$5,000) seems too high. Therefore, the projection used an upper limit of US\$2,200. Second, prices of second-line drugs are expected to fall; the projections assumed that they will decline through 2014 at the rate implied by Stover (Note 15).
21. This assumption is broadly consistent with thorough costing estimates available for some countries, as well as the literature on the economic impacts of HIV/AIDS preceding the scaling up of antiretroviral therapy, usually assuming costs of treatment amounting to one to four times GDP per capita. (The parameter is lower here; this paper focuses on fiscal costs, excluding private spending.) Because HIV/AIDS mortality does not fluctuate widely, the projections are robust with respect to the distribution of the individual costs of treatment (the analysis assumes two years before death) over time.
22. Data on the composition of spending, by major category, are available from UNAIDS (see Note 3) for only twenty-one of the thirty-four countries in Exhibit 1.
23. These countries are Angola, Benin, Botswana, Burkina Faso, Burundi, Cameroon, Central African Republic, Chad, Congo, Côte d'Ivoire, Eritrea, Ethiopia, Gabon, Ghana, Guinea, Kenya, Lesotho, Liberia, Malawi, Mali, Mozambique, Namibia, Niger, Nigeria, Rwanda, Senegal, Sierra Leone, South Africa, Swaziland, Tanzania, Togo, Uganda, Zambia, Zimbabwe. The most common reason for exclusion from the data set is the fact that UNAIDS (see Note 12) truncates or does not report small absolute values, so that sufficient data on HIV prevalence and HIV/AIDS-related deaths are not available.
24. To avoid double-counting HIV/AIDS-related expenditures in the numerator and denominator, the level of total and public health expenditures for 2000 (as reported by the World Health Organization; see Note 7) was used as a basis for comparison.
25. Because drugs are imported, it makes sense to exclude them (as was done for many other imported supplies for which data are not adequate) from the comparison to obtain an indicator for the scaling up of health services implied by the projections.
26. This is specified in Equation (2) in the online appendix, as in Note 9.
27. The level of HIV prevalence explains 65 percent of the variation in total spending and 75 percent of the variation in domestically financed spending in 2015.
28. Further discussion is available from Haacker M. The impact of HIV/AIDS on government finance and public services. In: Haacker M, editor. The macroeconomics of HIV/AIDS. Washington (DC): International Monetary Fund; 2004. p. 41–95.