RETHINKHIV

FUNDING DISRUPTIVE IDEAS AGAINST HIV

Assessment Paper

Strengthening Health Systems

William McGreevey, Carlos Avila, and Maria Punchak

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RethinkHIV: The Project

2011 marks the 30-year anniversary since the Centers for Disease Control and Prevention introduced the world to the disease that became known as AIDS. Despite 30 years of increasing knowledge about transmission, prevention, and treatment, and current annual spending of $15 billion, every day around 7,000 people are infected with the HIV virus and two million die each year. The HIV/AIDS epidemic has had its most profound impact in sub- Saharan Africa, which accounts for 70 percent of new worldwide infections and 70 percent of HIV-related deaths, 1.8 million new infections in children each year, and has 14 million AIDS orphans.

Humanitarian organizations warn that the fight against HIV/Aids has slowed, amid a funding shortfall and donor fatigue. Yet HIV is still the biggest killer of women of reproductive age in the world, and of men aged 15-59 in sub-Saharan Africa. Time is ripe for a reassessment of current policy and expenditure.

The Rush Foundation has asked the Copenhagen Consensus Center to commission a group of leading health academics to analyze HIV policy choices and identify the most effective ways to tackle the pandemic across sub-Saharan Africa.

RethinkHIV identifies effective interventions in the fight against HIV/Aids across sub-Saharan Africa. It applies cost-benefit analysis to highlight investments and actions that can make a significant difference.

The Copenhagen Consensus Center has commissioned eighteen research papers by teams of top health economists, epidemiologists, and demographers who examine the cost-effectiveness of a range of responses to HIV/AIDS in sub- Saharan Africa under the following topics:

- Efforts to Prevent Sexual Transmission
- Efforts to Prevent Non-Sexual Transmission
- Treatment and Initiatives to Reduce the Impact of the HIV/AIDS Epidemic
- Research and Development Efforts
- Social Policy Levers
- Initiatives to Strengthen Health Systems

A panel of five eminent economists, including recipients of the Nobel Prize, convenes in the fall of 2011 to carefully consider the research and engage with the authors. The Expert Panel is tasked with answering the question:

If we successfully raised an additional US$10 billion over the next 5 years to combat HIV/AIDS in sub-Saharan Africa, how could it best be spent?

After deliberating in a closed-door meeting, the Nobel Laureate Expert Panel provides their answer, highlighting investments and actions that could be most effective avenues for additional funding. Their findings and reasoning are released in the fall of 2011, and published in full alongside all of the research in a collated volume in 2012.

RethinkHIV will generate global discussion regarding responses to HIV/AIDS in sub-Saharan Africa. To participate in a dialogue on the research and findings within sub-Saharan Africa, a Civil Society Conference and forums for youth are held following the Expert Panel meeting in late 2011.

The Civil Society Conference is a means of creating a dialogue with African civil society and to agree on a set of bold new actionable priorities with society politicians, civil society organizations, influential thought-leaders, and others within sub-Saharan Africa.

It is hoped that the project will motivate donors to direct more money to the investments and actions that are demonstrated to be most effective to curtail the pandemic in sub-Saharan Africa.

All of the research papers, and many different perspectives on priorities can be found online at the project's website:
www.rethinkhiv.com

You are invited to join the dialogue and provide your own perspective on priorities for action in Africa.

The Copenhagen Consensus Center

The Copenhagen Consensus Center is a Danish state-funded think- tank that commissions and promotes research highlighting the most effective responses to global challenges. The Center is led by author Bjorn Lomborg, named 'one of the 100 Top Global Thinkers' by Foreign Policy in 2010, 'one of the world's 75 most influential people of the 21st century' by Esquire in 2008, and 'one of the 50 people who could save the planet' by the Guardian in 2008. The Copenhagen Consensus Center is implementing the project, which follows the format of past projects such as Copenhagen Consensus 2004, Consulta de San José in 2007, Copenhagen Consensus 2008, and Copenhagen Consensus on Climate in 2009.
www.copenhagenconsensus.com

The Rush Foundation

The Rush Foundation, based in Lausanne, is dedicated to providing fast, effective funding for innovative thinking addressing the HIV/AIDS epidemic in sub-Saharan Africa. The Rush Foundation is the sponsor of the project. The Rush Foundation was launched in 2010 to fund sustainable projects in sub-Saharan Africa focused on alleviating the pandemic through innovative thinking, and to shake up the status quo in HIV thinking by spearheading thought leadership projects and debates that will help reframe HIV policy. Among other initiatives, the Rush Foundation is currently designing a grant programme with ActionAid in Africa aimed at generating new, sustainable HIV initiatives on the ground.
www.rushfoundation.org

The Papers

The body of research for RethinkHIV comprises 18 research papers. The series of papers is divided into Assessment Papers and Perspective Papers. Each Assessment Paper outlines the costs and benefits of at least three of the most promising responses, interventions, or investments to HIV/AIDS in Sub-Saharan Africa within the respective category. Each Perspective Paper reviews the assumptions and analyses made within the Assessment Paper. In this way, a range of informed perspectives are provided on the topic.

Contents

This version of the Assessment Paper was updated in October 2011, after the Georgetown University Conference.

The final version of this paper will be available in the forthcoming volume to be published by Cambridge University Press in 2012.

Acronyms

ACT	Artemisin combination therapy for malaria prevention and treatment	IHP+	International Health Partnership
AGF	Abuja Goals Fund	IAC	International AIDS Congress
AMI	Acute myocardial infarction	IOM	Institute of Medicine (USA)
ART	Anti-retroviral therapy	IRR	Internal rate of return; also, economic rate of return
CAR	Central African Republic	MBB	Marginal budgeting for bottlenecks
CBA	Cost-benefit analysis	MD	Medical doctor
CHW	Community health worker	MDG	Millennium development goal
CM	Cryptococcosis meningitis	MDR-TB	Multidrug resistant tuberculosis
CMH	Commission on Macroeconomics and Health	NASA	National AIDS Spending Assessment
COD	Cash on delivery	NCD	Non-communicable diseases
CRAG	Cryptococcosis Antigen	ODA	Official development assistance
CCT	Conditional cash transfer	OI	Opportunistic infection
DALY	Disability-adjusted life year	OOPs	Out of pocket spending
DCP2	Disease Control Priorities in Developing Countries, Second Edition	PBI	Performance-based incentives
DHS	Demographic and Health Surveys	PEPFAR	President's Emergency Program for AIDS Relief
DOTS	Directly-observed treatment, short course	PMTCT	Prevention of maternal to child transmission
FAO	Food and Agricultural Organization	PPP	Purchasing power parity
GAVI	Global Alliance for Vaccines and Immunization	QALY	Quality-adjusted life year
GF	The Global Fund to Fight AIDS, Tuberculosis and Malaria	RBF	Results-based financing
GHI	Global Health Initiative	RfD	Results for Development Institute
HIPC	Highly indebt poor countries initiative of World Bank	SRH	Sexual and reproductive health
HLT	High level taskforce on International Innovative Financing for Health Systems	SSA	Sub-Saharan Africa
HSS	Health system strengthening = strengthening health systems	STI	Sexually transmitted infection
ICD	Infectious and communicable diseases	TB	Tuberculosis
TnT	Treat and test		

UNAIDS	United Nations Program on AIDS		
UNGASS	United Nations General Assembly Special Session on HIV/AIDS (June 2001)		
VCT	Voluntary counseling and testing		
VSL	Value of a statistical life		
WHO	World Health Organization		
XDR-TB	Extensively drug-resistant tuberculosis		
YLL	Years of life lost		

Executive Summary

RethinkHIV seeks answers to the question: "How can additional spending, US$ 2 billion per annum over five years, a total of US$10 billion, best be spent across a range of treatment, prevention, research, etc, measures in sub-Saharan Africa (SSA) to respond to HIV/AIDS?" Among the prospective options is an effective bridging between actions focused specifically on HIV/AIDS, and actions that aim to strengthen health systems. The strengthening health systems component considers below these possible solutions:

- Universal testing, informing, and counselling can be achieved with a voucher of US$5 paid to each of the 400 million adults who accept to learn their HIV status. The cost is substantial at US$2 billion, but benefits of knowledge could cut new infections by a quarter million annually, and the b/c ratio would range between a low of 2.5 and a high of 15;

- Deployment of community health workers to the rural population at a cost of US$2.64 billion could cut maternal deaths by 0.3 million annually and child deaths by millions more, with b/c ratios ranging from about 1.1 to 9.5;

- Reducing the opportunistic infection of cryptococcal meningitis (CM) at a cost of US$1.5 billion can yield a ratio of benefits to costs between 2.7 and 20; and,

- An Abuja Goals Fund (AGF) can offer a cash on delivery (COD) incentive for meeting agreed goals of spending 15 percent or more of public revenues on public health, yielding a ratio of benefits to cost between 1.1 and 8.

The analysis of these solutions applies cost-benefit analysis (CBA) to provide guidance for resource allocation at the margin between these and other potential solutions to health deficiencies in SSA. Each of the solutions reviewed offers positive returns of benefits compared to the incremental costs that would be incurred to implement them (see Summary Table 1). The analysis considers scenarios in which the value of a year of life is set at US$1,000 or US$5,000 to include the range of income levels in SSA. The net present value (NPV) of future years of life is assessed using both a three percent and a five percent discount rate. Once these values for a life-year are adjusted to yield net present value of all the years of life that can be saved by a solution, we calculate the ratio of these two measures of benefits to the costs identified.

Summary of Findings. As expected, the benefit-cost ratios varied substantially between the four solutions. The highest ratio of benefits to cost appears to derive from optimal treatment of the opportunistic infection, cryptococcal meningitis, which without treatment puts as many as 32 million persons at risk in SSA. . A lower but still positive ratio of benefits to costs emerges from using a cash on delivery bonus to countries that move toward the Abuja goal of more spending on public health. Other solutions lie between these high and somewhat lower results.

All four solutions show promise of implementation at a cost per disability-adjusted life-year (DALY) below the limits suggested for the US$1,000 and US$5,000 values of a life-year used in this exercise. Solutions that focus on young adults were deemed in the analysis to yield the best results in terms of life-years gained with the application of each solution. Solutions that combine HIV/AIDS prevention, family planning and reproductive health appear to be particularly strong choices.

Overview of solutions with potential impact on supply, demand, and price, and cost-benefit prospects.

Solution	Impact on…	Persons affected (millions)	Cost, US $millions	B/C ratio range	Comments
1. CCTs for VCT	Demand	400+	2,000	2.5 -15	Eliminate 0.25 million infections
2. CHWs, all	Supply	100+	2640	1.1 – 9.5	Front-line workers
3. CRAG to prevent CM	Supply OIs	32+	1,500	2.7 - 20	CRAG, test & treat
4. Abuja Goals Fund	Supply	500+	1,000	1.1 – 7.7	Upgrade HIV, basic health services

Source: Authors' estimates as described in Appendix Tables.

In aggregate, the costs for these proposed solutions would require a significant share of the proposed US$10 billion to be made available. They are not equally advantageous. One solution would supply the rural poor with upgraded and more numerous community health workers to assure them basic maternal and child care and expanded knowledge of HIV status. The poor can reasonably hope that their governments will be encouraged to reallocate public resources toward public health needs once an Abuja Goal Fund offers added incentives to governments to encourage matching rhetoric and reality.

Introduction

HIV/AIDS is a health challenge of global significance, but its greatest impact has been, and will continue to be, on the health of sub-Saharan Africa. After several decades of success in raising life expectancy since many countries in the region achieved independence, AIDS has driven down life expectancy at birth from greater than sixty years to less than fifty years in countries of eastern and southern Africa.

The combination of personal behaviour change, government action, and donor support now show signs of meeting the challenge of the epidemic. Incidence is on the decline. Treatment now becomes prevention, and male circumcision shows promise as a new mode of prevention of sexual transmission. More AIDS-positive persons are living longer lives thanks to anti-retroviral therapy (ART). Since the United Nations General Assembly Special Session on AIDS (UNGASS) in June 2001, substantial financial resources have contributed to a reduction in deaths associated with AIDS.

In this paper, we examine selected cases of policy actions, interventions, and solutions that bridge the objective of health systems strengthening (HSS) with that of continuing the fight against HIV/AIDS in sub-Saharan Africa. We find that incentives that encourage demand for selected HIV/AIDS interventions also contribute to health system objectives. Incentives can be blended as well to promote more effective and complementary supply improvements. Providing subsidized care by reducing or even eliminating user fees is in effect a price-reduction incentive. This paper identifies four specific interventions that repay costs with substantial benefits in terms of better overall health indicators and reduction of HIV.

Conditional cash transfers (CCT), a demand-side intervention, can be adapted to serve the joint objectives. Other demand-side interventions can complement conditional cash transfers, e.g. by promoting a new focus on 'cash-on-delivery' (COD) forms of donor assistance. Donor agencies, especially the World Bank, are also testing methods of results-based financing (RBF). This new approach is in the process of emerging and being subjected to monitoring and evaluation. The signs are positive that benefits of new guidelines for assistance will yield attractive ratios of benefits to costs.

Refocusing preventive care on service provision that blends concern with family planning, reproductive and sexual health can also help end the anomalous situation in which a large share of HIV+ persons in the region do not know their status and hence may become ill and infect others unknowingly with HIV. The search for and identification of that small minority of patients infected with *Cryptococcosis neoformans,* an opportunistic infection associated with AIDS patients with very low CD4 cell counts, can be a cost-effective intervention that will depend on effective build-up and deployment of health personnel able to apply a simple test and provide AmB/5FC to those few beneficiaries whose lives can be saved.

A revamped public health system built on a cadre of community health workers is now seen by UNAIDS and cooperating agencies as a sound means to upgrade preventive services at modest cost and promote voluntary testing and counselling that can reduce the spread of HIV.

Cost-benefit analysis can demonstrate the soundness of health system strengthening as a

complementary intervention along with other more HIV/AIDS-focused interventions.

Previous health systems analysis. An earlier work, *Global crises, global solutions* (Lomborg 2004), included a chapter on communicable diseases that focused on three 'solutions' or opportunities: Malaria control, HIV/AIDS control, and strengthening basic health services. After reviewing these and fourteen other proposed solutions, an expert panel rated control of HIV/AIDS highest priority and control of malaria fourth highest of seventeen challenges and opportunities. Scaled-up basic health services ranked twelfth. It is thus fitting that this work focusing on HIV/AIDS and HSS in sub-Saharan Africa builds on these earlier analyses.

A subsequent review of the proposed solutions by UN health sector representatives in October 2006 approved the general approach taken in *Global crises, global solutions.* They ranked strengthening health systems at the top of their priority list. As representatives of national governments on the receiving end of assistance, they expressed the need for comprehensive, system-wide support. Over the next several years, a British-led effort, International Health Partnerships (IHP+) also pressed for procedures and plans that would support sector-wide improvements; that leadership was in turn backed by major donors including some, such as PEPFAR, the Global Fund, and GAVI, that in principle operate more like 'vertical' than horizontal or sector-wide programs (see Avila 2009).

In support of these complementary objectives a High Level Taskforce on International Innovative Financing for Health Systems (HLT) reviewed modes of finance, new sources of funding and best means to implement programs aimed at improving health in low-income countries. The Taskforce sponsored the efforts of specialists to recommend how best to spend additional resources once available. That was the task of *Working Group 1, Constraints to scaling up and cost.*

As co-director of that working group, Professor Anne Mills, London School of Hygiene and Tropical Medicine (and co-author of the earlier *Global crises, global solutions* chapter), prepared an overview of issues facing the effort to strengthen health systems. Data include selected scenarios of aggregate health system strengthening costs. The analysis estimates parameters for annual spending requirements for sub-Saharan Africa. For seven years, 2009 to 2015, total requirements appear to range from just under US$100 billion at the low end to US$170 billion at the high end. Spending on a per person basis ranges from a low of only US$3 for the World Bank's marginal budgeting for bottlenecks (MBB) minimum scenario in 2009 to a high of US$54 under the MBB maximum scenario by the year 2015. A simplifying assumption may be that annual spending of US$20 billion added to current outlays, for a total of about US$52 billion annually, should yield the prospective benefits identified in the high level review exercise.

The need to add financing to strengthen health systems is so apparent that one easily understands the demand from public health advocates that more of the substantial increment available for HIV/AIDS since 2001 must support this broader health sector objective. Commitments to aid made in 2005 at the Gleneagles G8 meetings may be falling well short of intentions, perhaps by as much as US$19 billion in the current fiscal year. Thus the issue of how and what to fund is as great as ever: What actions in favour of both strengthening health systems and fighting HIV/AIDS can offer benefits adequate to repay the costs incurred?

Bongaarts and Over (2010) argue that the cost of universal access to treatment is unsustainable. The AIDS share of health assistance was already 'too high' in 2007, they argue, claiming 23 percent of

funds then available when deaths attributable to AIDS were less than five percent of all deaths in developing countries. "In a few African countries, foreign HIV/AIDS assistance exceeds the entire budget of the Ministry of Health."

In 2009 the leaders of UNAIDS, the Global Fund, GAVI, and PEPFAR (Piot and others 2009) argued that a third of their assistance is supporting health system strengthening as well as the specific objectives of AIDS support:

> *Although AIDS has exposed weaknesses in health systems, funds for this disease are making a major contribution to the strengthening of health systems.*
>
> *The Global Fund and PEPFAR are now among the biggest investors in health systems, joining other funds such as the GAVI Alliance. Although drugs and other commodities account for nearly half of Global Fund spending, 35% of the Fund's financing for AIDS, tuberculosis, and malaria contributes directly to supporting human resources, infrastructure and equipment, and monitoring and evaluation: all key components of health systems. Overall, the Fund has committed more than $4 billion in these three areas. From 2004 to 2009, on the basis of conservative estimates, PEPFAR will commit more than $4 billion to health systems, including more than $1 billion in 2009 alone.*

The authors go on to present details on health infrastructure, workforce and freeing up of health facilities, thanks to the efforts to strengthen health systems by using HIV/AIDS-specific funding provisions. A recent aids2031 summary paper identified substantial sums allocated by the principal donors to strengthening health systems (Avila and others 2009):

- PEPFAR – $638 million of the money it obligated in 2007 was devoted in full or in part to capacity building activities;
- The Global Fund expected (in mid-2008) to spend US$363 million on actions that will strengthen health systems in recipient countries; and,
- The GAVI Alliance pledged on 23 May 2008 to 'increase its funding for health system strengthening to US$800 million' (Avila and others 2009).

Broadly speaking these commitments have continued despite the global recession. *The Economist* on 4 June 2011, p. 90, went so far as to identify these agencies, substantially supported by US-government funded allocations, among the heroes in the history of AIDS. Continued dedication of the UK-led International Health Partnership (IHP+) further complements these efforts.

Total expenditures by region and type of expenditure, 2006
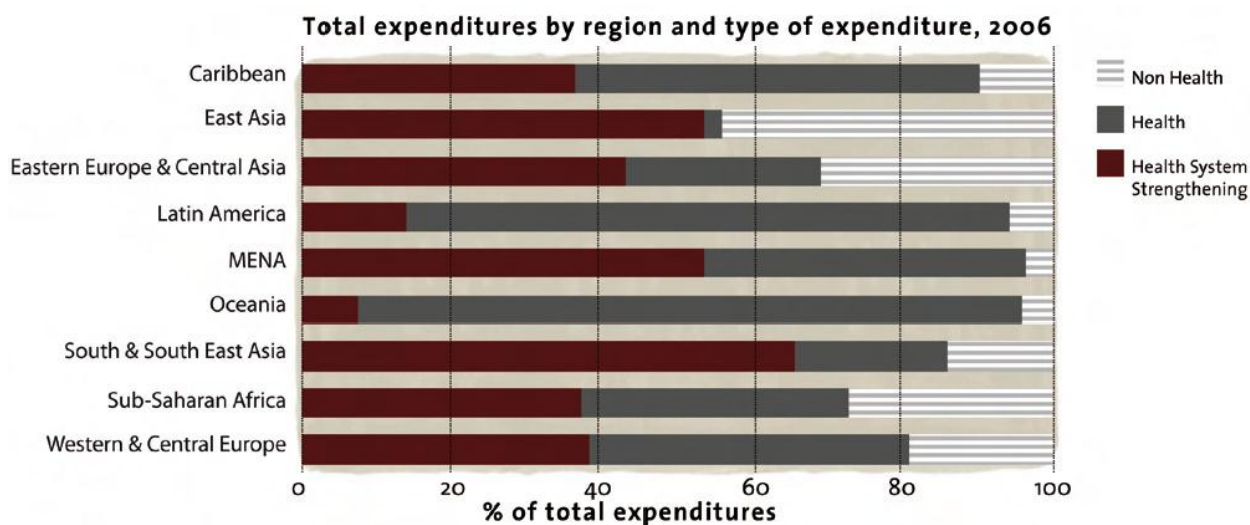
HIV/AIDS spending contributes to HSS. WHO defines health systems as "all organizations, people and actions whose primary intent is to promote, restore or maintain health." Health system strengthening includes cross-cutting activities that reinforce the whole system including governance, human resources, and information systems. Potential beneficial solutions could include governance-planning, health infrastructure build-up, expanded workforce, better information systems, and improved procurement and supply of medicines.

UNAIDS has compiled evidence to support the argument that HIV/AIDS program spending does contribute to the general objectives of health systems strengthening. Among nearly 40 interventions that promote prevention, care and treatment of HIV/AIDS, the following also contribute to HSS objectives:

- Universal precautions
- Safe medical injections
- Blood safety
- Patient transport and emergency rescue
- Operations research
- Drug supply systems
- Information technology
- Upgrading laboratory infrastructure and new equipment
- Upgrading and construction of infrastructure and new health centers
- Human resources training
- Research

Analysts then reviewed actual outlays for all programs included in the National AIDS Spending Assessments (NASA) for major world regions (see Figure 1). In only two of the nine regions, Latin America and Oceania, did the share of HSS-assisting expenditures fall below a third. It is over half in

East Asia, Middle East and North Africa, South and Southeast Asia.

Nearly 40 percent of AIDS spending in SSA supports HSS objectives. Priority areas include upgrading lab infrastructure, staff training, drug supply systems, construction of new health centers, operations research, and blood safety. This 'vertical' program offers important 'horizontal' and 'diagonal' support to health improvements more generally.

However, many specialists express doubt about the extent to which HIV/AIDS spending supports broader objectives. The number of approved Global Fund grants for HSS is fewer in the most recent year (2010) than in previous years, according to a brief note in *Global Fund Observer:*

> **Health systems strengthening**. *The number of cross-cutting health systems strengthening requests recommended for funding dropped to 11 in Round 10, from 17 in Round 9 and 25 in Round 8. The two-year cost of the approved proposals in Round 10 dropped to $128 million, from $363 million in Round 9 and $283 million in Round 8. The Global Fund says that these drops are likely due to a range of factors, including availability of funding from other sources, previously approved requests, and proposals not being of the best quality (Global Fund Observer, 24 May 2011).*

Table 1. Health spending ratios, major world regions, 2000, 2008.

Ratio Indicators	WHO Africa Region		LICs		Lower-MICs		Upper MICS		High income countries	
	2000	2008	2000	2008	2000	2008	2000	2008	2000	2008
Health as % GDP	5.5	6.0	4.6	5.4	4.4	4.3	5.9	6.3	10.0	11.1
Govt Share, all health	43.7	49.8	37.1	40.5	37.1	45.4	54.0	57.2	59.3	62.2
Govt Health as % all Govt.	8.2	9.6	7.7	8.9	7.1	7.8	9.0	9.9	15.3	16.7
External as % all Health	6.6	9.5	11.0	16.4	1.1	1.0	0.6	0.2	0.0	0.0

Source: WHO Health Statistics, 2011, p. 136. Acronyms: LICs = low-income countries; MICs= middle-income countries, lower and upper. WHO Africa region includes Maghreb countries north of the Sahara.

These changes suggest that HIV/AIDS supporters face a continuing challenge as they seek to combine 'vertical' assistance with the 'horizontal' task of strengthening health systems. This combination of efforts can then yield a satisfactory 'diagonal' blend of donor support.

Increased health spending, 2000-2008. Spending on health in sub-Saharan Africa, and for most regions and countries, has risen substantially in this new century (see Table 1). For the WHO Africa region, which includes North Africa as well as sub-Saharan Africa, several health spending indicators have increased, including the health share in total GDP, government's share of total health spending, the health share in all government spending, and external assistance as a share of all health spending.

The direction of change has been the same for all low-income countries, most of them being in sub-Saharan Africa.

The picture of overall health financing has grown more positive and data on health status improvements since the 1990s are positive, too (United Nations 2011). SSA is supplying more funds to support health system strengthening now than it did in past years. Donors are contributing a larger share of aggregate health spending than they were at the start of this century. The funding base is increasing. A substantial part of the reason for that increase is the supply of donor assistance for HIV/AIDS programs.

A principal challenge now has two parts. First, donors and governments in Africa need to continue to raise their commitment to financing health care and strengthening the system as a whole. Second, greater efficiencies remain to be developed, particularly the effective extension of basic services to rural areas. In the longer term of half a century or more, part of the 'efficiency solution' will lie in the continued process of rural-to-urban migration. Costs of reaching and providing services to those in need will decline as the friction of distance falls with concentration of more people in cities. For those advantages to unfold as they have in what are now high-income and middle-income countries, spending on urban health will require safe water and sanitation and safe means of transport to reduce the still-high levels of infectious and communicable diseases (ICDs) and injury in the low-income countries of sub-Saharan Africa. These changes are costly but practical and will yield benefits that can amply repay costs incurred. These supply-side improvements then need to be supported by continuing expansion of incentives to spur demand for better health systems as well as for an effective use of HIV/AIDS services. It is to that topic we now turn.

Table 2. Return on investment in the proposed UNAIDS framework

Benefit identified	2011-2015	2011-2020
Total infections averted	4.2 million	12.2 million at a cost of $2450 each
Infant and child infections averted	680,000	1.9 million at a cost of $2180 each
Life years gained	3.7 million	29.4 million at a cost of $1,060 each
Deaths averted	1.96 million	7.4 million at a cost of $4090 each

Source: Schwartländer and others 2011, annex Table 2.

UNAIDS – a new approach and its expected returns

In April 2011, UNAIDS released an analysis demonstrating that a basic spending program, combined with 'critical enablers' and support from 'synergies with development sectors,' would cost about US$17 billion in 2011, US$22 billion in 2015, at its peak, and US$19 billion in 2020. What are the expected returns on these investments? Reduced infections, gains in years of life lived, and deaths averted appear in the estimates of benefits (see Table 2).

These results can be turned into an aggregate cost-benefit analysis by comparing the costs estimates

in Table 2 for deaths averted to two ranges of benefits, namely, when the value of a year of life is given as US$1,000, appropriate for low-income countries in sub-Saharan Africa, and US$5,000, more fitting for Botswana, Namibia, and South Africa, the somewhat better-off countries of the region.

Deaths averted in the 2011-2020 period are 7.4 million. (For purposes of this analysis there is no discounting of future-year lives saved over the framework period of a decade.) The cost of averting these deaths is set at US$4,090 per death averted, for a total expenditure of US$30.3 billion. The benefits derive from the estimated value of averting each of these deaths. For purposes of analysis the value of US$1,000 and US$5,000 are presented as lower- and upper-bound estimates of the value of a year of life saved. When discounted at three percent, and assuming that all lives saved occur at age 22, then the aggregate benefits of the interventions, at their lower- and upper-bound levels are US$185 billion and US$925 billion, respectively.

The estimated ratios of benefits to costs derived from these data are B/C=6.1 at the lower bound, and B/C=30.5 at the upper bound. These findings will be compared later in this paper against other estimates that focus more explicitly on health system strengthening as a complement to HIV/AIDS programs. We do not propose to assess this comprehensive plan as one of the solutions offered here. It may be useful, however, as a basis for comparison with the b/c ratios estimated for specific solutions discussed below.

A final word on these aggregate estimates. Global resource needs estimates first appeared at the time of the UNGASS meetings held in mid-2001 (Schwartländer 2001). These quantitative targets and scenarios supported scientists' arguments in favour of allocating more resources for the fight against AIDS. Establishment of the Global Fund to Fight AIDS, Tuberculosis and Malaria followed soon after UNGASS. The USA PEPFAR program came soon after that. The establishment of explicit costing estimates proved to be a key reason for the success of the global effort to address the HIV/AIDS epidemic. Emphasis on resource needs and sound estimation of the potential effectiveness of spending have been major sources of support for programs and their financing. Without the estimates of the kind discussed here, there may never have been a concerted effort to address this global health challenge.

Priority setting, other approaches

Dean Jamison (Lomborg 2010, pp. 325-26, Table 17.6) lists seven intervention areas as key investment priorities for disease control:

- Tuberculosis: appropriate case finding and treatment
- Heart attacks (AMI): acute management with low-cost drugs
- Malaria: prevention and ACT treatment package
- Childhood diseases: expanded immunization coverage
- Cancer, heart disease, other: tobacco taxation
- HIV: prevention package
- Injury, difficult childbirth, other: surgical capacity at the district hospital

B/C ratios range from a high of 30:1 to a low of 10:1. HIV prevention is one of the seven investment priorities; several of the others would serve as complementary health strengthening interventions that also support HIV prevention, e.g., tuberculosis treatment, in light of the co-infection frequencies in Africa; childhood immunization practices that can include testing services that could support VCT for HIV; and, malaria prevention and treatment as this disease may also have co-infection implications. The summary tables in this report draw substantially on the analysis provided by Jamison in that report.

Valuing benefits of lives saved. Analysts building on the work of Viscusi (1986, 1993), Nordhaus (2003, 2008), Cutler (2004, 2008), and others have placed the value of a statistical life in the USA at more than US$7 million. Viscusi and Aldy (2003) show further that revealed preference in other countries indicate lower values of a statistical life but in amounts that reflect other countries' lower levels of income and wealth. Shillcutt and others discuss twice per capita GNI as a 'threshold' level for an acceptable price for value of a statistical life (Shillcutt 2009, 3-4).

Using the proposed value of a DALY as US$1,000 and US$5,000 for low and high estimates, we can then prepare a simple table showing how undiscounted and discounted values of a life saved compare under these circumstances (see the Box Tables 1A and 1B, which are based on the more detailed Appendix Table 1).[1]

The 'most-valued' persons in the age distribution are young adults. At the same time they are also the persons most at risk of HIV/AIDS infection and death. Infants are 'more valuable' than older adults only at very low discount rates of 0 and 3 percent. They are less valuable than all adults at high discount rates (5 percent and 10 percent). This is broadly compatible with the observed under-spending in African countries on low-cost health interventions that could save many more children's lives than is now current practice.

Box Table 1A. Estimated benefits of saving lives, assuming adult DALYs valued at US$1,000 and infant DALYs valued at US$500, with discount rates of 0, 3%, 5%, and 10%, US$000. Panel A.

Discount Rate	Infant	Age 22	Age 50
0	33	43	15
3%	15	25	13
5%	10	18	11
10%	5	10	8

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[1] **For sub-Saharan Africa as a whole, the 2009 gross national income per capita, Atlas method, was US$1,125, and by purchasing power parity (PPP) method, was US$2,051 (World Bank WDI 2011, p. 12). GNI per capita for South Africa was US$5,760 by Atlas, and US$10,050 by PPP. One of the lowest GNI per capita amounts is for Burundi at US$150.**

Box Table 1B. DALYs valued at US$5,000 and infant DALYS valued at US$2,500.

Discount Rate	Infant	Age 22	Age 50
0	163	215	75
3%	72	123	64
5%	48	90	56
10%	25	50	41

Source: Details in Annex Table 1. All estimates assume life continues from age at which life is saved by the intervention to age 65. The value of an infant life-year is 0.5 value of an adult life-year.

So-called 'hyperbolic discounting,' as the example of a discount rate of ten percent per annum shown in the table can indicate, reflects a tendency to over-value the present at cost to future concerns. Such very high discounting of the future may be common among the poor. Many Africans face a high degree of uncertainty about the future in part because of their poverty and dependence on factors like weather and risks of drought and must thus focus on the present at the cost of preparing for an uncertain future. Without discounting, the life of a person aged 50 is worth less than half the life of an infant even when each life-year of an infant is counted as only half that of the adult. But with discounting, the older person's life is worth sixty percent more than that of the infant under conditions of ten percent discounting, a rough equivalent of 'hyperbolic discounting.' This behavioural feature may help explain health care spending decisions that lead to what better-off persons in developed countries would deem as inadequate attention to the health needs of the young.

Deeply discounting the future, a common enough practice whenever there is substantial uncertainty, has an inordinate and unwelcome influence on many private and public choices. Saving, investing, protecting one's health, getting an education may all be under-supported when doubts about the very possibility of survival are at stake. Reducing uncertainty is broadly recognized as a means to increase subjective well being (Graham 2009). Investing in health and reducing health risks can confront discounting practices that support under-investment, producing a virtuous circle of better health and more effective spending on health improvements that matter most.

Advances in estimating health benefits

The five pages of references to the Mills and Shillcutt paper in *Global crises, global solutions* does not include key papers that have advanced our understanding of the benefits derived in financial terms from the additions of lives saved and life-years gained from selected interventions. Their work focuses, as do many of the leading works in the area of cost-effectiveness of health interventions, on disability-adjusted life-years (DALYs) gained. There is of course controversy about valuing life and life years that can be gained from a host of interventions.

DCP2 and health sector priority setting. By 2005, there was already broad though not universal agreement among health economists that lives and life-years saved are sound measures of benefits to be derived from health investments (Cf. Behrman (1998), Chapter 1, Jamison and others (2006), and *Disease control priorities* (DCP2, ed., Jamison and others, 2006).

Despite the advantages offered by CBA, its use has been on a long-term decline in the World Bank:

> *The percentage of Bank projects that are justified by cost-benefit analysis has been declining for several decades, owing to a decline in adherence to standards and to difficulty in applying cost-benefit analysis. . . .*
>
> *[T]he percentage of projects with such analysis dropped from 70 percent to 25 percent between the early 1970s and the early 2000s. . . A little more than half of this decline was due to an increase in projects in sectors at the Bank that tend not to apply a cost-benefit analysis to their projects. . . [M]ost of the improvement in project performance ratings that has occurred at the Bank in the past 20 years has been in the five sectors that tend to apply cost-benefit analysis (Warner 2010, ix).*

In lending operations for education, health, nutrition, population, and public sector governance, a mere one percent of projects approved over the nearly forty years of Bank lending reported economic rates of return (ERR). Such rates, when present, are an indication that a BCA has been performed (Warner 2010, Table 2.1, p. 7 and related text). In most cases, this result suggests, the Bank did not conduct such analysis for these so-called 'soft sector' projects. Given that such analysis was shown in the Warner analysis to greatly improve project performance, the absence of it in these sectors is a source of regret.

Details by solution

Solution 1: Conditional cash transfers (CCTs)

Conditional cash transfers (CCTs) that induce all adults to seek testing and hence reduce the current high prevalence of HIV+ persons ignorant of their status.

Four decades ago, in the 1970s, the Government of India provided in-kind grants to men who accepted a vasectomy. The government's purpose? Reduce what many viewed as too-high fertility. But whatever the effects on the birth rate in India (it was small), there arose a storm of opposition claiming that the grants were coercive. Very poor people sacrificed their capacity to have more children in exchange for current payments. The Chinese government used a different approach in the 1970s. It offered no incentive for couples to conform to its new one-child policy. It imposed controls and enforced them with some vigour. World opinion was even more outraged against this form of coercion than it was against Indian government vasectomy incentives.

Not so many years later, in the mid-1990s, Mexico's government upped the ante on incentives. Families got cash payments in exchange for assuring their children attend school at least 85 percent of required days. Separate payments went to women who sought and received antenatal and neonatal care. There, few if any complaints of coercion arose. The conditional payments have now spread to many countries (they were even tried though soon abandoned in New York City).

How well did they work? As with all topics in health policy, views differ. One of the originators has written of its success (Levy 2006). Karlan and Appel warmly agree in their book, *More than good intentions* (2011, pp. 201-205, 231-35). Banerjee and Duflo, leaders of the MIT Poverty Lab, are not so sure: Payments may be less important than alerting families to their own actions that can promote or impede their children's health and education (see their *Poor economics, a radical rethinking of the way to fight global poverty,* 2011).

As these and other authors are wont to remind us, details matter. Applying CCTs to strengthen health systems and address the HIV/AIDS epidemic will require careful thought. Payments must not be allowed to be, or even appear to be, coercive. They must not endanger human rights by focusing on any 'key' groups or most-at-risk populations. Any system of payments, incentives, and actions must be designed to avoid the opposition that surrounded the earlier attempts in China and India to reduce fertility.

The solution proposed here: Offer a voucher worth US$5 to every adult aged 18 to 49 in exchange for agreeing to be tested, counselled and as necessary treated for HIV/AIDS. The one-time cost of this voucher if all eligible persons accept would be about US$2 billion. As the discussion below argues, benefits could exceed these costs by a factor of 2:1, just in considering the reduction in new infections. There will also be contingent benefits in reduced numbers that eventually require ART and in the ramping up of basic health services needed to provide testing and related support services to the dispersed, largely rural population of Africa. Perhaps most importantly, this testing-for-all strategy avoids the stigma and human-rights violations that confound any proposal to focus on most-at-risk populations.

The proposal by Granich and others (2008) for universal voluntary testing goes much farther than the cash transfer proposed here. Granich recommends moving immediately to ART for all persons found to be HIV positive. Garnett and Baggaley (2008) in commenting on this plan urge caution; voluntary testing might lead to coercive therapy. The payment recommended here should be provided for testing and counselling but leave treatment and other behaviour change as personal, informed choices.

CCTs as a path to knowing. Far too many Africans who are HIV+ do not know it. Reports in Demographic and Health Surveys (DHS) show that three-quarters or more of all HIV+ persons in countries surveyed are not aware of their status. This lack of knowing varies widely among nine countries surveyed in sub-Saharan Africa "with more than 20 percent of people living with HIV being aware of their HIV status in four countries (up to 31.4 percent in Rwanda) and less than 20 percent in five countries. The median percentage in the nine African countries is 16.5 percent."[2] Health systems remain far from achieving a 'test and treat' objective for addressing efforts to prevent the further spread of HIV. This 'not knowing' must be a key factor that permits the numbers of new infections to continue to exceed each year's additions to the number of persons treated with ART in the region.

How CCTs might work. Many poor rural Africans live on less than a dollar a day, spend more than three-quarters of their resources on food and basic shelter, and live many hours walk from the nearest modern health facility. The combination of poverty and isolated rural location causes them to procrastinate and not seek health care beyond what can be provided by a nearby traditional healer. It

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[2] **WHO 2008,** *Toward universal access,* **p. 54 and Table 3.3.**

is thus no surprise that with an infection like HIV that can remain undetected for years, that many who are infected do not know it. Only the presence of a visible threat such as a sexually transmitted disease, like syphilis or gonorrhoea, will cause the ill person to seek diagnosis, care, and treatment. If that health-seeking behaviour also includes a test for HIV, then potential sexual partners of that person may in future benefit from NOT being at risk of transmission assuming that behaviour change results from a positive diagnosis.

Where CCTs have worked in Africa. In rural Malawi, Rebecca Thornton studied a demand-side performance-based incentive (PBI) by randomizing the distribution of vouchers to clients worth up to a day's wage, redeemable upon submission to an HIV test and receipt of their results at a nearby voluntary counselling and testing (VCT) clinic. She found that while there was substantial demand for HIV testing even in the absence of cash incentive, any positive amount nearly doubled uptake of HIV testing. She also found that HIV-positive respondents who learned their test results were significantly more likely to purchase condoms in follow-up interviews. She concludes that even small cash incentives might be useful in overcoming inertia or stigma-related costs in learning HIV status, and may even be marginally useful in condom uptake, thereby averting further infections (Thornton, 2005).[3] Provision of basic and accessible clinic services for HIV testing can equally strengthen the health system. Such an incentive can yield benefits that more than repay its costs.

Also in Malawi, Baird, Chirwa, McIntosh, and Ozler (2009) randomized a conditional cash transfer that sought to estimate the effect of receiving a small cash payment conditional on girls' school attendance. Some girls received the cash regardless of whether they went to school, others only if they went to school, and others received nothing. The authors found that one year after the intervention, cash transfers led not only to increases in self-reported school attendance but also to declines in early marriage, pregnancy, sexual activity, risky sexual behaviour, and coital frequency for the sexually active.

As for using conditional cash transfers for HIV prevention, Medlin and de Walque (2008), after surveying the literature, suggest that the best proxy on which to condition transfers might be new sexually transmitted infections (STIs), as they are transmitted by similar risk behaviour as HIV. They are in some cases easier to observe and, unlike HIV, some are curable. By conditioning the transfer on a reversible event (STI infection), instead of an irreversible one (HIV infection), a conditional transfer program can continue to provide rewards for safe behaviour to people who have previously failed the condition, a group of particular interest for curbing the epidemic.

The results of this randomized trial are encouraging in another respect: They refute the assertion that is sometimes made that poor African women have little or no physical control over their own sexual risk. In another randomized study that demonstrates how much control women can have even in the absence of an income transfer, Dupas has shown that the information that older men are more likely to be HIV infected has led young poor African women to reduce the frequency with which they have sex with older men. (Dupas, 2010). Focusing on persons who must seek treatment for STIs can be just as stigmatizing as focusing on those who agree to be tested for HIV. Even though this approach 'works,' it is basically fraught with the implication that the beneficiaries of the cash transfer are 'different' from the population as a whole.

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[3] **We are indebted to Mead Over for calling these examples to our attention in his papers and presentations through the Center for Global Development (Over 2008 and Over 2010). Several of his works are included in the list of references to this paper.**

A promising, preliminary study appeared at the recent XVIII International AIDS Conference. The Schooling, Income, and HIV Risk (SIHR) study in Malawi assigned 3,796 young women aged 13–22 randomly to two groups, with half the women receiving cash payments of varying amounts. Interviewed 18 months after the project start-up, girls in the cash group who were in school at the start of the study had a 60 percent lower HIV prevalence compared with schoolgirls who received no payments. This result was probably due to a reduction in transactional sex with older men. These results held even for girls who received cash with no school attendance requirements (unconditional cash). The effect increased with payment size; extreme poverty may thus have influenced girls' sexual choices.

The RESPECT study in Tanzania examined the effect of CCTs as an incentive for young people to stay free of STIs. Investigators randomly assigned young men and women aged 18–30 years to a control group or CCT group. Participants in the cash group were eligible to receive a payment of US$20 every 4 months if they had negative laboratory tests for curable STIs: Prevalence of STIs declined in the cash group compared with the control group. In contrast, a study in Malawi found that a one-time cash reward for maintaining HIV-negative status for one year had no measurable effect.

The examples above show that CCTs can work. But they can also be stigmatizing unless carefully designed. It may now be time to take a more universal approach to offering a voucher for performance. Proposals from WHO scientists have been urging expanded testing for some time (Granich and others 2008), and UNAIDS offers continuing support so long as rights are respected (Schwartländer and others 2011).

Why universal adult testing for HIV? Consider the less-stigmatizing procedure of universal adult testing: Provide a voucher worth five US dollars equivalent in local currency to any and all who agree to be tested and then to hear test results and participate in appropriate counselling. Payment need not be conditioned one way or the other on the test outcome or further behaviour; the only purpose is to increase knowledge.

In light of the millions of persons who will have to be tested, there are obvious implications for increased near-term demands on the health sector and its personnel. There are about 400 million adults in the region that could take the tests and receive the vouchers. Would the benefits repay such high costs? Could health systems handle the very heavy service load such testing would imply?

Linkage to social enablers. Note that the improved investment approach promoted by UNAIDS and others already proposes annual resources required above US$16 billion annually (Schwartländer and others 2011, Table 2) and a substantial part of that goes to provider-initiated counselling and testing. "Program enablers include incentives for program participation, methods to improve retention of patients on antiretroviral therapy, capacity building for development of community-based organizations, strategic planning, communications infrastructure, information dissemination, and efforts to improve service integration and linkages from testing to care" (Schwartländer and others 2011, pp. 4-5).

Spending in these areas would amount to over a third of total requirements. The cost benefit analysis must then move to address the question of whether a cash transfer might complement the proposed social or program enablers. Since this approach of providing a cash incentive for such testing has not

been tried and proven to work, the authors must acknowledge that a certain amount of guesswork underlies the estimate suggested below. What can be confirmed without qualification is that current approaches of a purely voluntary nature are not working; something else has to be tried and an incentive for testing that does not stigmatize any specific group may just be the right way to begin.

For all low- and middle-income countries, this new UNAIDS program seeks to cut new infections from about 2.5 million annually in 2011 to one million by 2015. Suppose that the proposed voucher could be credited with cutting a quarter of a million infections annually. That reduction in new infections is here conceived as the incremental benefit of the conditional cash transfer. That benefit would constitute one-sixth of the projected reduction in new infections annually. This crude estimate is at best a guess at how much of a contribution to reduced incidence this modest payment can make. Current efforts to induce people in SSA to undertake voluntary counselling and testing are having at best very modest success, as indicated by the high numbers of persons ignorant of their HIV status. Thus, this solution is offered on grounds that some additional direct incentives for testing and counselling are worth investigating.

Equally, we can have no prior certainty about how many infections averted can be attributed as an incremental benefit to be associated with the incremental cost derived from the payments made to adults to undertake the testing and receipt of information about their status with respect to HIV. Further, the incremental reduction in new infections will have the important secondary effect of reducing the number of persons who, years later, will need treatment for opportunistic infections and anti-retroviral therapy (ART). The cost savings derived from this reduced incidence of HIV add to the incremental benefits deriving from this conditional payment to these millions of adults. The specific amounts attributable to the cash transfer are again a subject of guesswork. With these caveats in mind, we proceed to examine this scenario.

For each of the presumed quarter million infections avoided, this solution saves varying amounts determined in a two-way relationship between the presumed value of a life year and the assumed discount rates used to evaluate future years of benefits, both life-years saved and OIs and ART costs avoided (see Appendix Table 2). In these scenarios, the four resultant b/c ratios range from a low of 2.5 to a high of 15. All four combinations yield benefits that more than compensate for costs.

This solution holds an appeal by reason of its potentially striking impact on new infections, on the demands it makes to strengthen the health sectors as a whole for participating countries, and its inclusion of the whole population of sub-Saharan Africa into participation in the fight against AIDS.

If a quarter million deaths are averted at a cost of US$2 billion, the cost per death averted is then US$8,000 (US$ 2 billion / 0.25 million lives saved = US$ 8,000). Assume the person saved by this intervention is age 22 so that the present discounted value of that saved life is 25 years at a 3 percent discount rates and 18 years at a 5 percent discount rate. Thus the Cost/DALY ranges from US$320 with a three percent discount rate for future years of life to US$444 with a five percent discount rate (see Appendix Table 2). This cost would appear reasonable when compared to the range of values of a year of life that appear in Appendix Table 1.

Does it make sense to test 400 million adults or can a far more limited but effectively targeted number of persons be offered the CCT voucher? Targeting can quickly devolve into a human rights issue inasmuch as the most-at-risk populations may be further stigmatized by the very existence of

such a payment. Thus the starting point, to avoid the possible stigma generated by a program 'targeted' on high-risk groups, must be the whole population.

It is not essential that all testing begin in all countries. The nine countries in eastern and southern Africa with HIV prevalence rates above ten percent among adults aged 15 to 49 might be an appropriate place to start.[4] There need be no stigma or discrimination attached to a national program in those countries. In those countries the number of now unaware HIV+ persons would be significantly higher than in countries with lower prevalence rates in, for example, West Africa. Thus the benefits of increased knowledge would be greatest in these nine countries.

In the event, smaller numbers may fit the requirements in selected countries or even regions within countries where presumed prevalence is so low as to vitiate the testing procedure. But as a starting point, the program should be universal. It may in any case prove useful to begin this cash transfer plan in eastern and southern African countries with high rates of prevalence hence gaining useful knowledge more quickly there than in lower-prevalence West African states.

Some readers may suggest that the benefits of mass testing would not be adequate to repay such a high cost. Of these 400 million adults only 17-18 million of them, less than five percent of the total, will be discovering that they are HIV+.[5] If all these persons then abstain from sexual contact, the next year's incidence of new infections should fall precipitously from an otherwise anticipated nearly two million.[6]

These considerations only serve to emphasize further how important it may be to increase the share of all Africans aware of their status and hence able to benefit from care and to take measures to protect their partners. Without effective health system strengthening those changes will be difficult to implement. Thus even opportunistic infections that burden those persons who have moved to full-blown AIDS can work more completely and effectively in a strengthened health care system. They may fail badly where the overall system fails.

Recall that South Africa's President, Mr. Jacob Zuma, has himself submitted to HIV testing and has urged his fellow countrymen to join him in such testing. Thus there is already senior leadership in support of the proposed solution offered here.

Solution 2: Upgrade health worker skills & services

Enhance numbers, training, and skill development for community health workers to strengthen basic health services and test and treat for HIV/AIDS.

The success of Solution 1 will depend on health system strengthening (HSS) and having adequate

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[4] **These countries include Swaziland, Botswana, Lesotho, South Africa, Zimbabwe, Zambia, Namibia, Mozambique, and Malawi, as listed in Table 1 of the chapter by Behrman and Kohler.**

[5] **UNAIDS 2008 report placed the number of HIV+ persons in sub-Saharan Africa at 22 million, of which about four to five million are aware of their status, so that the numbers to be discovered are just under 20 million.**

[6] **Professor Alan Whiteside has suggested a one-month sexual abstinence period as a method to break the cycle of infection.**

health human resources. This staffing requirement has gained particular attention in the work of several international health agencies:

The Commission on Macroeconomics and Health (CMH) led the way more than a decade ago in defining the health care needs summarized in the Millennium Development Goals (MDGs);

- International Health Partnerships (IHP+) focuses on requirements across the board to achieve HSS objectives;

- The Platform for Health System Strengthening moves a step closer to developing country government control over the way forward and, as noted below in considering solution 5, some means to remove user fees;

- The High Level Taskforce (HLT) that urges "Promoting the retention and motivation of health workers particularly in underserved areas" (Mills 2009); and

- The Earth Institute Technical Task Force Report, *One million community health workers* (CHW 2011), which provides detailed estimates of costs for all SSA of expanded rural health services.

The bridge between HSS and HIV/AIDS can best be crossed with enough personnel to be able to conduct tests and report diagnoses for very large numbers of persons, including the rural poor. Because of poor nutrition, long distances from the sites of health care services, and levels of uncertainty that may lead to simply putting off the search for care, the rural poor are those most at risk to a range of infectious and communicable disease.

The World Bank *Voices of the Poor* project interviewed thousands of poor people in sixty countries. Their report is a clarion call for more effective attention to the health needs of the poor, including better access to health workers and health services:

Distance to health-care facilities, problems and costs of reaching them, and lack of medicines often make obtaining treatment difficult.

In Africa and elsewhere, people report a sheer lack of health posts, clinics and hospitals—and discouraging distances to the ones that exist. Rural areas suffer the most marked lack of services. In discussing problems in obtaining medical care, participants in parts of Ethiopia, Ghana, Malawi, Somaliland and Zambia mention the long distances that have to be traversed more often than problems of cost or quality. . . . In Malawi an increase in disease, especially HIV/AIDS, has made the lack of accessible facilities a more pressing problem (Narayan 2000, p. 101).

The shortage of health workers is particularly critical in countries experiencing severe HIV/AIDS epidemics. WHO identifies five countries – CAR, Lesotho, Malawi, Mozambique, and Zambia – in which adult HIV prevalence rates exceed 10 percent and the shortage of health workers is acute (Herbst in Lule 2008, 329). The Food and Agricultural Organization (FAO) estimates that more than two-thirds of the population of the 25 African countries most affected by HIV live in rural areas (FAO 2008). In contrast medical doctors (MDs) live in the cities. For example, patient load in Maputo City is 342/MD, but on average in the Mozambique countryside that ratio is 6,496/MD (Hagopian and others 2008). "Such patient loads exceed any reasonable standards" (Herbst 2009, 329).

Moreover, there is a serious 'performance problem;' in the five countries identified by WHO above, an average 35 percent absentee rate among health workers is the norm. Researchers in many low-income countries have found similar slacking of effort in many low-income settings. The World

Bank's *World development report 2004, making services work for poor people*, gave ample attention to the problem. Since then, the randomistas have studied the staffing problem in detail (Banerjee and Duflo 2011, Karlan and Appel 2011). Too often, skill requirements do not match salaries. Workloads set by managers exceed the skills and capacities of community health workers. Too often, the details of actual practice in Africa's health sectors do not fit service-provision norms.

There remains the persistent problem of retaining newly-trained health staff whose skills are rewarded at far higher wages outside the public health sector. This applies especially in high income countries. A study of final-year medical students in Ethiopia finds that more than 40 percent of students chose jobs outside the health sector upon graduation (Herbst and others (2008) based on Serneels and others (2005)).

To what level of skill do these front-line health workers need to be trained? With two-thirds of Africans resident outside urban areas, it is to rural areas that most newly-trained community health workers will have to be assigned. They will have to be workers committed to work among their neighbours, most of whom will be part of the large majority of the rural poor. This new group of community health workers will have to be recruited in full recognition of their work being more closely tied to the needs of their own communities.

Strengthening health services in rural areas. UNAIDS recently drew on an Earth Institute study of what costs would be incurred to put in place an adequate human resource base (CHW Technical Task Force 2011). A community health worker (CHW) can take care of over five hundred rural households per year, at a per-person cost of about US$5 per annum. The cost to serve sub-Saharan Africa's 530 million rural persons is about US$2.64 billion per annum. This amount is then a small share, about four percent, of the needed annual health spending for the region of around US$52 billion identified by the Task 1 report of the HLT (Mills 2009). The Earth Institute study goes on to estimate that extending HIV testing once a year to all HIV-negative persons above the age of fourteen would add about US$2.50 per person serviced by the CHW program (CHW Technical Task Force, p. 60). The cost of providing community health workers need not be a barrier. What must be assured is that there are adequate benefits to repay such costs.

The Malawi case was developed to assess specific contributions that the new staffing plan could make to strengthening family planning services and reducing the risks of maternal to child transmission of HIV. It did not include the additional costs and benefits of universal testing and treatment, services discussed here as part of solution 1 in the preceding section.

The protocol referred to as Option B+ provides that all HIV positive pregnant women, regardless of their CD4 cell count, will continue to receive ART for life (Fasawe and others 2011). The study estimates that Option B+ can save more than 100,000 life years above the natural progression expected if the mothers only receive PMTCT prophylaxis. The generalized cost effectiveness ratio for option B+ was US$ 697 per maternal life year saved. Moreover, if the cost and outcomes from mothers and children are added using Option B+, then 331 thousand life years would be saved and the cost effectiveness ratio would improve to US$261 per life year. This amount is well below the US$1,000 as the value of a life-year used throughout this paper and for this RethinkHIV exercise in general. A reasonable conclusion is that the integration of family planning and ART services shows considerable benefits. Option B+ would require further financial resources, but it will also save

societal resources in the long-term.[7]

Reducing Maternal Mortality. Malawi has seen a reduction in maternal mortality in the last decade as it fell by half between 1998 and 2008. Coverage of ART among pregnant women has also increased from ten percent in 1999 to 58 percent by the end of 2009. These coverage improvements demonstrate successful national efforts in reducing disparities in safe motherhood within the country.

Preventing unintended pregnancies among women living with HIV. Adding family planning to the menu of sexual and reproductive health services can provide substantial clinical, health, and human development benefits:

> *The majority of people living with HIV in Africa – 61 percent – are women. Women age 15-25 are three times more likely to be HIV+ than men their age . . . Furthermore, women with HIV have a 20-45 percent chance of passing the virus on to their children. The feminization of the epidemic in Africa may be the single most important reason for linking HIV/AIDS and SRH programs (Lule 2009, p. 372).*

An effective family planning strategy requires community mobilization to increase the uptake of family planning services. If 90 percent of the unmet need for family planning were to be met among women living with HIV, the cost per DALY averted would fall below US$70, well within the acceptable cost-effectiveness range (see Joshi 2011). Reducing the unmet need for family planning is a more cost-effective strategy than delivering just ART to HIV+ women. Even at lower levels of family planning service provision, the relative cost-effectiveness demonstrated in the Fasawe 2011 study remains high.

Assessing benefits and costs of staff expansions. The solution under discussion here is massive expansion of the number of community health workers who would provide basic health services in rural areas, especially focused on family planning and reproductive health. The Malawi exercise provides a template for a scenario of expansion of the CHW build-up to continental scale. At an estimated cost of US$5 per person served, the 530 million rural persons in sub-Saharan Africa could be provided with CHWs at a total cost of US$2.64 billion. The full benefits of their efforts can be summarized as follows:

- Reducing maternal deaths by 0.3 million with a net present value of US$25,000 (low estimate) and US$123,000 (high estimate) each ;
- Reducing infant infections with HIV by PMTCT programs could save up to 0.1 million infant lives with a net present value of US$15,000 (low estimate) and US$72,000 (high estimate) each;
- Meeting the currently unmet need for family planning can reduce total births by ten million; and,
- CHWs can contribute to reducing other infectious and communicable diseases via

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[7] **Estimates derived from this modelling are comparable to previously published estimates that range from US$ 60- US$274 per DALY. Sweat and colleagues (Sweat 2004) derived an estimate range of US$58-310 per DALY averted across seven countries in Sub-Saharan Africa and another study done in Tanzania by Robberstad et al. (2010) reported a cost-effectiveness ratio of US$162 per DALY averted.**

health promotion activities.

We focus here on the reduction of infant and maternal deaths associated with the reduction of unmet need for family planning. Note that the specific benefits cited above refer to reduced numbers of infant infections with HIV in response to fuller availability of PMTCT. The substantial benefits of PMTCT are the subject of another paper in this collection (Bollinger 2011).

The sum of the full value of benefits 1 and 2 cannot all be attributed to increased provision of services by CHWs. We estimate that half of the value of benefits 1 and 2 can be attributed to the incremental services provided by CHWs (see Appendix Table 3). The resultant b/c ratio estimates range from a low of 1.1 when net present value is estimated with a US$1,000 value of a year of life discounted at a five percent discount rate, to 9.5 with a lower three percent discount rate and the higher US$5,000 for the value of a year of life.

These ratios of benefits to costs are substantial, and they will be larger, the larger are the collateral benefits implicit in items 3 and 4, not to mention the merits of family planning now reaching women who express need for it.

The cost per death averted is about US$16,000 (US$2.64 billion/ (0.3m women + 0.05m infants) * 1/2 = US$15,857). Net present value of costs per DALY range from about US$587 to US$825 depending on the lower 3 percent or higher 5 percent discount rate used for future years of life gained.

Whether presumed incremental benefits will in fact be forthcoming depends fundamentally on the 'truth' of the assumed value of the upgrade of basic service availability. Will these additional community health workers really add value? Is such a system subject to extension into fairly remote rural areas where supervision is difficult?

The most recent update on progress toward MDG 2015 objectives underlines the large remaining gap between goal and progress through 2008 in SSA. Maternal deaths per 100,000 births fell from 870 in 1990 to 640 in 2008, a 26 percent decline (United Nations 2011, 28). However, the 2015 goal is much lower. Fewer than half of SSA births are attended by skilled personnel, and the region remains with the highest level of unmet need for family planning and reproductive health services (United Nations, 2011, 30, 33).

A recent review sponsored by the World Bank demonstrates that family planning programs are very cost-effective while generating both direct and indirect benefits. The author summarized other studies in these words:

> *By offering FP services at voluntary counselling and testing sites in the 14 countries with high HIV prevalence, child HIV infections could be averted at a cost of US$489, and child deaths could be averted at a cost of US$278 per event – well below the cost of averting these events using traditional PMTCT services. In addition, these family programs would avert orphans at a cost of US$278, and maternal deaths at a cost of US$1,284 per event. In terms of DALYs the benefits of such programs are even more startling: while HIV services cost approximately US$27 per DALY, the reduction of mother-child transmission costs about US$5 per DALY (Joshi 2011).*

Even though these programs offer positive returns, family planning has declined in donor emphasis as HIV/AIDS assistance has risen:

> *Unfortunately, funding for family planning programs has faltered for more than a decade. Between 1995 and 2008, while funds committed by donors and developing countries to HIV and AIDS programming increased by nearly 300%, funds devoted to family planning declined by some 30%. As a result, many countries are less able to provide family planning services today than they were a decade ago, and much of the earlier commitment has waned. There are indications that fertility declines are levelling off or even being reversed in some countries (Bongaarts and Sinding 2009, 43).*

Few programs in public health have the potential to complement each other as well as family planning and HIV/AIDS prevention services. With continued high fertility and unmet need for family planning both programs need strengthened health care systems if they are to flourish in SSA, the region with highest fertility and highest HIV/AIDS prevalence. Combined programs need to reach beyond the easiest households to reach in major cities to the under-served countryside. It is hard to imagine an upgrade to health services and an improvement in health outcomes without effectively reaching rural Africa.

Solution 3: Test for cryptococcal antigen (CRAG)

Test for cryptococcal antigen (CRAG) to support focused treatment of an opportunistic infection.

An opportunistic infection associated with HIV, Cryptococcal meningitis (CM), is a major threat to health in sub-Saharan Africa. It killed over six thousand persons in South Africa in a recent year and threatens the lives of an estimated 720,000 in the region as a whole. "When comparing the estimate of deaths in sub-Saharan Africa with other diseases excluding HIV, deaths associated with cryptococcal meningitis are higher than tuberculosis (350,000) and approach the number related to childhood-cluster diseases (pertussis, poliomyelitis, diphtheria, measles, and tetanus, 530 000 death combined), diarrheal diseases (708 000), and malaria (1.1 million)" (Park et. al. 2009, 527). Lives can be saved with a newly-developed optimum treatment strategy. It identifies the presence of cryptococcal antigen (CRAG) among HIV+ with very low CD4+ cell counts. The small percentage found with CRAG is then treated with amphotericin B and 5-flucytosine (AmB/5FT). Most survive for an average of eleven years. Full testing of 32 million persons in SSA, followed by focused treatment on the small minority with CRAG, about 0.7 million persons, can yield very positive benefit-cost ratios (Punchak 2011).

The effectiveness of this solution will depend in substantial measure on early identification of the small group likely to fall victim to CM. Thus, an expansion of the tested population, an expansion that will require strengthening the health system to permit it to manage such testing, depends on better staff and inclusion of a larger share of the population among those tested. This solution thus relies on both effective HIV/AIDS programs and expansion and improvement of the testing capacity of the health system as a whole. The best approach to identifying candidates for CRAG will be to focus on those most obviously ill yet uncertain of the cause of their illness. A share of such persons, perhaps a significant share, will be persons with low CD4 cell counts below 100 and hence persons at great risk of death from an opportunistic infection associated with HIV and AIDS. Testing for CD4 cell count can be made a part of the overall testing expansion provided under Solution 1 above, and it will be

strengthened with the enhanced provision of community health workers suggested as a key part of Solution 2.

Evidence presented here depends largely on data and analysis generated in the Republic of South Africa (see Table 3). There is reason to believe findings about this solution in this one country will apply in varying degrees in other SSA countries. Poorer countries may well have more of their people in extreme distress due to opportunistic infections yet may remain undiagnosed and untreated except for minimal palliative care. This possibility adds yet more support for an expanded effort to test and treat a larger share of adults in sub-Saharan Africa who may be ill yet not know the cause of their illness. Expansion of basic test-and-treat capacity to rural Africa is an essential part of the next phase of addressing the HIV/AIDS pandemic.

Cryptococcosis neoformans is an opportunistic fungus that affects immuno-compromised individuals causing the human cryptococcosis infection, common in SE Asia and Africa; as many as seven hundred thousand deaths annually may be attributed to this opportunistic infection. It is a major cause of AIDS-related death even in developed countries linked to intracranial pressure as a result of cryptococcal meningitis (Bicanic 2005).

Table 3. Disease statistics for HIV/AIDS infected population of South Africa, all sub-Saharan Africa.

Indicators	South Africa	All SSA	Source/Comments
Population, m=millions	49.3	800	World Development Indicators
CM cases, most recent year	6,309	720,000	DOH, Rep of So Africa; Park et. al. 2009
Mortality rate, CM cases, %	64	73.6	DOH, Rep of So Africa; Park et. al. 2009
HIV infected, %	11.3	2.8	UNAIDS 2008
% CD4+<100 cells/ul of treated	41		Lawn and others
Need screening with CRAG, millions	0.85	32	Author estimates
Need to treat with AmB+5FC	6,309	720,000	Same as CM cases identified
Need to treat with fluconazole, m	0.85	32	Author estimates

Source: Punchak 2011, based on Dept of Health, Republic of South Africa; World Bank *World Development Indicators,* **UNAIDS, Lawn and others. Author estimates.**

Untreated CM is uniformly fatal; infection is usually diagnosed at a late stage, but if the cryptococcal antigen is detected early, treatment can reduce mortality and gain life-years for the infected person (Perfect et al. 2010).

Researchers in SSA are at work to determine if screening the group at risk for developing cryptococcosis for the cryptococcal antigen, and then providing *only those who test positive* with the

optimal drugs, would be cost effective (Meya et al. 2010). Screening the group at risk for the cryptococcal antigen (CRAG), and treating only those relatively few persons identified as positive with the optimal treatment yields the best ratio of benefits to costs.

Costs and Benefits of CRAG. Even at the point of initial testing, when the CD4+ cell count is below 100, patients will survive for two years on average with only palliative care. Screening the 32 million persons in the at-risk group will cost US$6 per test and total about US$200 million. Identifying that small minority testing positive for CRAG, and treating only that group can increase average life span of the estimated 0.72 million at-risk persons to 11.6 years (Meya et al. 2010). That process along with treatment will cost $1,810 per person for this smaller group, a total of US$1.3 billion. This cost includes one CRAG screening test for 32 million persons, a two-week supply of AmB/5FC for the many fewer, approximately 0.7 million, in need of this targeted treatment, and an eight-week supply of fluconazole. Once this treatment is completed, it does not need to be repeated.

The benefit is US$1,000 or US$5,000 per year for the 9.6 additional years of life gained by the 0.7 million who will benefit from treatment (see Appendix Table 4). With this discounting the benefits for SSA as a whole range from US$6 billion (with a value of a year of life of US$1,000 and a discount rate of five percent) to US$30 billion (with a value of a year of life of US$5,000 and a discount rate of three percent), yielding b/c ratios ranging from a low of 2.7 to a high of 20. The cost per death averted is US$2,083.[8] The cost/DALY discounted at 3 percent and 5 percent ranges from US$260 to US$347.

The success of this intervention depends on reasonably complete access to and knowledge of how subject are patients to proceed from *C.neoformans* to CM and hence near-term risk of death. Persons with CD4+ cell counts at levels below 100 may show such significant symptoms of illness that they seek health care. Thus the share of these most ill persons that are ignorant of their HIV status is probably low. Recall, nonetheless, that over two-thirds of Africa's population lives in rural and isolated areas at some distance from any health care service points.

These considerations only serve to emphasize further how important it may be to increase the share of all Africans aware of their status and hence able to benefit from care and to take measures to protect their partners. The problem of CM would appear to be far greater in sub-Saharan Africa beyond South Africa's borders than in that country alone, which has made the most progress in developing this treatment protocol. Without effective health system strengthening those changes will be difficult to implement. Thus even opportunistic infections that burden those persons who have moved to full-blown AIDS can work more completely and effectively in a strengthened health care system. They may fail badly where the overall system fails.

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[8] **Cost per death averted is lower than for other solutions discussed here in large part because the solution adds fewer additional years life, only about ten more years, than do the other solutions that cause a young adult to survive to age 65.**

Uganda and AGF, a potential case study?

Uganda recently allocated 10.5 percent of its public spending to the health sector, 4.5 percentage points short of the 15 percent Abuja goal. Assume the government proposes to raise its share to 13 percent in 2012, 14 percent in 2013, and 15 percent in 2014, and maintain that share into the future. Spending on public health will have to rise from about US$220 million now to over US$300 million by 2014.

Uganda proposes to increase its health spending to US$250 million in 2012, US$275 million in 2013, and US$300 million in 2014. AGF agrees to disburse US$3 million by 30 June 2013 if the Ugandan government reaches or exceeds the 2012 target. Additional disbursement of US$4.5 million and US$8 million occur at the midpoints of 2014 and 2015, respectively, if Uganda meets the next-year goals. Total AGF disbursements to Uganda, 2013 through 2015, would total US$15.5 million if, and only if, all Abuja targets are met on time.

Similar outlays for thirty countries would total about half a billion dollars. Sums could be larger if additional donors agree to join AGF. Goals and timing would be adapted to each country's capacity to increase its health share.

There are still ways to improve treatment. In South Africa, only 37 percent of HIV+ persons receive ART therapy; only that percentage of patients have their CD4+ cell levels tracked. Thus currently, many potential beneficiaries are at risk, unidentified, and untreated. Identification and treatment can cut mortality rates in South Africa substantially; achieving that objective will require far better coverage via test-and-treat protocols that need to reach all persons at risk of being HIV+. Expanding the numbers and skills of community-directed health workers would enhance the performance of a more comprehensive test-and-treat strategy.

Upgrading the quality and quantity of diagnosis and treatment for opportunistic infections will require strengthening health systems overall. In that respect, HSS is an essential component of better HIV/AIDS programs as well.

Solution 4: 'Cash on delivery' (COD) through an Abuja Goal Fund (AGF)

Offer 'cash on delivery' (COD) through an Abuja Goal Fund (AGF) as an incentive to induce countries to raise public health spending and strengthen health partnerships in ways that also strengthen health and HIV/AIDS programs.

Solution 1 would provide individual vouchers that promote demand for testing to identify millions of adults who are HIV+ but do not know it. Solution 2 promotes an increase in the supply of basic health service personnel. Solution 3 targets specific testing services for OIs that harm those with diseases linked to HIV/AIDS but require an upgrading of health services generally. Solution 4 suggested here would promote upgrades in the financing of public health by governments. This solution would make payments to governments in exchange for progress toward the agreed goal of allocating at least fifteen percent of public spending to health services. Payment would flow through a to-be-established Abuja Goal Fund (AGF) endowed initially with a billion dollars. Disbursements would be made against

actual, agreed progress in allocating more public funds for public health in countries that agree to pursue this goal.

Subsidiary agreements about the nature and content of spending objectives could be negotiated between AGF managers and governments seeking funds. The incentive provided to governments with AGF funds need not imply a specific commitment of these payments to the provision of health services. The purpose of the COD payment is to induce an SSA government to devote its own financial resources to the health sector, not to pay for any specific health program, except the overall increase in public funding for the sector. Thus, in the BCA analysis of this solution, there is the (untested) assumption that the incentive of untied AGF resources will induce greater spending on health in line with objectives set out in the MDG framework, the IHP+ approach, and the Platform for Health Strengthening now being rolled out in selected countries.

Background on Abuja. In April 2001 representatives of all African governments pledged to achieve what has come to be called the Abuja goal for health spending. Few countries have actually achieved that goal (see Figure 2). More could do so. This solution would create a fund that would disburse against confirmed progress in raising the spending share from its current level (the health share in 2009, for example) to an agreed higher share in 2012 and years beyond through 2015. The way such a fund might work in one country, Uganda, appears in Text Box 1.[9]

The majority of sub-Saharan African countries still remain well short of an agreed goal, the Abuja target, established a decade ago to raise public health spending to 15 percent of all government spending. As of the year 2008, for which reasonably complete data are now available, seven countries had reached and exceeded that target level: Rwanda, Tanzania, DRCongo, Liberia, Burkina Faso, Zambia, and Djibouti. Five of these seven countries may have met the Abuja goal thanks to considerable donor assistance, which provided over a third to nearly two-thirds of health financing among five of the larger countries.[10] More than thirty other countries still fell below that target level in their public spending on health. The median and unweighted mean for all countries is ten percent of total government spending. Most countries are still well below the target public spending level for the health sector.

How can countries be induced to make progress toward the Abuja commitment? Can movement toward that commitment strengthen the health system and support the MDG of turning back the HIV/AIDS epidemic? We argue in favour of this approach fully recognizing doubts among those who reject such incentives as inadequate to cause ministries of finance to act positively.

Once such a fund is created other interested donors could add to it. Disbursements could begin in 2013 (against progress in the 2012 budget appropriation) and continue into the future. The target shares would be a subject for agreement between national governments and fund management. Disbursements would follow the principle of cash on delivery, i.e., presentation and agreement by both parties that verify progress (Barder and Birdsall 2006).

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[9] Dugger (2011) citing the work of Lu and others (2010) describes a serious incident in Uganda demonstrating lack of emergency obstetric care and suggests that donor assistance may have led to a reduction in public support for the health sector from government's own resources.

[10] The donor share is only 18.8 percent and 29.2 percent in D R Congo and Burkina Faso, respectively, according to the source. One may perhaps suspect that either donor shares or public-sector commitment to health spending might be incorrectly stated in these cases.

Current World Bank results-based funding (RBF) programs follow related procedures (Savedoff 2010). A platform approach inspired by the International Health Partnerships (IHP+) and the High Level Taskforce cited earlier, is already functioning in Ethiopia and Nepal (Glassman and Savedoff 2011).

In some respects at least, these new modes of financing parallel other donor practices. The Global Fund seeks proposals covering five years but disburses only for the first two years. GF then reviews progress with recipient country coordinating mechanisms and agrees to further disbursement depending on progress made. GF principles require it to 'leverage additional resources' beyond its own grants (Post and others 2005). In fact, it is a continuing challenge for donors to avoid having their external funds 'crowd out' support by governments. One estimate is that it would require US$1.4 in donor funds just to cover the US$1 of reduced health spending by SSA governments as finance ministries divert money away from health to other purposes (Lu and others 2010). This problem has been the subject of review at World Bank for more than two decades (for a recent review see Tandon 2009).

Table 4. Selected health benefits of health system strengthening.

Additional deaths averted in 2015	Calculated, millions	WHO	MBB
Under 5 deaths averted (including newborn, infant and neonatal) adjusted downward by 0.5	4	3 9m	4.3m
Maternal deaths averted	0.3	322 000	259 000
HIV deaths averted	0.1	193 000	74 000
Tuberculosis deaths averted	0.25	265 000	235 000
Total deaths averted (sum of first four lines above)	4.65		
Decrease in number of births due to increased use of family planning	10	11m	9m

Source: HLT Group 1 (Mills) report, Table 9, p. 57. The column, calculated, millions, adjusts original estimates in the WHO and MBB columns via the reduced valuation of infant and child deaths and an approximation of the mean between the WHO and MBB estimates.

The World Bank has for years operated structural adjustment lending approaches that make disbursement conditional on agreed goals and progress toward those goals. The highly-indebted poor countries initiative (HIPC) exchanges debt forgiveness against country pledges to increase public social spending. These examples suggest ample opportunity to provide attractive incentives to SSA governments that will induce them to shift priorities in favour of basic health. Similarly, AGF would not directly finance any health care services. Instead, it offers an incentive to a government to augment its own funding for health. The successful countries can avert many deaths that might otherwise occur as they strengthen health systems and build up the necessary staff support. To begin

estimating benefits from the incentive effect of AGF, consider what potential benefits of the Taskforce total could be scored as deriving from the AGF incentive.

Incremental costs in 2015. Data developed by HLT Group 1 follow the decade-earlier Commission on Macroeconomics and health (CMH) in proposing to more than double spending on health in the SSA region. They refer to an additional US$29 per capita beyond current spending on health of about US$25 per capita. Total health spending in the region would rise from its current level of about US$24 billion to a total of US$52 billion to be spent on all SSA health care in 2015 (HLT Group 1 report 2009).[11]

What incremental benefits can arise from this additional spending? The answer provided by HLT Group 1 can be summarized as additional deaths averted in the single year 2015 (see Table 4). Both WHO and the World Bank marginal budgeting for bottlenecks analysis (MBB) have provided best estimates of under-five, maternal, HIV, and TB deaths that can be averted.

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[11] Assume, along with UN and World Bank projections, a 2015 population of just under one billion for SSA and hence total health expenditure, when per capita spending is $54, of US$52 billion, half of which is incremental, additional spending recommended by the HLT Group 1 report.

Figure 2. Reaching the Abuja Goal: By 2008, 7 countries did, 38 did not.

Public health spending (share of government spending, percent)
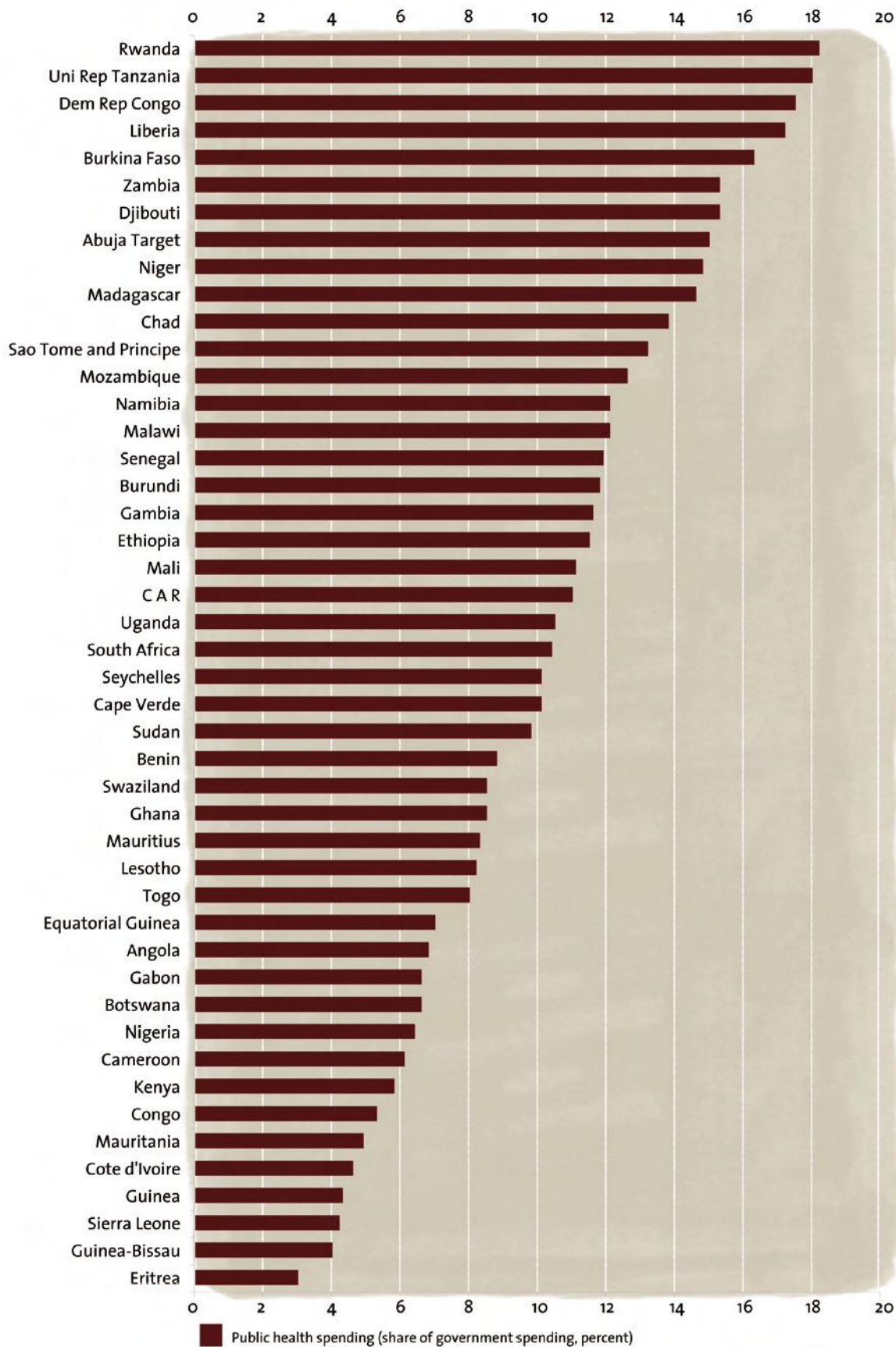
A total of about 4.65 million deaths will be averted and hence 4.65 million lives saved in the year 2015. Most of the lives saved, 86 percent of the total, are for children under age five. The value of lives saved might thus range from a low of US$20,000 per life saved to a high of US$100,000 per life saved, amounts when future years are discounted at three percent that lie mid-way between the values for infants and young adults in Box Table 1A and 1B.

For this exercise, we adjusted the number of under-five deaths to be consistent with the approach described earlier in the preceding text. The sum is then estimated as 2.65 million deaths averted in that single future year. This number of deaths averted then helps specify the incremental benefits deriving from the increased spending to strengthen health systems. Such strengthening also clearly contributed to reducing deaths from HIV/AIDS.[12] Thus calculated the lower- and upper-bound estimates of benefits are US$93 billion and US$465 billion, respectively (see Appendix Table 5).

These amounts for benefits, when divided by the incremental costs drawn from the HLT Group 1, yield the b/c ratios in the range of 1.1 to 7.7. Cost per DALY range between US$600 and US$1,000. Those amounts are broadly comparable if somewhat below levels identified for other solutions and interventions under discussion here. Cost per death averted would be about US$11,000 (US$29 billion/2.65 million deaths averted = US$10,943).

The HLT Group 1 report goes on to assess the plausibility of the cost and impact estimates and compares the cost per death averted derived from the cost and impact estimates done for the essential package in the World Bank, *World Development Report 1993, Investing in Health*. Updated to 2005 prices, the cost-per-death averted of the WDR package is $9,000. The estimates here look plausible for a broad set of interventions that address the main causes of the burden of disease. They require broad systems development, including buildings, staff, and management, to deliver the whole set at the same time. Averted deaths are only one element of the broad health gains that could be created by scaling up interventions and the health system platform.

Are the estimates reasonable? Do they complement other solutions focused more directly on HIV/AIDS? The HLT taskforce authors raise questions of their own:

> *The hoped-for health benefits may also appear high. The deaths averted represent a roughly two thirds average reduction in child and maternal mortality from the 2005-2008 baseline over a six-year period. Rapid reductions are possible. For example, Eritrea managed to reduce the under-five mortality rate from 147 deaths per 1000 live births in 1990 to 70 in 2007…. The infant mortality rate also declined significantly over this time period…. Tanzania managed to reduce its rate of under-five mortality from 157 to 116 deaths per 1000 live births over the same period (HLT Group 1 report, p. 59.*

The earlier Commission on Macroeconomics and Health (CMH) estimated annual economic benefits of US$360 billion for a similar upgrade of future health spending. That earlier estimate lies above the

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[12] There are in addition substantial reductions in morbidity, and improved individual wellbeing and quality of life benefiting millions of people. In the WHO approach an extra 56m women would have access to safe birth attendance and antenatal care, and their babies would receive quality care at birth and during the neonatal period. In the MBB approach an additional 17 million women would receive antenatal care in 2015, and 16 million would benefit from safe birth attendance. Moreover, the strengthened national health systems would enable sustained health improvements into the future.

range of the benefits estimates in Appendix Table 5. The highest estimate there is a net present value of life-years saved of US$223 million for the combination of a life-year valued at US$5,000 and a discount rate of 3 percent for future life-years.[13]

An issue for this solution is whether and how the AGF incentive can be said to help achieve these benefits along with the direct costs for service delivery. Since the AGF does not yet exist, there is no way to 'prove' that it will contribute much less to show with certainty 'how much' its existence can contribute to the prospective benefits of HSS. At best one can say, "Incentives matter, and governments respond positively to them." That much we know from responses to HIPC, structural adjustment lending, and IHP+.

Central to this analysis is the presumption that the additional investments in service delivery really will work as planned. There are many sceptics and even some evidence from trials that suggest that success if achieved will be far from universal (Banerjee and Duflo 2011, Karlan and Appel 2011, and earlier analyses by Hammer, Pritchett and others 1999). Even at the higher prospective estimate of the value of life used here, and with the modest discount rate of three percent, the B/C ratio is not notably high when compared to some 'vertical' programs or HIV prevention measures.

The advantage that AGF can bring to the table is that the nearly forty governments in sub-Saharan Africa that have not reached Abuja goals can set their own plans and priorities before the Fund and its staff and work out plans consistent with national goals. This 'hands-off approach' is consistent with cash on delivery and results based financing approaches according to one recent overview of the new Platform meant to replace excessive donor involvement in what must be national governments' policies and actions (Glassman and Savedoff 2011).

Conclusions and recommendations

In preceding pages we examined four possible solutions to strengthen health systems and support the ongoing effort to turn back the pandemic of HIV/AIDS in sub-Saharan Africa. In general, these solutions offer positive returns of benefits compared to the costs that would be incurred to implement them (see Table 5). Their costs per DALY, shown separately, are reasonable as well.

The recently issued UNAIDS scenario, when applied to SSA, calls for spending US$22 billion annually (first rising then falling in the years 2012 to 2020). It will reduce the incidence of new infections and extend the lives of persons already HIV positive.[14] Estimates of lives saved and costs incurred yield cost per death averted of US$4,090 (see Table 2 above). This cost is well below the lower value of a life saved at age 22 and extended to age 65 (discounting future years at 3 percent or even at 5 percent as in Box Table 1A and 1B above). The new strategy from UNAIDS suggests a b/c ratio of 6 to 30. These are very positive results.

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[13] **If as an alternative evaluation, the analysis did not discount the future years of life of infants by half, then the much larger total of US$368 million would emerge from the analysis. This comparison underlines the significant role played by the decision to reduce the estimated value of future life-years of the very young when compared to those of adults.**

[14] **Over the 2011 to 2020 period the new strategy can save 29.4 million life-years at an average cost of US$1,060, roughly equivalent to the lower-bound value of a life-year used in this paper.**

How well do the four solutions that combine the strengthening of health systems and HIV/AIDS efforts compare to the UNAIDS scenario? The b/c ratios for these four approaches range from a low value of 1.1:1 to a high value of about 20:1. Cost per DALY ranges from about US$250 to US$1,000. Costs per death averted, with future years of life assumed to begin at age 22 in most cases, and discounted at three percent and five percent, range between US$2,000 and US$16,000. Details appear in the main text and annex tables.

Various studies used to support DALY estimates for strengthening health systems, improving family planning and reproductive health, reducing maternal deaths, improving treatment for OIs, and generally upgrading health systems range from well under US$100 per DALY to over US$1,200. The UNAIDS new approach offers a b/c ratio ranging from 6 to 30, a cost per DALY of US$1,060, and a cost per death averted of US$4,090. A comparison of this new approach to the proposed solutions may show that some solutions that provide *both* health system strengthening and HIV/AID prevention, care, and treatment offer somewhat better b/c ratios and costs per DALY and per death averted. Donor policies that blend vertical and horizontal approaches into a diagonal approach may be most advantageous. Much will depend on the efficacy of implementation.

Table 5. Solutions with potential impact on supply, demand, b/c, cost per DALY, and cost per death averted.

Solution	Impact on…	Persons affected (millions)	Costs (US$b)	B/C	C/DALY (US$)	C/D.A. (US$)
UNAIDS new scenario	Incidence, prevalence		22/yr	6-30.5	1,060	4,090
Proposed Solutions						
1. CCTs for VCT	Demand for prevention	400	2	2.5-15	320 - 444	8,000
2. Upgrade health workers & services	Supply of CHWs, esp. rural areas	100+	2.6	1.1-9.5	587 - 825	15,857
3. CRAG: prevent CM	Opportunistic Infections	32+	1.5	4-25	260 – 347	2,083
4. COD for AGF	Supply of public health services	300+	1	1.1-7.7	627 – 915	10,943
All HSS + HIV/AIDS	Supply, demand, incentives	400+	5			

Source: Authors' estimates. For details on b/c ratios, see Appendix Tables. C/DALY = cost per disability life-year saved; C/D.A.= cost per death averted. Cost/DALY and cost per death averted from Schwartländer 2011, UNAIDS scenario and Table 2 in text above; solution 1, assumes 1/6 of infections proposed to be averted by UNAIDS new approach attributable to CCT offered, with cost per deaths averted discounted at 3 percent; solution 2 from Joshi (2011), for child and maternal deaths averted, life-years saved; solution 3 from Punchak (2011) based in Rep of South Africa data in Excellent (2010), others; solution 4, from HLT Taskforce1, Appendix 2 on death averted; solution 5, life-years averting poverty = life- years assumed saved. For additional sources, see text.

Some of these cost estimates lie below the UNAIDS cost of saving a year of life, others above. In virtually all cases, there are possible ancillary, uncalculated benefits of these solutions. There may also be unintended consequences of some interventions. The incentives made explicit in conditional cash transfers and cash on delivery may cause unanticipated behavioural changes by persons and governments. Once such payments occur they may be demanded in the future when they cannot be further supported.

The best b/c ratios among these solutions arise from optimal treatment for the estimated 0.7 million persons in SSA with risk for cryptococcal meningitis. The other interventions also offer good value for money with ratios of benefits to costs exceeding one

The prospects for each of the four solutions presented in outline in Table 5 can be illuminated with the following summary descriptions:

- Universal testing, informing and counselling can be achieved with a voucher of US$5 paid to all those who accept to learn their status. The cost is substantial at US$2 billion, but benefits of knowledge could cut new infections by a quarter million annually in the effort to turn back the epidemic, and the health system's capacity to test and treat a range of ICDs would grow as well;

- Deployment of community health workers to the vast rural population at a cost of US$2.64 billion could cut maternal deaths by 0.3 million annually and child deaths by millions more, with b/c ratios ranging from 2 to 12, and we estimated that half the overall benefits from strengthening rural health service delivery could be attributable to this health outreach program;

- Reducing the opportunistic infection of cryptococcal meningitis at a cost of US$1.5 billion will require fuller health systems and can include enhanced attention to TB, XDR TB and other illnesses, and still yield a ratio of benefits to costs between 2.7 and 20; and,

- Creating an Abuja Goals Fund (AGF) can call attention to the need to double government health spending, giving incentives to enhance government spending with a US$1 billion fund that would offer cash on delivery (COD) for meeting agreed goals of spending more public money on public health. The ratio of benefits to cost is positive though somewhat lower than the other solutions reviewed here.

The solutions vary widely in the number of persons they can be expected to affect. The cash transfer for testing and counselling might reach all adults, about 400 million persons. Treatment for those at risk of cryptococcal meningitis would lead to testing for about 30 million persons and an actual intervention for fewer than one million but could extend lives that would otherwise be lost for a decade. Specialized testing for CM might affect fewer at-risk persons than other solutions but it could be consistent with the cash transfers recommended in exchange for widespread counselling and testing.

Cash on delivery for Abuja Goal progress might be easiest to negotiate with governments that would welcome a cash incentive in exchange for upgrading public health provision in line with commitments already made. An upgrade of public health spending by fifty percent, that is from just

ten percent of total government spending where it lies on average now, to fifteen percent of total government spending, could have a very wide impact.

Appendix

Appendix Table 1

Value of lives saved in infancy (where each year of an infant's life = 0.5 of an adult life-year), at age 22, and age 50, when value of current disability-adjusted life-year is US$1,000 and US$5,000, and discounted to present value at 3%, 5%, and 10%, US$000.

Value, lives saved, by age of person saved	VSL=$1, undiscounted	VSL=$5, undiscounted	VSL=$1, disc @3%	VSL=$5, disc @3%	VSL=$1, disc @5%	VSL=$5, disc @5%	VSL=$1, disc @10%	VSL=$5, disc @10%
Life saved as an infant*	65	325	29	144	19	96	10	50
Life-year of infant = 0.5 adult life-year	33	163	15	72	10	48	5	25
Life saved at age 22	43	215	25	123	18	90	10	50
Life saved at age 50	15	75	13	64	11	56	8	41

Source: based on a table in Excel workbook, "CCC VSL Disc.xls".

Appendix Table 2.

Incremental b/c ratio ranging from 2 to 15, cost per DALY ranging from US$320 to US$444 for spending US$2 billion to test, inform, and counsel all SSA adults on their HIV status, cutting expected new infections by a 0.25 million annually to yield benefits of US$6.25 billion (low) or US$32 billion (high).

	Benefits US$ b		Costs US$ b	B/C ratios		C/DALY US$		Cost/death averted
Value Life-yr	3% disc.	5% disc.		3% disc	5% disc.	3% disc	5% disc.	
$1,000	6	5	2	3.2	2.5	320	444	$8,000
$5,000	31	23	2	15	11	320	444	

Source: Authors' estimates allocating a share of all infections averted to the proposed cash transfer. See Appendix Table 1 for the US$25,000 and US$123,000 estimated value of life of a young adult discounted at 3 percent per annum.

Appendix Table 3.

Benefits and costs to expand community health workers, US$billions, cost/DALY, US$).

Value Life-yr	Benefits US$ b		Costs	B/C ratios		C/DALY US$		Cost/death averted
	3% disc.	5% disc.		3% disc	5% disc.	3% disc	5% disc.	
$1,000	5	3	2.64	1.9	1.1	587	825	$15,857
$5,000	25	15	2.64	9.5	5.7	587	825	

Source: Authors' estimates based on data in HLT Taskforce 1 report (Mills 2009). Only benefits from averting deaths included, using the average of WHO and World Bank MBB estimates of deaths averted with adjusted value of child deaths.

Appendix Table 4.

B/C ratio ranging from 4 to 25 for CRAG testing and treatment among 0.72 million in SSA, extending lives by 9 years at cost/DALY beyond age 22, b, c values in $billions, C/DALY US$).

Value Life-yr	Benefits US$ b		Costs	B/C ratios		C/DALY US$		Cost/death averted
	3% disc.	5% disc.		3% disc	5% disc.	3% disc	5% disc.	
$1,000	6	4	1.5	4.0	2.7	260	347	2083
$5,000	30	20	1.5	20.0	13.3	260	347	

Source: Punchak 2011, Table 5; calculated from Meya (2010), Excellent (2010). Future years discounted at 3 percent for value of life-year $1,000 and 5 percent for value of life-year $5,000.

Appendix Table 5.

Incremental B/C ratios for spending an additional US$29 billion on basic health system strengthening in 2015.

Value Life-yr	Benefits US$ b		Costs	B/C ratios		Cost/DALY		Cost/death averted
	3% disc.	5% disc.		3% disc	5% disc.	3% disc	5% disc.	
$1,000	46	31	29	1.6	1.1	627	915	10943

$5,000	223	155	29	7.7	5.3	627	915	

Source: Authors' estimates based on data in Task Force 1 of HLT group. Only benefits from averting deaths included, using the average of WHO and World Bank MBB estimates of the value deaths averted adjusted downward for under-five deaths as in Box Table 1A.

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