Introduction

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There has been commendable progress in the fight against HIV/AIDS, but the time for a declaration of victory has not yet arrived. Humanity has struggled to eliminate diseases even when they are totally curable and preventable. AIDS – a disease which we do not yet know how to cure, and which we struggle to comprehensively prevent – has proven an immensely difficult adversary. It is still the biggest killer of women of reproductive age worldwide, and of men under the age of 40 in sub-Saharan Africa, where the pandemic is also responsible for 14 million orphans.

Sub-Saharan Africa continues to bear a disproportionate share of the HIV burden. With just 12 percent of the global population, the region accounted for a staggering 68 percent of all people living with HIV in mid-2010 (World Health Organization, UNAIDS, UNICEF 2011). While the number of new infections is decreasing, the 1.9 million people who became infected in 2010 represented 70 percent of all new cases globally (World Health Organization, UNAIDS, UNICEF 2011). For every person receiving anti-retroviral treatment, two others get infected, so HIV continues to exact an enormous socio-economic toll on a continent whose time is ripe for growth.

Today, the response to the epidemic is at a critical juncture. Following a decade of unprecedented increases in donor funding and a corresponding 17 percent decline worldwide in the number of new infections (UNAIDS and World Health Organization 2009), the fight against HIV is losing momentum.

An alarming 10 percent drop in funding was reported from 2009–10 (UNAIDS and Kaiser Family Foundation 2011). Meanwhile, US foreign aid outside the war zones of Iraq and Afghanistan has been cut by Congress (Cornwell 2011). There is a trend of reducing funding from European governments, owing both to financial crises and currency fluctuations (UNAIDS and Kaiser Family Foundation 2011). And in sub-Saharan Africa, few governments have made good their commitment a decade ago in the Abuja Declaration to increase health spending to 15 percent of GDP (World Health Organization 2011).

The considerable progress in recent years – including the 22-fold increase in the number of people receiving anti-retroviral drugs between 2001 and 2010 (UNAIDS 2011) – was due to scientific breakthroughs and to civil society's efforts to keep AIDS on the political agenda. But it is sobering to note that in sub-Saharan Africa and across all low- and middle-income countries globally, more than half of the people requiring treatment are not receiving anti-retroviral drugs. In western and central Africa, anti-retroviral therapy coverage is only 30 percent (World Health Organization, UNAIDS, UNICEF 2011).

Increasing treatment coverage is an imperative, not least because of its promise in preventing the spread of HIV. A breakthrough study in 2011 (Cohen *et al*. 2011) showed that when HIV-infected heterosexual individuals began taking anti-retroviral medicines while their immune systems were relatively healthy, they were 96 percent less likely to transmit the virus to uninfected heterosexual partners.

However, treatment remains expensive, and can be arduous for the individual. Stigma reduces the willingness of many to be tested in the first place. Such issues point to serious challenges to the sustainability of recent coverage increases. While we may hope for the situation to change, the truth is that right now we cannot simply treat our way out of the epidemic in Africa.

There remains an alarming lack of high-quality data evaluating responses to the HIV epidemic. As a result, we still know too little about what works, and how to replicate our successes elsewhere.

In a broad review of existing prevention interventions published in *Lancet* in 2011, Padian *et al*. noted that "until recently, HIV prevention lacked credibility with data from prevention trials showing little or no decrease in incident HIV. Furthermore, when successes were made public, explanations were often conflicting and lessons for application to other settings unclear" (Padian *et al.* 2011: 269).

We know that billions of dollars have been spent on abstinence campaigns without any reliable measure of the benefits they achieved. But this is not a unique problem. Even for mainstays of the response to HIV, like condom distribution and prevention information campaigns, there has been too little high-quality analysis of what benefits ha ve been achieved at what cost.

As the aids2031 Consortium found in the book, *AIDS: Taking a Long-term View* (The aids2031 Consortium 2010: 64), "evidence on whether prevention programs are having any impact is typically lacking, and monitoring efforts generally focus more on counting the number of people who receive services than on measuring actual outcomes."

There are suggestions that this could be starting to improve. Padian *et al*. (2011: 269) argued that 2011 had marked "the end of this steady stream of disappointing results, and a concomitant change [that] is evident in public perception and the opinions of policy-makers."

Fiscal constraints today make it especially important for HIV prevention and treatment programs to be accountable. In making the case for funding to continue or increase, campaigners and donors need to be able to access and highlight clear evidence of the value that is delivered.

To add to the body of evidence is the overarching goal of this book. There is a strong moral case for providing better knowledge about the costs and benefits of competing ways to respond to HIV in the worst-affected region, sub-Saharan Africa.

The research project that led to *RethinkHIV* was proposed by the Rush Foundation in 2010 against the backdrop of the global financial crisis and amid growing fears about the sustainability of the fight against HIV in Africa.

The Rush Foundation is dedicated to providing effective funding for disruptive, innovative ideas in the fight against HIV in Africa. It complements its work on the ground by stimulating policy discussion and challenging thought leaders to work outside the existing frameworks of debate.[1]

The Rush Foundation approached the Copenhagen Consensus Center, which I am the director of, and proposed a major, year-long project utilizing teams of HIV specialist economists to create the first comprehensive cost-benefit analysis of HIV prevention and treatment interventions.

The Copenhagen Consensus Center is a think-tank based in Denmark that applies economic principles to analyze and prioritize opportunities to respond to global challenges. The Copenhagen Consensus Center's unique economic analysis framework has been used successfully to provide a comprehensive evaluation of the costs and benefits of climate change policy choices,[2] of Latin American development priorities,[3] and of ways to respond to ten global development problems.[4]

The Copenhagen Consensus Center's approach is founded on the belief that basic principles of economics can be used to improve the ability of any nation or organization to spend its money to achieve the most "good" possible.

Its past projects have been used by policymakers and major philanthropic organizations, and have attracted attention from all around the world. The first-ever Copenhagen Consensus project in 2004 prompted the Danish government to increase HIV/AIDS spending to 500 million Danish kroner (Fogh Rasmussen 2008).

At the launch of the Copenhagen Consensus Center's flagship global development project in 2008,

[1] See: www.rushfoundation.org.
[2] The research is available in *Smart Solutions to Climate Change: Comparing Costs and Benefits* (Cambridge University Press, 2011).
[3] The research is available in *Latin American Development Priorities: Costs and Benefits* (Cambridge University Press, 2009).
[4] The research is available in *Global Crises, Global Solutions* (Cambridge University Press, 1st edn., 2005; 2nd edn., 2009).

Prime Minister Anders Fogh Rasmussen declared that, "because the results of Copenhagen Consensus are so concrete, and because they are based on solid knowledge, the results provide a valuable insight for politicians." In all, the Copenhagen Consensus Center has commissioned and published more than 100 research papers, which have been utilized by donors and international organizations.

This project set out to apply the Copenhagen Consensus methodology to responses to the challenges presented by HIV epidemics across sub-Saharan Africa, in a way that would provide academics, campaigners, politicians, and donors with fresh, robust analysis.

Part I of *RethinkHIV* presents the eighteen final research papers.

These chapters have been written by world-leading health economists, epidemiologists, and demographers examining responses to HIV/AIDS in sub-Saharan Africa under the following topics:

- prevention of sexual transmission
- prevention of non-sexual transmission
- treatment
- strengthening health systems
- social policy
- vaccine research and development efforts.

RethinkHIV marks the first time that cost-benefit analysis has been used systematically and comprehensively by teams of authors to analyze different possible responses to HIV/AIDS in Africa. The use of cost-benefit analysis allows us to establish – and compare – the overall benefits and costs to society of different responses to HIV.

As much as possible – and acknowledging the challenges posed by this being the first-ever effort – authors used the same set of broad assumptions and analytical tools to examine different interventions. This was designed to ensure the comparability of options. Also, authors were encouraged to identify and discuss potential synergies between different interventions, wherever possible.

Furthermore, authors identified where specific implementation issues exist for different interventions. Three research papers were commissioned for each topic in order to ensure a range of expert perspectives on what works, where, and why; and to identify and highlight specific implementation issues.

Of course, this approach primarily leads to a broad-brush analysis. A natural next step is to focus more specifically on national and cultural-specific issues that modify the general findings of research papers.

The process of selecting the interventions for study involved a broad range of different inputs. First, input was gained from leaders in the fields of HIV medicine and economics on the project framework and on the options that should be examined. As many options as possible were added to a long list, and input was sought on how the overall subject should be divided into manageable topics.

The project's academic framework saw researchers asked to explore ways to allocate the same marginal amount of money, instead of reallocating the entire existing funding, which would be unrealistic and a less constructive input for donors and policy-makers.

To focus the researchers, they were asked to establish within one topic how an *additional* sum of $2 billion yearly could best be spent over the next five years. This hypothetical figure was selected after input from HIV experts and economists, because it is deemed enough to create meaningful effects, but is a limited and realistic sum, meaning that marginal analysis remains relevant.

Some readers may worry that evaluating ways to make spending smarter could be a proxy for an argument to reduce HIV funding. This could not be further from the truth. By making a compelling case for the effectiveness of one investment over another, we can make the argument for greater funding to go to the initiatives that need to be scaled-up and made sustainable.

At a time of funding constraints, this project's research could be a valuable source of intellectual material bolstering the case for increased funding.

Specialist HIV economist authors were approached for each topic and asked to use their expertise to identify quantifiable costs and benefits that would provide a meaningful input for policy-makers, even where data were scarce. In every case, it was left to the experts – the HIV authors – to draw the line as to how far the data could take us.

It is a striking feature of HIV intervention analysis that in some cases – even for mainstays of the HIV response – *RethinkHIV* authors concluded that there is simply too little reliable existing research to provide reliable numbers.

Therefore, one of the first-level, key conclusions that must be drawn from this pioneering project is the underscoring of a need for further analyses of intervention effectiveness, costs, and benefits, that are performed in specific settings and more broadly across regions.

This point is perhaps most obvious in the topic of prevention of sexual transmission (Chapter 1), where Jere Behrman and Hans-Peter Kohler highlight a startling absence of solid empirical evidence about the effectiveness, costs, and benefits of interventions and programs. They find sufficient data exists to compare just three approaches, pointing to a need for considerable empirical research into sexual prevention approaches.

Behrman and Kohler find strong empirical evidence of effectiveness from investment in male circumcision. While benefit-cost calculations are more speculative for HIV testing and counseling, they conclude that relatively comprehensive, repeated, home-based treatment and counseling is a realistic option in sub-Saharan Africa. And they point to studies showing that the efficacy of information campaigns can rise when more innovative program designs are used.

Two authors offer alternative perspectives on this topic. Damien de Walque (Alternative Perspective 1.1) supports Behrman and Kohler's selection of three interventions for analysis, and stresses the need for more and better impact evaluations of HIV/AIDS prevention interventions. De Walque argues that cost-effectiveness calculations should better integrate potential behavioral responses to prevention interventions, and discusses implications for cost-effectiveness of scaling-up interventions, especially male circumcision. He also reviews three additional solutions mentioned but not thoroughly analyzed in the previous chapter because they have been proposed and tested only recently and the evidence about their efficacy and effectiveness remains very limited: treatment as prevention, pre-exposure chemoprophylaxis for HIV prevention, and conditional cash transfers.

Alan Whiteside (Alternative Perspective 1.2) agrees that male circumcision is a good option, but notes that the analysis by Behrman and Kohler ignores the issue of men who have sex with men (MSM). No completed randomized controlled trial (RCT) has assessed whether circumcision could reduce transmission within this group.

Whiteside finds the cost-benefit evidence weakest for information campaigns, noting that there are numerous such programs but trying to evaluate them is extremely difficult and there are no RCTs or robust cost analyses. He proposes the novel idea of exploring the concept of a "sexual abstinence month" to reduce HIV incidence, a behavioral intervention where a population-wide "safe sex/no sex" effort for a set period of time could make a significant contribution to global prevention efforts. This is based on the idea that people have higher viral loads immediately after they are infected, and if they could avoid infecting others then the population viral load and infectivity would be reduced.

In Chapter 2, Lori Bollinger explores the topic of prevention of non-sexual transmission. She finds that there are cheap and effective ways to reduce or eliminate virtually every form of non-sexual transmission of HIV.

Bollinger finds that programs that prevent mother-to-child transmission are among the most cost-effective interventions available in the HIV/AIDS arsenal. But she finds that uptake of these programs is limited by low antenatal clinic attendance and hospital deliveries, and high levels of stigma associated with an HIV-positive diagnosis. She finds making blood transfusions safer the most attractive investment, with extremely high pay-offs for each dollar spent.

Bollinger also examines ways to make medical injections safer by ensuring an adequate supply of auto-disposable syringes, improving training for hospital staff, safe disposal of medical waste, and providing more information for the public. And she looks at ways to reduce risky injecting drug user behavior, but notes the difficulty of achieving a high level of coverage with programs targeting socially marginalized groups.

Baltussen and Hontelez (Alternative Perspective 2.1) draw attention to the issues associated with using a continent-wide analysis. While they are skeptical about the validity of some of Bollinger's estimates at an individual country-level, they agree that overall interventions to prevent non-sexual transmission are economically attractive, mainly due to their low cost and potential to prevent a large number of new infections.

Mira Johri (Alternative Perspective 2.2) focuses on mother-to-child transmission of HIV. She concludes that an analysis of a more comprehensive range of mother-to-child intervention options is required, including family planning, reproductive counseling, cotrimoxazole prophylaxis, early infant diagnosis, maternal ART for women requiring therapy for their own health, and other WHO Options (the guidelines of drug treatment provided by the World Health Organization) than "Option A," which Bollinger mainly looks at.

Johri examines four additional intervention strategies that she finds are likely to offer good value for money in some contexts and that have received less attention to date: interventions to improve health system performance, HIV screening in the labor ward, interventions to interrupt MTCT for HIV-positive women not delivering in a health facility, and the potential of an emerging "leapfrog" technology, multiplex point-of-care diagnostics.

In their examination of treatment (Chapter 3), Mead Over and Geoffrey Garnett find that an extra $10 billion over five years and proportionally sustained thereafter would have a dramatic impact on treatment coverage. They even look at the scale and resources needed to reach the Universal Coverage promised by world leaders.

Over and Garnett investigate a number of important trade-offs for discussion: should we invest in early or late treatment, first- or second-line drugs, cheaper or better quality drugs? Their findings suggest that the highest pay-offs can be obtained by treating people with the weakest immune system first with cheaper, first-line drugs.

Robert Brent (Alternative Perspective 3.1) sets forward an alternative analysis of costs and benefits of treatment scale-up, and suggests that Over and Garnett underestimated the benefits of treatment, for example by not allowing for the fertility effects of treatment. Brent also points to doubts regarding Over and Garnett's assumption of falling average costs with treatment scale-up.

Brent explores the sensitivity of cost benefit ratios in the presence of a budget constraint. He recommends that the first $2 billion of the hypothetical additional funding of $10 billion should be devoted to the prevention of MTCT as this treatment intervention is likely to have the highest benefit to cost ratio of any treatment intervention.

In his analysis (Alternative Perspective 3.2), John Stover finds benefit to cost ratios to be higher than Over and Garnett. The difference is mainly due to different assumptions about the future costs of treatment per patient. Stover uses the assumptions of the Treatment 2.0 initiative (UNAIDS 2009) to project that improvements in drugs and service delivery will result in a 75 percent decrease in per patient costs. Stover also explores whether Over and Garnett's approach to simulating national epidemics is the best way to determine the impact of an additional $10 billion over five years.

William McGreevey *et al*. (Chapter 4) examine policy actions, interventions, and solutions that bridge the objective of strengthening health systems with that of continuing the fight against HIV/AIDS in sub-Saharan Africa.

McGreevey *et al*. evaluate four specific interventions, among them conditional cash transfers for HIV testing, and strengthening the community health worker base. They find that these interventions repay costs with substantial benefits in terms of better overall health indicators and reduction of HIV.

McGreevey *et al*. argue that HIV/AIDS spending already contributes to health system strengthening, but identifies two, key challenges. The first of these is that donors and African governments need to continue to raise their commitment to financing health care and strengthening the systems as a whole. The second is that greater efficiencies need to be developed, particularly in the effective extension of basic services to rural areas.

Among the options that McGreevey *et al*. explore in their chapter is the suggestion of using financial

incentives to encourage sub-Saharan African governments to meet the target agreed in Abuja in 2001 to allocate 15 percent of their national budgets to the improvement of the health sector, with an adequate portion used for the fight against HIV/AIDS, tuberculosis (TB), and other related infectious diseases.

In an alternative take on this topic, Till Bärnighausen, David Bloom, and Salal Humair (Alternative Perspective 4.1) agree that the shift toward health system strengthening interventions has the potential to increase the effectiveness, efficiency, and sustainability of HIV programs. However, they question the static analyses utilized by McGreevey *et al*., arguing that dynamic models incorporating unintended consequences and feedback are essential for a proper cost-benefit accounting of interventions.

Nicoli Nattrass (Alternative Perspective 4.2) raises two methodological concerns with the analysis by McGreevey *et al*.: their monetization of a human life year; and the way they extrapolate costs and benefits to the entire African continent without taking into account regional differences. Nattrass criticizes the way that incentives are designed by McGreevey *et al*., arguing that this is based on conjecture, impossible to implement, and risks undermining other efforts to ensure people learn their HIV status.

Nattrass is also critical of McGreevey *et al*.'s proposal of an "Abuja Goals Fund." She argues that the *RethinkHIV* hypothetical budget would be best utilized if given to the international global infrastructure of the Global Fund to Fight AIDS, Tuberculosis and Malaria to carry on its current work, and specifically to help it build better health systems on the back of the AIDS response and to ensure that funding for patient advocate groups continues.

In their analysis of social policy levers (Chapter 5), Vassall, Remme, and Watts focus on interventions that seek to address key social drivers of HIV/AIDS vulnerability, and the social barriers to achieving a high coverage to proven HIV interventions. Economic and social factors continue to fuel HIV risk behaviors and undermine proven HIV interventions.

Vassall, Remme, and Watts propose using conditional cash transfers to keep girls in schooling longer as one response to the problem of transactional sex between young girls and older men, one of the main bridges of HIV infection from older sexually active men to uninfected, newly sexually active adolescent girls.

Widespread problematic alcohol use helps fuel engagement in risky sexual behaviors, and undermines core HIV prevention messaging. The authors cite research showing that pricing and tax policies can have a significant impact on problematic alcohol use.

They advocate "piggy-backing" training focusing on HIV and gender relationships onto livelihood interventions that have an income effect, in order to reduce gender inequalities and intimate partner violence which are both associated with an increased risk of HIV.

Finally, Vassall, Remme, and Watts look at programs to mobilize communities and reduce stigma which they argue is an important way to enable other core HIV prevention interventions.

Tony Barnett (Alternative Perspective 5.1) argues that the development of social policy interventions in response to the HIV/AIDS epidemic has been framed in the language of metaphors. He argues that three critical metaphors have been unexamined – the metaphor of "going upstream," the metaphor of a body undergoing treatment, and the idea of "drivers." These three metaphors have been important in framing the questions to be addressed by cost-benefit and cost-effectiveness analysis but their use obscures important problems which require working through before policy formulation. Barnett examines the flaws with using each metaphor and goes on to suggest a possible diagnostic tool which does away with the need for these metaphors: hope.

Harounan Kazianga (Alternative Perspective 5.2) offers insight into the potential challenges that policy-makers are likely to be confronted with when they wish to scale-up promising pilot studies in the field of social policy levers. Kazianga stresses the need for providing policy-makers with the tools and the information to move from promising pilot studies to full-scale projects. He also argues

that cost-benefit calculations should better integrate changes in average costs that are likely to occur when going from a pilot study to full-scale project.

Finally, he proposes the tool of offering life insurance to adult individuals to stay HIV-free as a means for reducing risky sexual behavior and hence HIV transmission. Calibration exercises have suggested promising results, but randomized control trials would provide more credible evidence on the effectiveness of this policy.

In their examination of vaccine research and development (Chapter 6), Dean Jamison and Robert Hecht focus on vaccine research, but canvas the state of research into other options.

Based on interviews, they find a low probability of developing a drug to clear the body of HIV in the next twenty-five years. That said, they argue that research should continue. Other research efforts include those to create less expensive, more effective, and safer ARVs; better therapies for treating or preventing opportunistic infections; better diagnostics; and better barrier devices for transmission interruption. The interviews give good reason to believe that an effective vaccine will be possible within the next twenty years.

Jamison and Hecht find there to be a strong case, based on benefit-cost analysis, for increasing existing funding into vaccine research and development. Whether the vaccine is introduced in 2030 or in 2040, the investment appears to be compelling.

They explore the benefit associated with an increase of $100 million per year in research and development expenditure, spent outside existing institutional funding channels to increase the likelihood of an earlier discovery. This will likely shorten the time taken to achieve vaccine availability by half to one year, and would provide high potential benefits relative to costs.

Steven Forsythe (Alternative Perspective 6.1) notes that the decision to produce and manufacture an AIDS vaccine will not be made purely based on benefit to cost ratios, and there are many qualitative and non-economic issues which will need to be addressed by national and international policymakers.

Forsythe points out the tremendous uncertainty about the characteristics of an AIDS vaccine: economists don't know what an AIDS vaccine will cost, either for research and development or for manufacture; its effectiveness is unknown, along with its year of readiness; effects on disinhibition behaviors are not understood; the shape of the HIV epidemic in 2030 or 2040 is unclear.

He finds that there appears to be a strong case for developing an AIDS vaccine, but argues that it is important to recognize that resources are limited and therefore funds allocated to an AIDS vaccine will not be available for other interventions, such as the scale-up of male circumcision, an expanded distribution of condoms, or increased treatment.

Joshua Salomon (Alternative Perspective 6.2) notes that the analysis misses an exploration of the financial (as opposed to economic) implications of vaccination. A consideration only of the total cost misses the important lag between expenditures on vaccination and subsequent recovery of these costs through averted treatment, which means that even if a vaccine appears cost-saving based on the present value of expenditures in all years, that does not necessarily mean that it will be cost-saving in terms of the financial resources required in all specific budget periods. Rather, the largest component of the benefits provided is the social value of healthy life years gained and deaths averted.

Each of the eighteen research papers in Part I lays out a thoughtful evaluation of different ways to respond to HIV across Africa, with pioneering cost-benefit analysis for researchers, donors, and activists to grapple with.

Part II of this volume contains informed perspectives on the research. It is easy to say that we should do everything we can against the epidemic, all at once. That would be impossible even in the most optimistic funding scenario, let alone in a world of cutbacks. We lack the resources to scale up every intervention at once. It is much more difficult – but much more relevant – to ask: if we have limited resources, where should we first devote any additional funding?

That is the challenging question that the Rush Foundation and the Copenhagen Consensus Center posed to members of civil society, Nobel Laureate economists, senior representatives from HIV-focused international organizations, and other

groups, in order to bridge the gap from this new research to debate and discussion that could inform policy decisions. Grappling with priorities forces us to consider more deeply the economic arguments put forward in each research paper.

Over the course of 2011, a panel of five expert economists, including three recipients of the Nobel Memorial Prize in Economic Sciences, read the *RethinkHIV* outlines and draft research papers, and conveyed feedback via the Copenhagen Consensus Center to authors. This group met at Georgetown University in September 2011 to interact with the researchers and to form their own prioritized list in answer to the question: where should additional funding be devoted first?

Their findings are presented here, along with the conclusions of a panel of African civil society members that gathered in Addis Ababa, Ethiopia, in December 2011. Members of the civil society panel attended the Georgetown University deliberations, and engaged with researchers there. In addition, the Copenhagen Consensus Center and the Rush Foundation conducted similar prioritizations with international institutional donors, students at Georgetown University, and students at the University of Addis Ababa School of Public Health. In the Conclusion, I will examine the similarities and differences between these groups' outcomes and other prioritization exercises completed for *RethinkHIV*, and explore potential next steps for this project.

I invite you to read the research and the viewpoints on priorities, and to form your own perspective on the best ways to continue to fight against this disease. This book clearly demonstrates that there are many investments that will do much more good than they cost. In a resource-constrained world, this is an important message. Moreover, it is my hope that this book will be used as powerful intellectual ammunition to make the case for ever-more effective action against HIV/AIDS in Africa.

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