Draft Working Paper

Estimating Long-Term Global Resource Needs for AIDS through 2031

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Introduction and Summary

While much progress has been made in the HIV/AIDS pandemic over the last 25 years, significant challenges remain. There are still 33 million people living with HIV in the world, with 2.7 new adult HIV infections occurring in 2007[1]. The aids2031 project was established to ask what might be done differently today to affect the HIV/AIDS pandemic significantly by 2031, fifty years after HIV/AIDS was first identified. To achieve this goal, a number of working groups were formed to identify potential game-changing issues in several areas: Modelling, Social Drivers, Programmatic Response, Leadership, Financing, Science and Technology, Communication, Hyper-Endemic Areas, and Countries in Rapid Economic Transition[2]. This paper presents results from the Resource Needs work of the Costs and Financing Working Group (CFWG).

Working collaboratively with several of the other working groups, the CFWG has incorporated key recommendations and results from these groups to perform analyses in order to answer questions such as:

- What are the long-term global resource needs for HIV/AIDS through 2031?
- What factors are critical in driving costs either up or down?
- Are there ways to improve allocative and technical efficiency in order to achieve more impact or reduce expenditures to produce the same set of AIDS services?
- Are there "game-changers" that could dramatically affect the price tag for fighting HIV/AIDS?
- How can countries and donors be persuaded to adopt new strategies?
- What are the potential financing sources for the resources required to fight HIV/AIDS?
- What mix of sources and channels of funding would be most equitable, efficient and sustainable?

This paper will address the first four questions; other parts of the CFWG project will address the final three questions.

Answers to Key Questions

- Future resource requirements vary between US$19 billion and US$35 billion annually by 2031
- Key drivers are the cost of ARVs for treatment, and appropriate allocation between interventions for prevention
- The Hard Choices for Prevention scenario illustrates that significant savings are possible with appropriate re-allocation, while achieving nearly the same prevention impact
- The only true "game-changers" are new technology innovations such as treatment leading to a cure or an AIDS vaccine

The primary question to be answered is what are the resources required for HIV/AIDS programs in low- and middle-income countries through 2031. This information can illustrate how policy decisions taken in the next few years (e.g., to greatly improve prevention and thus lower long-run treatment expenditures) or other important breakthroughs (e.g., introduction and widespread use of a vaccine or microbicide) might dramatically affect the financial resources required to fight AIDS over the next 22 years. The estimates presented here build upon the methods used for the UNAIDS Global Resource Needs Estimates (GRNE), which include resources required for 19 prevention

[1] UNAIDS, 2008 Report on the global AIDS epidemic. Available at: http://www.unaids.org/en/KnowledgeCentre/HIVData/GlobalReport/2008/2008_Global_report.asp
[2] See http://www.aids2031.org/working-groups for a complete description of each working group.

interventions, 7 care and treatment interventions, OVC support, and 15 program support functions for the period 2007-2015[3]. The resources required for each of the prevention, care and treatment, and OVC support interventions are determined by multiplying the population in need of the service by the coverage (the percentage of the population in need actually receiving the service) and multiplying this result by the unit cost. The number of people in need of each service is determined from epidemiological and demographic projections. Unit costs are based on current country-specific costs with possible changes as programs expand to reflect economies of scale. For coverage, information is available for most countries on the current coverage of key services, while future coverage targets vary by scenario. Projections of future resource needs were prepared using four scenarios in order to explore the sensitivity of the results to future conditions. Those scenarios are: Current Trends (continuation of current rates of program scale-up), Rapid Scale-Up (significant increases in funding allow for more rapid scale-up to achieve universal access to all interventions by 2015), Hard Choices for Prevention (limited future funding allows scale-up of only the most cost-effective prevention interventions), and Structural Change (a long-term focus on changing societal factors that affect vulnerability).

Results show that future resource requirements scale-up rapidly in the near term, and then increase more gradually over the remainder of the time horizon, reaching between US$19 billion and US$35 billion annually by 2031, depending on the scenario under review. Improved allocation of resources to the "Hard Choices in Prevention" scenario results in nearly the same number of infections being averted as in other scenarios but with substantial cost savings. On the treatment side, the key driver of the resources required is the cost of ARVs; sensitivity analysis shows that varying the price of both first- and second-line drug prices for both low- and middle-income countries by 25 percent results in a variation in the final resources required of three percent. Finally, even under the Rapid Scale-up scenario, which achieves the maximum impact possible on the epidemic due to high coverage levels for both prevention and treatment interventions, the number of new HIV infections is only reduced by half; in order for the epidemic to be stopped, true scientific "game-changers" need to become available, such as an effective AIDS vaccine or treatment leading to an actual cure.

Methodology

The methodology for estimating the global resources required through 2031 follows the basic framework used in estimating the UNAIDS Global Resource Needs Estimates (GRNE), although there are some modifications. The initial GRNE were calculated in 2001 to support the first UN General Assembly Special Session (UNGASS) on HIV/AIDS[4]. Over time, the GRNE have evolved to include more interventions, such as post-exposure prophylaxis (PEP) kits and interventions to prevent violence against women (VAW). In general, however, the basic components of a comprehensive package to address the HIV/AIDS epidemic remain the same: prevention, care and treatment, support for orphans and vulnerable children, national program costs, and international support costs. The aids2031 projections consider target population sizes, unit costs and coverage through 2031 for the same interventions used in the GRNE and considers new interventions (technologies) that may become available in this time frame, such as pre-exposure prophylaxis (PrEP), microbicides, vaccines or cures. The interventions included in each of these components are listed in Table 1 below, and are described thoroughly in Annex A (Annex D for Care and Treatment Programs):

[3] Financial Resources Required to Achieve Universal Access to HIV Prevention, Treatment, Care and Support. 26 September 2007, UNAIDS.

[4] Schwartländer B, Stover J, Walker N, Bollinger L, Gutierrez JP, McGreevey W, Opuni M, Forsythe S, Kumaranayake L, Watts C, Bertozzi S. Resource Needs for HIV. *Science* 2001 Jun 29;292(5526):2434-6.

Table 1: List of interventions by component

Prevention Programs	PMTCT	**National Program Costs***
Vulnerable populations	Safe medical injections	Health facilities
Sex workers	Post-exposure prophylaxis	Program management
MSM	Universal precautions	IEC & advocacy
IDU	*New technologies (included selectively)*	M&E including OR
Prisoners	Pre-exposure prophylaxis	Training
Other special populations	Microbicides	Logistics and supply
Youth: In-School	Vaccines	Lab upgrading
Youth: Out-of-school	Cures	Supervision and patient tracking
Formal sector employees		Drug resistance surveillance
Behavior change	**Care and Treatment Programs**	Human resources
Community mobilization	*ART*	**International Support Costs***
Mass media	Drug costs (FL, SL, Pediatric)	Civil society strengthening
Social marketing	Laboratory costs	Technical assistance
VCT	Service delivery	Global advocacy and coordination
Condoms	*Non-ART*	Policy, human rights, stigma
Medical services	Opportunistic infections treatment	**Support for OVC***
Blood safety	Provider-initiated counseling/testing	Education
STI treatment		Health care support
Male circumcision		Family/home support
		Community support
		Organization costs
*Interpolated directly from the UNAIDS Global Resource Needs Estimates		

The basic estimation methodology has also remained the same: first, the target population in need of a particular intervention is identified. Second, the number of people actually served by the intervention is calculated by multiplying the identified target population by a target coverage rate. Finally, the number of people served is multiplied by the appropriate unit cost to calculate the resources required:

Population in need * Coverage * Unit Cost = Resources Required

The data sources and general description of each part of this equation are described in turn below.

Population in need

Data sources for population in need vary by intervention; a detailed list of the data sources used by intervention can be seen in Annex B. Briefly, for prevention programs the basic demographic estimates and projections are from the UN Population Division 2006 World Population Prospects. These estimates are supplemented by national estimates for special population groups; when national-level estimates for special population groups are not available, regional averages are used. Socio-economic variables are derived from the World Development Indicators data base, while data regarding the need for medical services are supplied by the World Health Organization.

The number of people needing care and treatment was estimated in collaboration with the Modelling Working Group. Because of the long-term nature of the projections, prevention efforts

in earlier years will have an impact on the number of new HIV infections, and thus the number of people needing treatment, in later years. After extensive consultation, the Modelling Group decided to estimate the impact of the different scenarios on new HIV infections using the *Goals* model[5]. This model estimates the effects of prevention interventions on behavior change and then simulates the effects of behavior change on the number of new infections. The *Goals* model has been used in numerous national and global applications. It links coverage of prevention and care and treatment interventions to behavior change and reduction in infectiousness. The impact of exposure to prevention interventions on behavior change is estimated on the basis of an impact matrix that summarizes all of the impact studies of good quality that have been conducted in the developing world. This matrix describes how coverage of various prevention activities (such as VCT, school-based programs and community mobilization) affects four key behaviors: condom use, number of partners, age at first sex and needle-sharing behavior. In addition, increasing ART coverage reduces the infectiousness of people living with HIV. (The infectiousness of a person taking ART is assumed to be 1/8 that of a symptomatic individual not on ART and ½ that of an asymptomatic individual.[6]). The impact of PMTCT programs in reducing the number of new child HIV infections is also included. An HIV transmission model with five risk groups (high, medium, low, MSM, IDU) calculates how changes in behavior reduce the number of new HIV infections and thus the need for ART.

The Modeling Group applied the *Goals* model to the top 20 countries in terms of new infections along with two more countries for geographic representation (Brazil and Mexico). Together, these 22 countries account for over 85 percent of all new infections that are occurring in low- and middle-income countries. The group applied different target coverage rates for each scenario (described below), and calculated for each scenario the number of new HIV infections and the number of people needing ART, along with adult HIV prevalence rates and the number of AIDS deaths. These results were then scaled-up by the CFWG to the regional and global levels by calculating the proportion in 2007 of new infections and deaths associated with the 22 countries, and applying the inverse of that proportion to future years to scale-up the statistics to calculate totals for 139 developing countries.

The Modelling Group also used the *Goals* model to estimate the impact of both pre-exposure prophylaxis (PrEP) and microbicides on the number of new infections and AIDS deaths through 2031. The incremental impacts of these new technologies were estimated as further additions to the Rapid Scale-up scenario (see below for scenario description).

Unit costs

The data for unit costs are derived from a variety of sources. For prevention interventions, most unit costs are based on data from published sources and then applied to all countries with appropriate adjustments for purchasing power parity between countries. Regional averages of the unit costs are displayed in Annex C. A special analysis of the relationship between unit costs and scale is used to project changing unit costs over time for six prevention interventions: PMTCT, counselling and testing, STI treatment, and outreach programs for sex workers, MSM

[5] Stover J, Bertozzi S, Gutierrez JP, Walker N, Stanecki K *et al.* The Global Impact of Scaling-Up HIV/AIDS Prevention Programs in Low- and Middle-Income Countries. *Science* 10 March 2006; Vol 311.no.5766, pp. 1474-1476; Bollinger L, Cooper-Arnold KA, Stover J. Where are the Gaps? The Effects of HIV-prevention Interventions on Behavioral Change in Developing Countries *Studies in Family Planning* 2004; 35[1]27-38.

[6] Kayitenkore K, Bekan B, Rufagari J, Marion-Landais S, Karita E, Allen S. The impact of ART on HIV tranmission among HIV serodiscordant couples. Poster discussion: AIDS 2006 - XVI International AIDS Conference. Abstract no. MOKC101. and Bunnell R, Ekwaru J, King R, et al. 3-year follow-up of sexual behavior and HIV transmission risk of persons taking ART in rural Uganda. Program and abstracts of the 15th Conference on Retroviruses and Opportunistic Infections; February 3-6, 2008; Boston, Mass. Abstract 29.

and injecting drug users[7]. A two-step process was followed: first, the average cost curve was calculated based on published studies that reported both fixed and variable costs. Second, the number served by an intervention was distributed across cities within a country using Zipf's Law, which predicts the size of a city based on its rank. The appropriate average unit cost for the estimated population reached in a particular city was then applied based on the estimated average cost curve, and an average unit cost was calculated by country using weighted averages for all cities greater than 5,000 population. Charts of the relationship between changes in coverage and unit costs for these six interventions are also available in Annex C.

For care and treatment interventions, the unit costs are calculated following the same methodology used in the UNAIDS GRNE, the details of which can be seen in Annex D. One of the key drivers of care and treatment costs is the price of ARVs; since there is a great deal of uncertainty surrounding the unit costs, we have performed sensitivity analyses for both first- and second-line ARV prices, varying the equilibrium price reached in 2015 by 25 percent in both directions.

Coverage: Drivers and Scenarios

Future levels of coverage will depend on a variety of factors including funding availability, political will, health system strength, and household and individual demand (which in turn is affected by information, social mobilization, and cost). Assumptions about possible rates of scale-up in program coverage, introduction and uptake of new technologies, and underlying global and national approaches or strategies cut across the domains of many of the aids2031 working group. The Costs and Financing Working Group developed a set of draft scenarios to address this need. The scenarios were discussed at a meeting of the aids2031 Steering Committee (October 7-8, 2008) and reviewed in detail with the Modeling Working Group and the Social Drivers Working Group.

Scenarios can be used to address the uncertainty associated with long-term projections such as those required in the aids2031 activity. The use of multiple scenarios allows us to examine resource requirements under a range of possible futures. Scenarios are usually constructed around a series of 'drivers' which are the most important influences on the actions of interest. There are a large number of possible drivers for the aids2031 scenarios. These scenarios are constructed around three key dimensions (see Table 2):

Resource availability: Will the resources available for HIV/AIDS programs continue to grow rapidly as they have in the past few years or will resource availability be more constrained as costs increase, other global concerns take some attention away from AIDS, and the global economy experiences slower growth or more instability? The three possible choices for this dimension are Low, Medium, and High Resource Availability, and are displayed in purple.

Political will: Will national politicians and governments make even stronger commitments to achieve universal access and to address politically sensitive issues regarding marginalized populations? Or will they be content with more modest or selective efforts, or even express declining commitments as other issues come to the forefront of the political debate? The two possible choices for this dimension are Mixed or Strong, and are displayed in red.

Approach: Will the global approach continue to treat AIDS as an emergency and focus on short-term solutions, or will it take the longer-term view and give more emphasis to addressing

[7] Full details of the calculations and results can be seen in L Bollinger and J Stover, Projecting changes in unit costs of key interventions as national programs scale-up coverage, aids2031 Costs and Financing Working Group, Draft August 2009.

structural changes that could lead to less vulnerability and a more sustainable response in the long run? The two possible choices for this dimension are Address Immediate Needs or Focus on Long-Term Structural Change, and are displayed in blue.

Different levels of these three drivers will produce very different futures for the HIV/AIDS response. From the range of possible combinations of these drivers, we selected four scenarios that will encompass the range of uncertainty, displayed below in black.

Table 2: Taxonomy of scenario possibilities

		Resource Availability		
Approach	**Political Will**	**Low**	**Medium**	**High**
Address Immediate Needs	Mixed		Current Trends	
	Strong	Hard Choices for Prevention		Rapid Scale-up
Focus on Long-Term Structural Change	Mixed			
	Strong		Structural Change	

The proposed scenarios are described below, with details of the coverage assumed by intervention for each of the scenarios following in Table 3:

Rapid Scale-up. Political will to achieve universal access is strong and resource availability continues to grow rapidly. The focus is on scaling-up direct approaches to preventing HIV transmission and providing care and support. All countries achieve universal access to key prevention, care and treatment, and OVC support services by 2015 and continue at that level to 2031. Universal access is defined as 80% coverage for most interventions, with the exception of school programs, blood safety and safe medical injections, where universal access is defined as 100% coverage.

Current Trends. Coverage of key interventions continues to expand to 2015 as it has in the past few years. As a result some countries achieve universal access for some services but not others and some countries do not achieve universal access by 2015. Across all interventions coverage reaches about 2/3 of universal access targets by 2015 and then remains at those levels after 2015.

Hard Choices for Prevention. Resources for HIV/AIDS programs are limited, so there is a focus on scaling-up only the most cost-effective approaches for prevention in order to achieve maximum impact with the resources available. For prevention this implies greater emphasis on programs for most-at-risk-populations such as sex workers, MSM, and injecting drug users, and less emphasis on general population interventions such as workplace programs and community mobilization, particularly in low-level and concentrated epidemics[8].

Structural Change. In recognition that AIDS is a long-term problem, there is a much greater focus on structural change that can reduce vulnerability to AIDS and produce a more sustainable response. This might include, for example, programs to reduce violence against

[8] We use the UNAIDS classification by epidemic type. Hyperendemic countries are those where HIV prevalence among the population exceeds 15%. Generalized epidemic countries are those where HIV is firmly established in the general population but prevalence does not exceed 15%. Concentrated epidemic countries are those where HIV has spread rapidly in certain high-risk population but is not well established in the general population. Low level epidemic countries are those where HIV prevalence has not reached 5% in any population group.

women, modify employment practices that lead to the separation of workers and their families, removal of legal and other stigma-related barriers, and strengthen health systems[9].

Table 3 below shows the intervention-specific targets. The targets for **Rapid Scale-up** assume that funding is available to scale-up all interventions as rapidly as possible. Maximum coverage levels for most behavioral interventions are set at 60% under the assumption that structural and societal factors will make it difficult to reach more than 60% of the most vulnerable populations at the national level. Targets for the **Current Trends** scenario were chosen to reflect current trends in program scale-up. Targets for the **Hard Choices** scenario are similar to **Rapid Scale-up** for those interventions that have proven impact. These include condom promotion; outreach to sex workers, MSM and IDU; male circumcision, PMTCT, blood safety, safe medical injection and ART. Other prevention interventions are not scaled up[10]. Targets for the **Structural Change** scenario assume that societal change will facilitate greater acceptance of prevention interventions among marginalized populations allowing coverage to reach higher levels (80%) under this scenario than under the Rapid Scale-up scenario. In addition, some prevention interventions assumed to be important in achieving structural change are scaled-up to match the target coverage rates in the Rapid Scale-up scenario (community mobilization, mass media, youth programs). Financial resources available, however, are similar to those in the Current Trends scenario, resulting in similar coverage rates for care and treatment interventions (about 2/3 of universal access targets by 2015, remaining at that level through 2031). Finally, we also assume that the societal changes allow increased effectiveness of all prevention activities[11].

These targets are achieved by 2015 in all countries under the Rapid Scale-up, Current Trends and Hard Choices scenarios. Working in close collaboration with the Social Drivers Working Group, we assume that structural change takes longer to achieve full effects, thus the targets for the **Structural Change** scenario are not achieved until 2025. Coverage remains constant once these target levels are achieved across all of these scenarios.

The **Rapid Scale-up** scenario has several variants. The base variant does not include the impact of any new technologies. Other variants use the same scale-up assumptions for the existing interventions and add (separately) the impact of microbicides, pre-exposure prophylaxis, vaccines, and treatment leading to a cure.

[9] See Rao Gupta G, Parkhurst JO, Ogden JA, Aggleton P, Mahal AS, Structural Approaches to HIV Prevention, *The Lancet* (372:9640) pp 764-775 for a complete explanation of interventions identified as structural change interventions.

[10] Those prevention interventions not scaled up under the Hard Choices scenario are: mass media, community mobilization, counseling and testing, condoms for low risk populations, school-based AIDS education, outreach to out-of-school youth, IDU drug substitution, workplace prevention, STI management, post-exposure prophylaxis, safe medical injections, and universal precautions.

[11] The model estimates of the impact of interventions on behavior change rely on a synthesis of over 200 impact studies. For most projections the average impact from all available studies is used for each intervention. For the Structural Change scenario the upper quartile of the effectiveness is used.

Table 3: Coverage of Prevention, Treatment and Mitigation Interventions in Different Types of Epidemics by Scenario

Intervention	2007	2015			2025
		Current Trends	Rapid Scale-up	Hard Choices	Structural Change
Community mobilization		H/G=30%, L/C=0%	H/G=70%, L/C=0%	Constant (2007 values)	H/G=70%, L/C=0%
Mass Media		50%	80%	Constant (2007 values)	H/G=80%, C=60%, L=50%
Counseling and testing	10%	H/G=30%, L/C=4%	H/G=80%, L/C=10%	H/G=30%, L/C=4%	H/G=30%, L/C=4%
Condom promotion (Medium Risk)		50%	60%	50%	70%
Youth: In-School	40%	H/G=75%, L/C=15%	H/G=100%, L/C=30%	H=50%, G=30%, L=5%, C=0%	H/G=100%, L/C=30%
Youth: Out-of-school		H/G=25%, L/C=5%	H/G=50%, L/C=10%	Constant (2007 values)	H/G=50%, L/C=10%
Workplace		H/G=35%, L/C=0%	H/G=50%, L/C=0%	Constant (values)	H/G=35%, L/C=0%
Sex work	20%	50%	60%	60%	80%
MSM	15%	35%	60%	60%	80%
IDU: Outreach	20%	35%	60%	60%	80%
IDU: Needle exchange	10%	35%	40%	40%	60%
IDU: drug substitution		10%	20%	5%	40%
Blood safety	98%	100%	100%	100%	100%
STI treatment		100%	100%	Constant (2007 values)	100%
Male circumcision		NA	H/G=60%, L/C=0%	H/G=60%, L/C=0%	H/G=80%, L/C=0%
PMTCT	33%	50%	80%	80%	50%
Safe medical injections	60%	100%	100%	0%	100%
ART	31%	64%	80%	80%	64%
Structural Change Interventions		0%	0%	0%	100%

Notes: H=Hyper-endemic, G=Generalized, C=Concentrated, L=Low level epidemic countries

Note that the results for OVC support costs, national program costs and international support costs are all derived directly from the UNAIDS Global Resource Needs Estimates. The support costs for OVC include a combination of targeted subsidies in areas such as education, food and health care costs and cash grants to households for all vulnerable and orphaned children in sub-Saharan Africa, and children made vulnerable or orphaned because of HIV/AIDS in the rest of the world[12]. National program costs are based on the average percentage of the health

[12] Stover J, Bollinger L, Walker N, Monasch R. Resource needs to support orphans and vulnerable children in sub-Saharan Africa. *Health Policy Plan*. 2007 Jan;22(1):21-7.

system strengthening costs calculated by World Health Organization for the GRNE. International support costs are absolute amounts that are taken directly from the GRNE.

Impact

Although our focus is on examining the resources required under each of the future scenarios we also consider the impact of the scenarios in order to provide a context for the discussion of resources. Impact is measured by the number of new adult HIV infections and the number of AIDS deaths. These indicators are produced by the *Goals* model described above. In the application of the *Goals* model the population is divided into six groups. They are:

1) IDU: Injecting drug users
2) MSM: Men who have sex with men
3) High risk heterosexual: adults engaging in commercial sex
4) Medium risk: adults who have more than one sexual partner
5) Low risk: adults who are faithful to one sexual partner

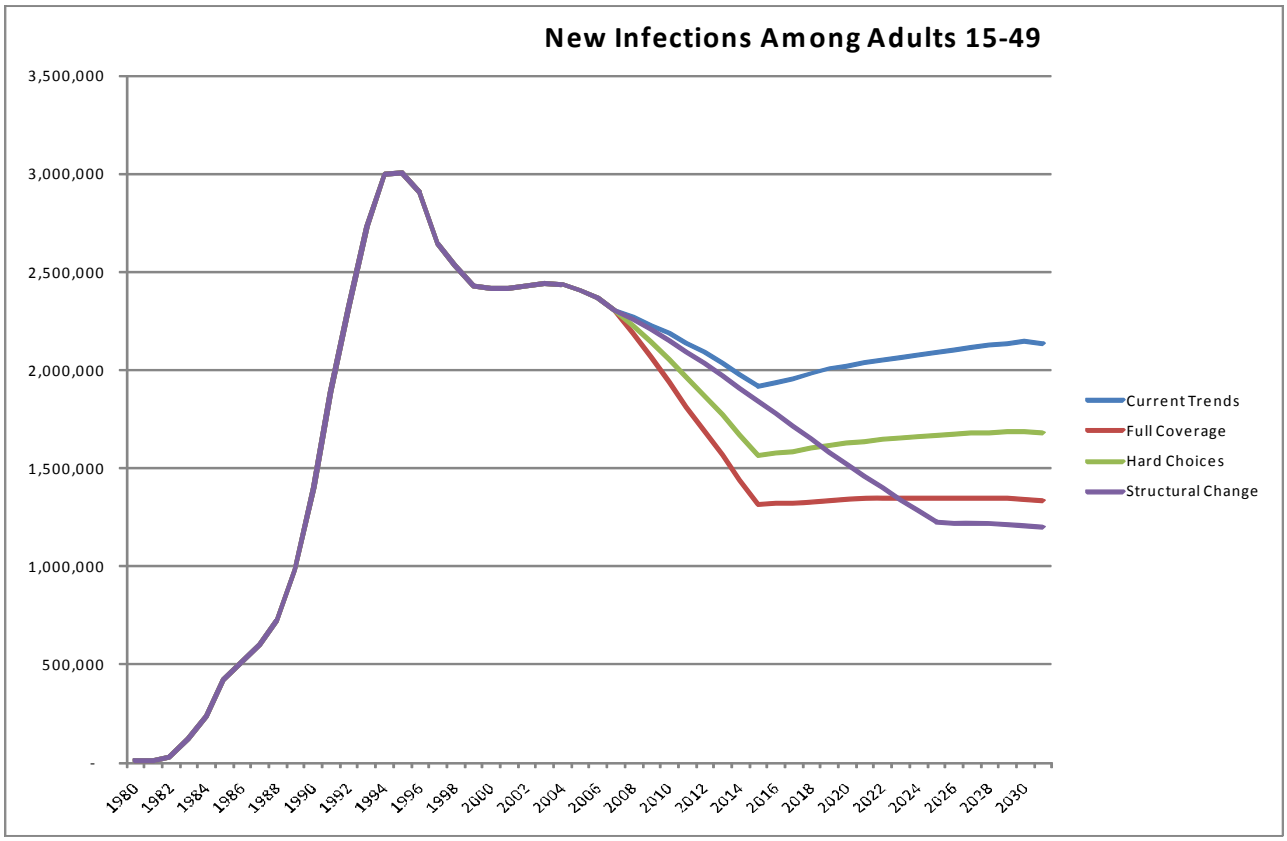
People are classified according to their own behavior. Thus a person is considered low risk if he or she is faithful to one partner even if that partner has other sexual contacts. For this reason there can be new infections occurring even in the low risk group. Any person who could be in more than one population group is placed in the category of highest risk.

Results

The epidemiological impact and the resources required are presented below for 139 low- and middle-income countries.

The number of new infections associated with each scenario is displayed in Figure 1:

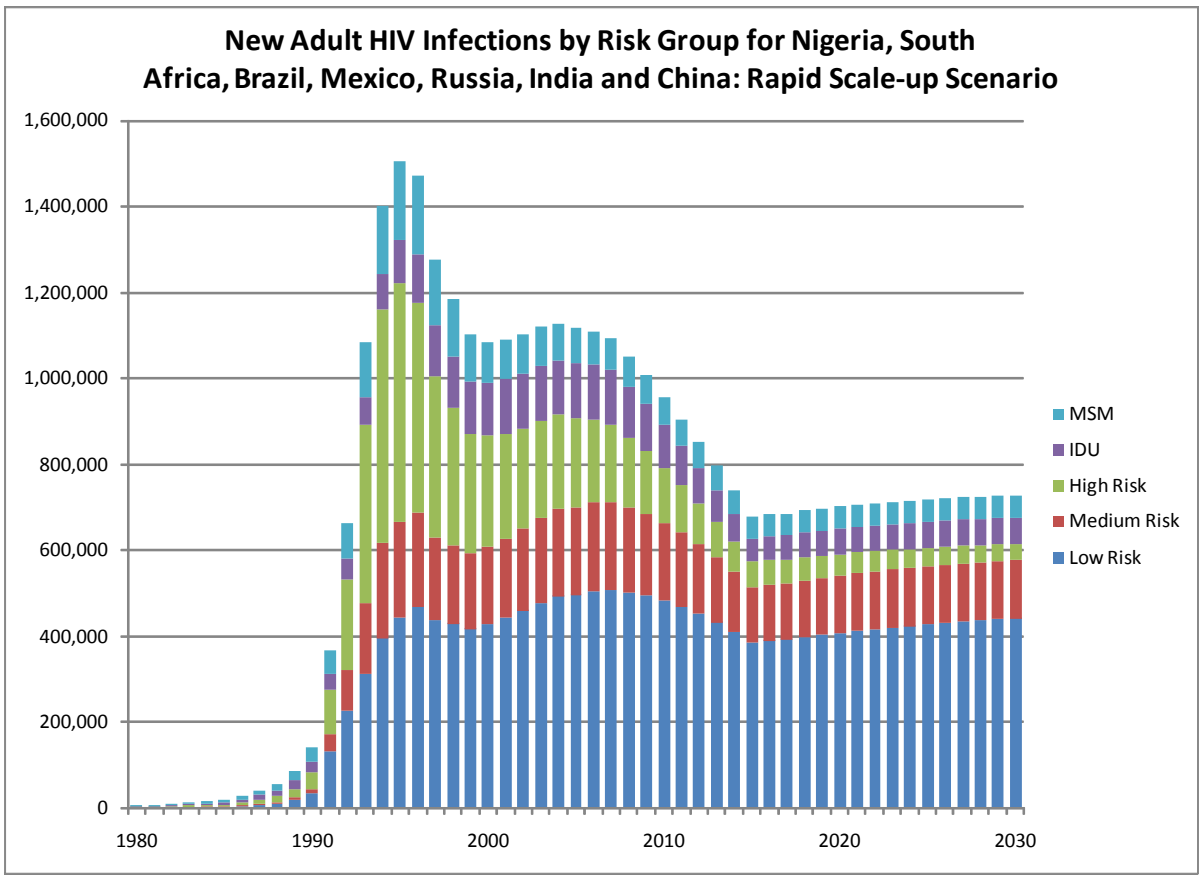
Figure 1: New infections among adults aged 15-49 by scenario for top 22 countries



The number of new adult infections increased rapidly from the start of the epidemic until peaking at about 3 million in the mid-1990s. Since then, the number of new adult infections has decreased by about 25 percent, reaching about 2.3 million in 2007. If Current Trends of coverage for prevention and treatment interventions continue, there will be a further decline in the number of new adult infections to about 1.9 million in 2015, when coverage reaches maximum rates, and then a gradual increase over the next 16 years as coverage remains constant but population growth occurs. In the Rapid Scale-up scenario, where the maximum coverage rates are significantly higher in 2015 than in the Current Trends scenario, the number of new adult infections declines much further, reaching a low of about 1.3 million in 2015 and remaining at about that level over the rest of the time period. If Hard Choices in Prevention are enacted, and the same high coverage is achieved in 2015 for a subset of the interventions for which there is high coverage in the Rapid Scale-up scenario, the number of new infections by 2015 falls between the first two scenarios, reaching a low of about 1.6 million before experiencing a gradual increase. Note that the financial implications of the Hard Choices scenario, which is the underlying rationale for the scenario, will be explored further below. Finally, if structural interventions are implemented resulting in even higher coverage rates for

certain interventions, the final number of new adult infections reaches its lowest level of about 1.2 million annually. This low level is not reached until 2025, the year that the coverage target rates reach their maximum in the Structural Change scenario. Performing a sensitivity analysis on the results for Structural Change by extending the timeframe of the scenario 10 years to 2041 for one country, South Africa, confirms that the reduction in number of new infections reaches its minimum around 2025, and remains at about the same rate of new infections through 2041 as is experienced in 2025. Note that, although substantial progress is made against the epidemic in the above chart, even scaling-up interventions to the maximum possible only cuts the number of new adult infections by half; new "game-changing" strategies will be necessary to have any further impact on reducing the number of new adult infections. Part of the reason that new prevention strategies are necessary is because the majority of new adult infections will come from the low-risk group, and few effective strategies have been identified that target this group. Although a large percentage of new infections have been occurring in the higher-risk groups (and especially in the decade of the 1990s), after the prevention interventions are scaled-up fully by 2015, the number of new infections in those risk groups drops, until by 2031 infections in the low-risk group account for almost two-thirds of all new infections. Of the 728,000 new infections that occur in the top 7 countries in 2031, 443,000 are from the low-risk group (see Figure 2). If the epidemic is to be stopped, new infections in the low risk group must be reduced.

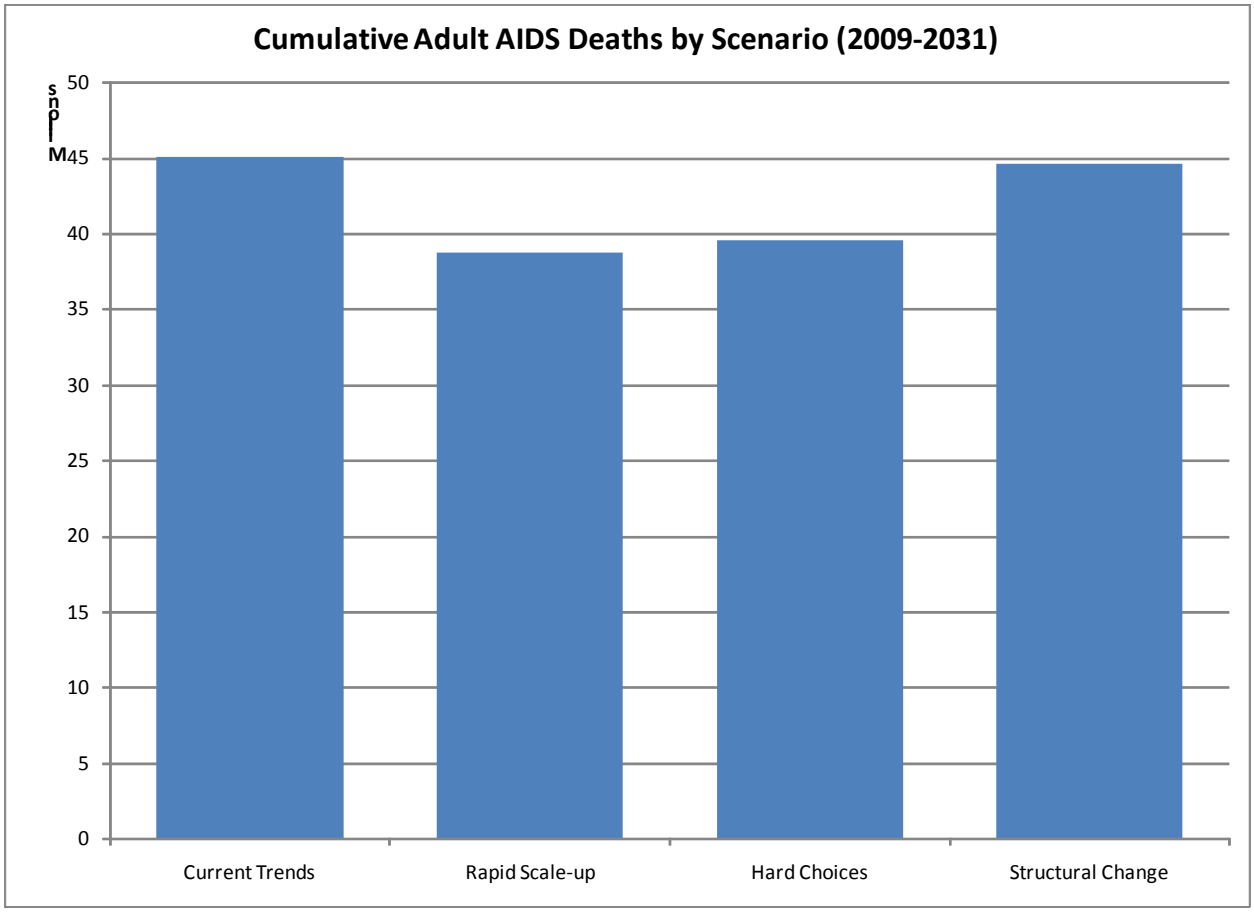
Figure 2. Number of new infections by risk group in the Rapid Scale-Up scenario



Another key indicator used to measure relative success of programs is the number of AIDS deaths for each of the scenarios (see Figure 3). Over the time period 2009 to 2031, the number of AIDS deaths in low and middle income countries varies between 39 million and 45 million.

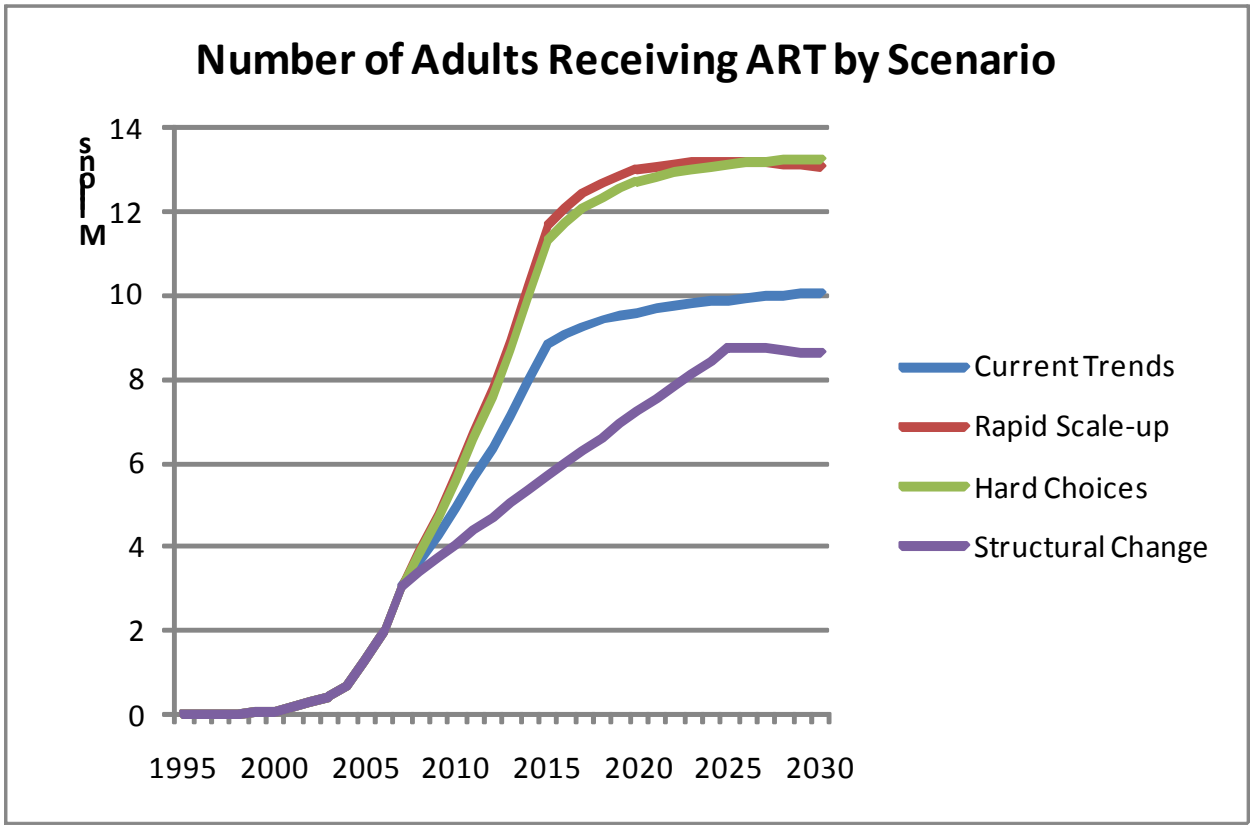
The lowest number of cumulative AIDS deaths is experienced in the Rapid Scale-up scenario, where ART is scaled-up to 80 percent by 2015 and prevention interventions are also scaled-up to reach their maximum by 2015. The Hard Choices scenario is similar to the Rapid Scale-up scenario, as ART has the same scale-up pattern as the Rapid Scale-up scenario and the most effective prevention interventions have the same scale-up pattern, as well. The Current Trends scenario has the highest number of adult AIDS deaths through 2031, over 45 million; thus continuing on the same growth path as the current one results in the highest number of AIDS deaths. The Structural Change scenario contains almost as many cumulative adult AIDS deaths as the Current Trends scenario, as the scale-up rates of both ART and prevention interventions are slower, reaching the maximum by 2025 rather than 2015. However by 2031 the annual number of AIDS deaths is 10% lower than in the Current Trends scenario. The full benefits of the Structural Change scenario will occur after 2031 whereas AIDS deaths will continue to increase each year under the Current Trends scenario.

Figure 3. Cumulative number of adult AIDS deaths, 2009-2031, by scenario



To further elaborate on the pattern of increasing ART coverage for the different scenarios, the chart below displays the number of adults and children receiving ART between 2009 and 2031 for the four scenarios. The number reaches a maximum of over 13 million in 2031 in the Rapid Scale-up and Hard Choices scenarios (which have the same target coverage rate and year for ART but differ in prevention target coverage rates), versus about 10 million in the Current Trends scenario and about 9 million in the Structural Change scenario:

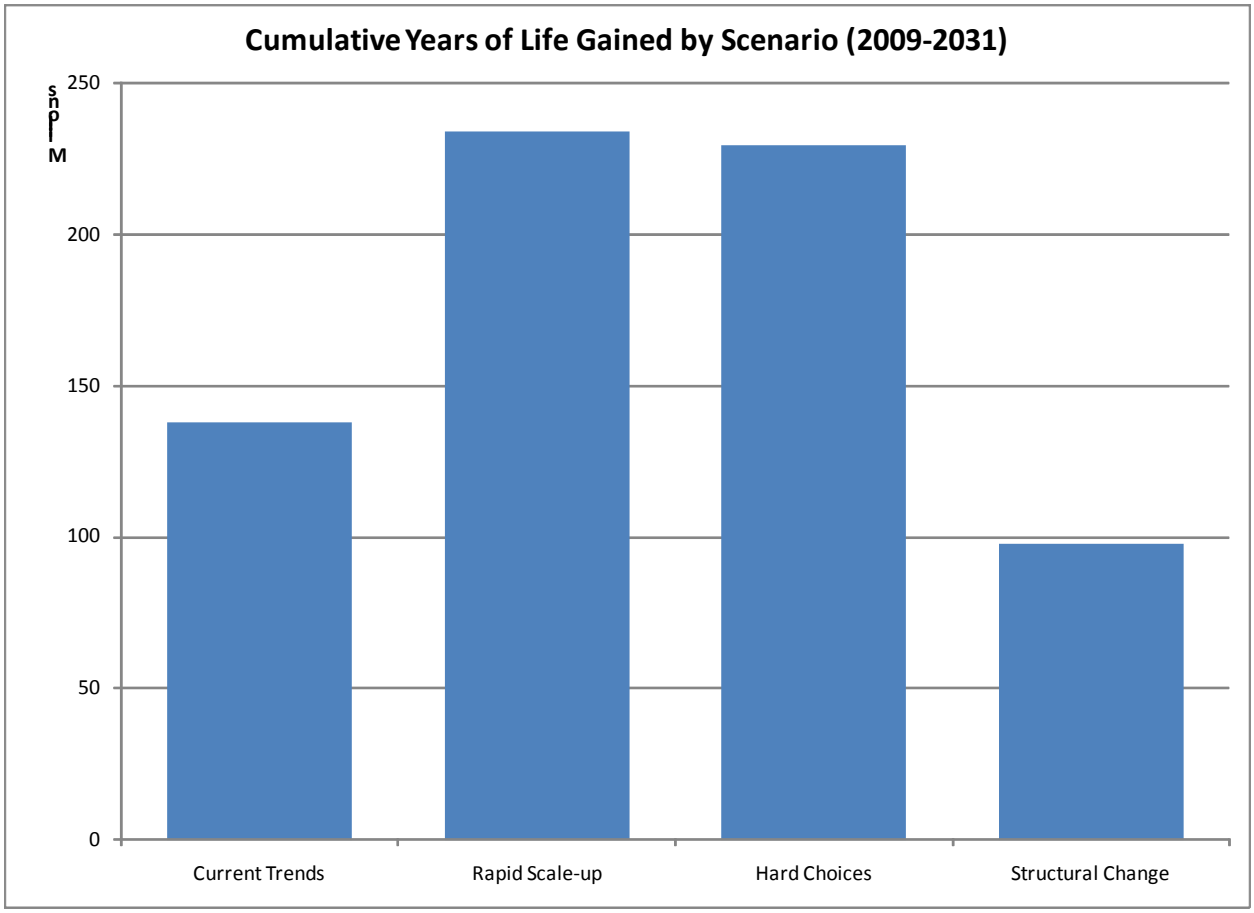
Figure 4. Number of adults receiving ART by scenario



Note that, once the maximum coverage rates are attained in 2015 (2025 for Structural Change), the number of people on ART only increases marginally, as people begin to fail second-line therapy.

Another way of evaluating the impact of the different scenarios is to examine the number of years of life gained relative to a baseline scenario which maintains current levels of key behaviors and interventions through 2031(see Figure 5). Each of the four scenarios contributes years of life evaluated relative to the baseline projection of no change in treatment levels or behavior between 2009 and 2031. The impact ranges from a low of 97 million years of life gained in the Structural Change scenario to a high of 234 million years of life gained in the Rapid Scale-up scenario. As with the previous chart, Structural Change provides the fewest additional years of life because the full scale-up does not occur until 2025. Note that the Hard Choices for prevention scenario has similar results to the Rapid Scale-up scenario, as they both have 80 percent coverage rates for ART beginning in 2015.

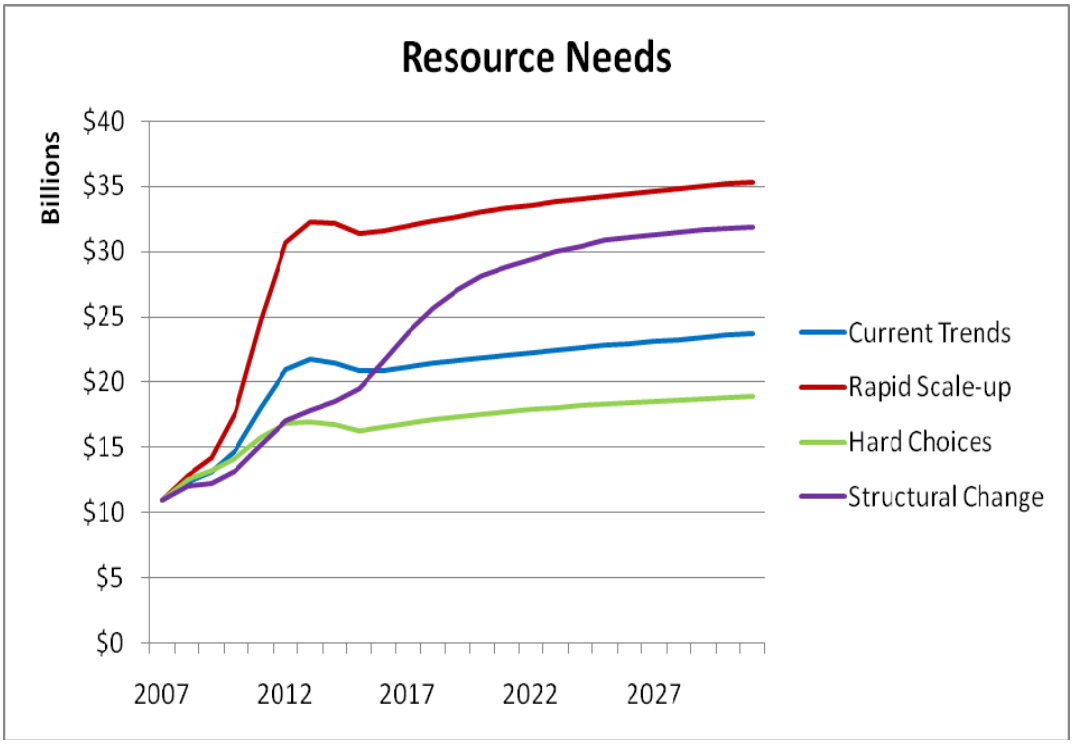
Figure 5. Cumulative number of life years gained, 2009-2031, by scenario



The resources required to achieve these results for each of the different scenarios can be seen in Figure 6. Overall, the most expensive scenario is Rapid Scale-up, which reaches high coverage rates in 2015 and maintains these rates through 2031, resulting in resource needs of over US$35 billion annually by the end of the time period. Note that there is a rapid increase in the resources required at the beginning of the time period, and then the rate of growth levels off after the maximum coverage rates are reached. In contrast, although the Current Trends and Hard Choices scenarios exhibit the same patterns of initial rapid increase and levelling off after the maximum coverage rate occurs, the final level of expenditures required are substantially lower than in the Rapid Scale-up scenario: about US$24 billion in 2031 in the Current Trends scenario, and a bit less than US$19 billion in 2031 in the Hard Choices scenario. Recall that the number of new adult infections is substantially lower in the Hard Choices scenario than in the Current Trends scenario, and yet the level of expenditures is shown here to be 20 percent lower, rather than higher as one might expect from a higher number of HIV infections averted. This happens because spending in the Hard Choices scenario is focused on the most cost-effective interventions whereas in the Current Trends scenario current spending patterns are maintained. Finally, by the end of the time period, the resources required by the Structural Changes scenario fall between Current Trends and Rapid Scale-up, reaching about US$32 billion annually by 2031. The Structural Change scenario requires additional resources to implement the structural change interventions but this scenario costs less overall than the Rapid Scale-Up scenario largely because of lower costs for VCT and ART programs. ART programs scale up more slowly in this scenario so fewer people are on ART by 2031. The coverage of

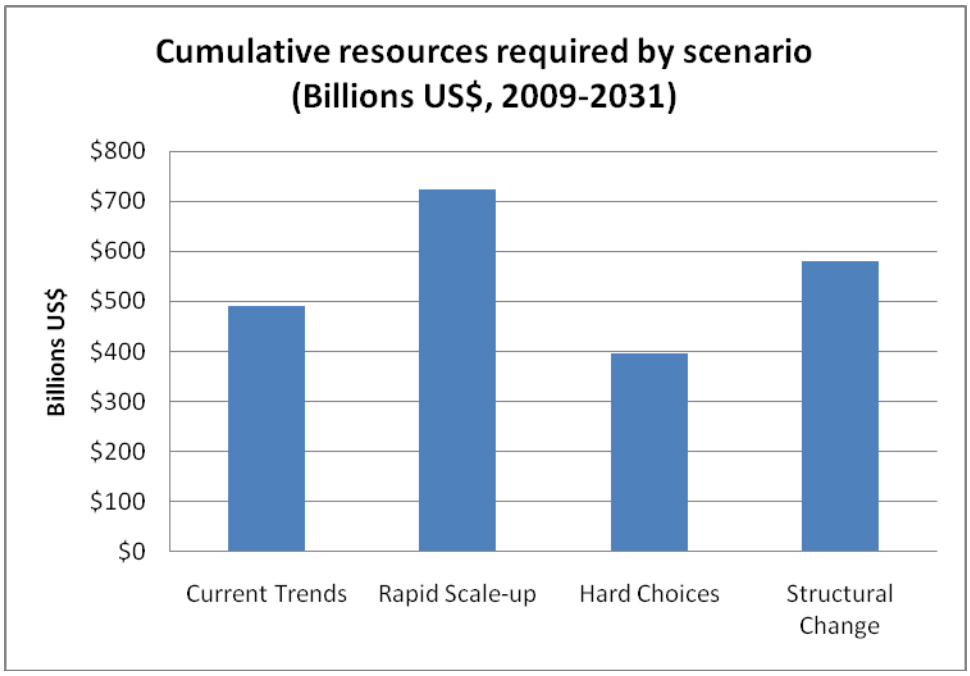
some key interventions for high risk groups is higher in the Structural Change scenario requiring more resources but the coverage target is lower for a few of the most expensive interventions, including VCT. The net result is that the resources required for the Structural Change scenario are less than for the Rapid Scale-Up scenario. Interestingly, by 2031 the number of new adult infections is actually the lowest in the Structural Change scenario, lower than Rapid Scale-up scenario.

Figure 6. Resources required by scenario, 2007-2031, in billions of US$



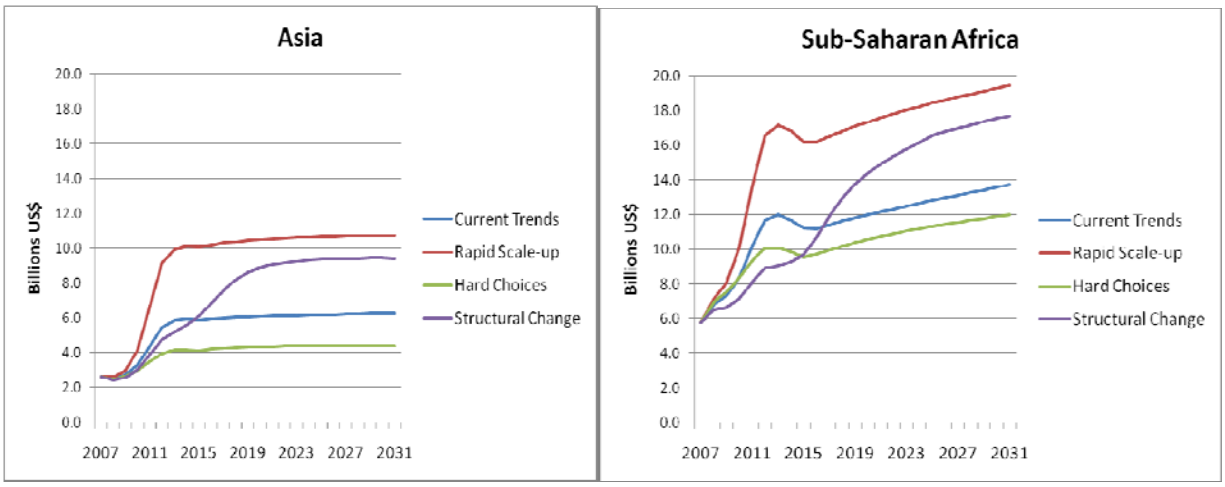
Over time, the cumulative amount of resources required varies substantially between scenarios (see Figure 7). The Rapid Scale-up scenario requires the largest amount of cumulative resources, reaching US$722 billion between 2009 and 2031. The next highest amount is for the Structural Change scenario, which requires about 80% of the amount in Rapid Scale-up, at US$579 billion between 2009 and 2031. The cumulative resources required for the Current Trends scenario is even lower, at about US$490 billion between 2009 and 2031, while the lowest amount of cumulative resources required is in the Hard Choices for Prevention scenario, which requires only half the cumulative amount required by the Rapid Scale-up scenario, about US$400 billion between 2009 and 2031.

Figure 7. Cumulative resources required by scenario, 2009-2031



The two regions with the largest resource requirements are Asia (because of the large populations) and sub-Saharan Africa (because of the disease burden), displayed below on the same scale in order to compare the expenditures required. There is a rapid increase in the amount of resources required over the short-term in both Asia and sub-Saharan Africa until the maximum coverage levels have been reached. For the first three scenarios, this occurs in 2015, while for Structural Change, this occurs in 2025.

Figure 8: Resource needs in Asia and sub-Saharan Africa by scenario



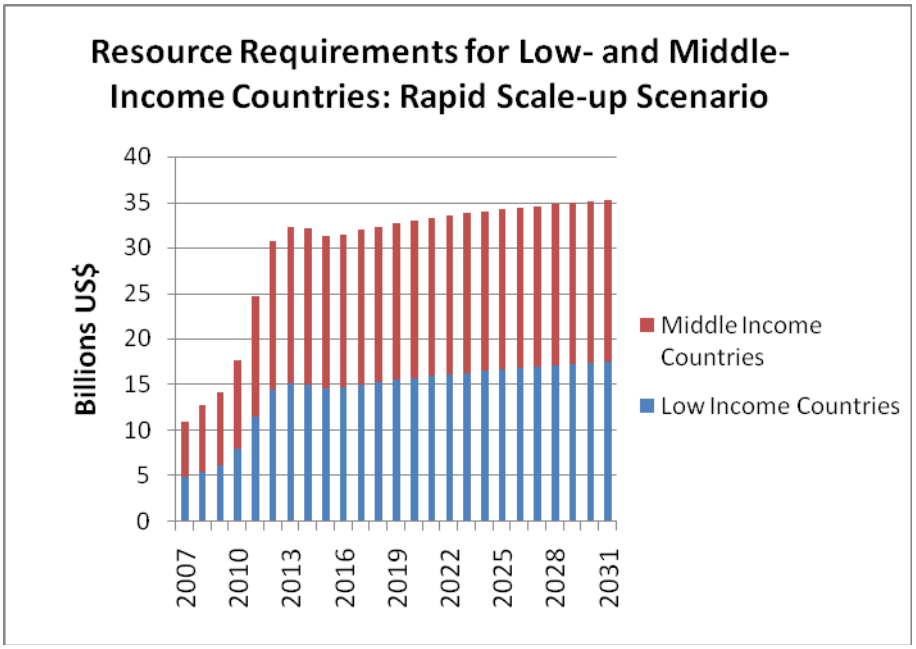
In Asia, the Rapid Scale-up scenario reaches about US$10.7 billion annually, the Current Trends scenario reaches about US$6.2 billion annually, and the Hard Choices scenario reaches US$4.4 billion annually by 2015. In the Structural Change scenario in Asia, the resource requirements reach about US$9.4 billion annually by 2025, the peak year of scale-up, and levels

off thereafter. In general, the resources needed for Asia basically level off after reaching the maximum coverage levels for each of the scenarios.

In sub-Saharan Africa, there is a bump in the amount of resources required as maximum coverage is attained, reaching about US$16.8 billion annually in the Rapid Scale-up scenario, about US$11.7 billion annually in the Current Trends scenario, and almost US$10 billion annually in the Hard Choices scenario around 2014. After a pause in the growth of expenditures required when the initial maximum coverage has been reached for these first three scenarios, required resources increase through 2031 in sub-Saharan Africa, as the number of new infections continues to increase. By 2031, the resource requirements in sub-Saharan Africa for the Rapid Scale-up scenario approach US$20 billion annually, while the Current Trends scenario requires US$13.7 billion and the Hard Choices requires US$12 billion. The path of the Structural Change scenario has a fairly consistent growth pattern over the entire time period for sub-Saharan Africa, reaching about US$17.78 billion annually by 2031.

Figure 9 displays the total resource requirements according to low- and middle-income status for the Rapid Scale-up scenario only:

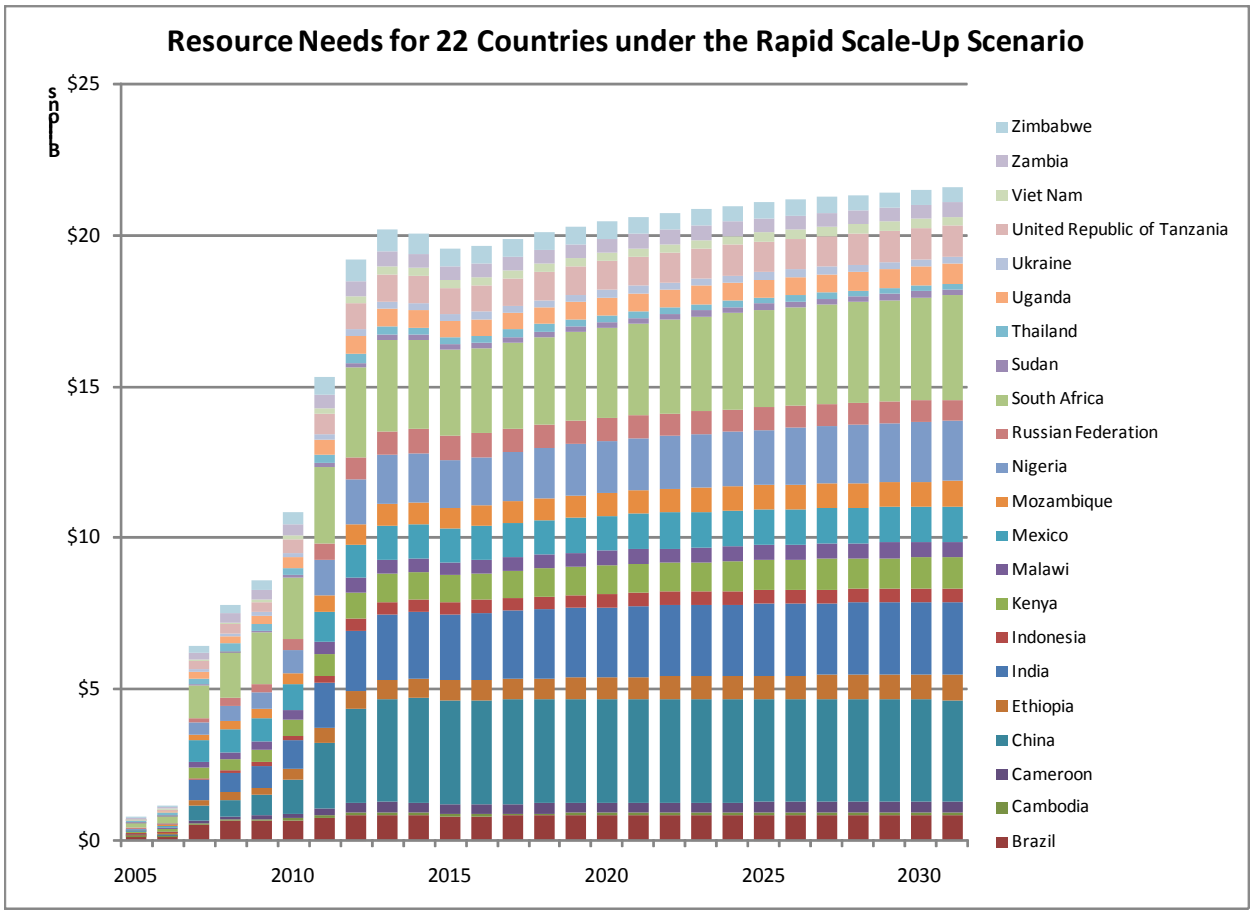
Figure 9. Resources required in low and middle income countries in the Rapid Scale-Up scenario



The resources required for low-income countries, defined by the World Bank as those countries with GNI per capita of US$875 or less in 2005, accounts for slightly less than half of the total resources required between 2009 and 2031. In 2009, the low-income countries require 45 percent of the total resources required, or US$6 billion; by 2031, that percentage has increased to almost 50 percent of the total resources required, or US$17.5 billion.

Country-specific results for the 22 countries for which individual models have been constructed can be displayed as well. Figure 10 shows the resources required in the Rapid Scale-up scenario for the top 22 countries. The sum of these requirements in 2031 is about US$22 billion annually, which accounts for about two-thirds of overall expenditures required for low- and middle-income countries.

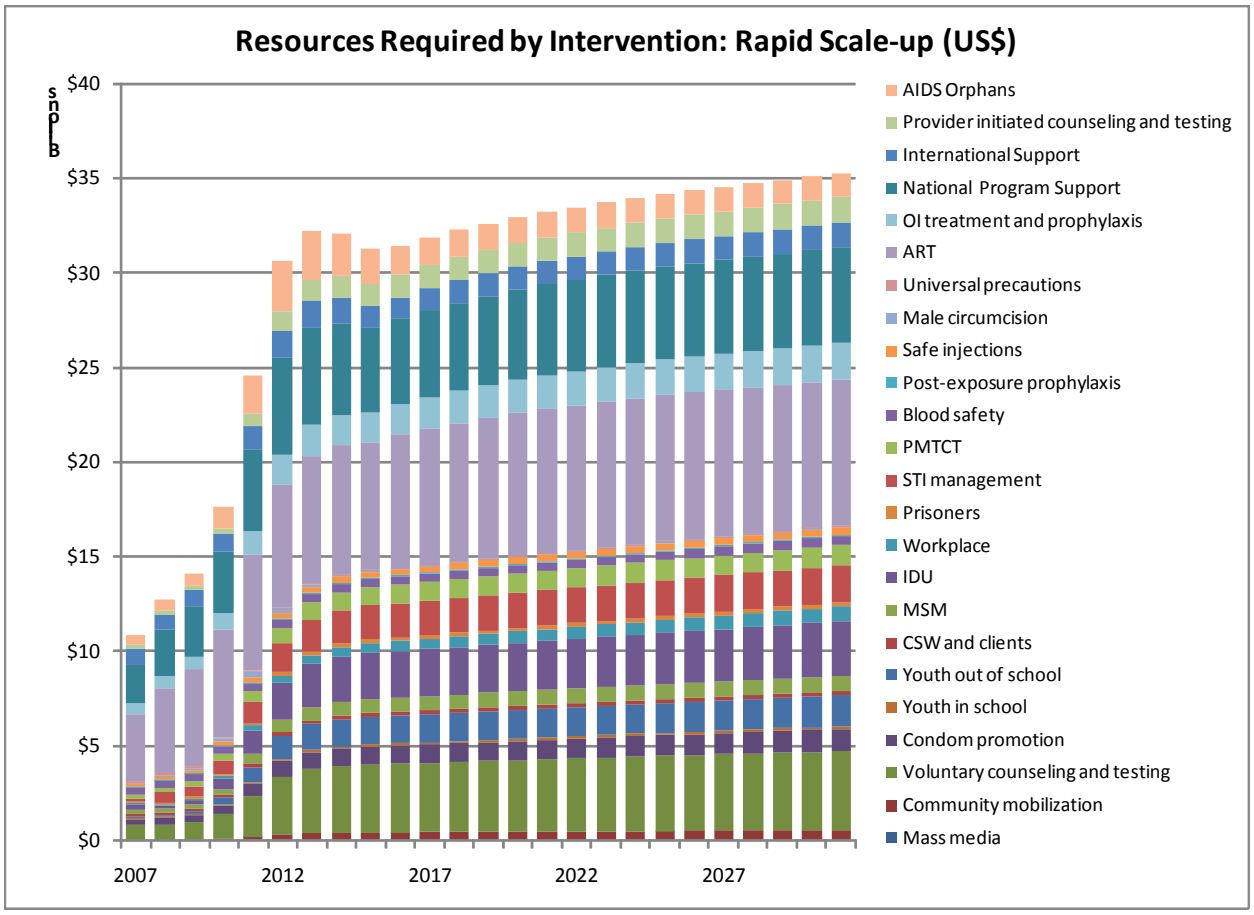
Figure 10. Resource needs for by country for 22 countries under the Rapid Scale-Up scenario



This chart illustrates that the highest requirements are experienced by a few of the countries with the largest populations (China, India) and countries with both large populations and high HIV disease burden (South Africa, Nigeria). By 2031 in the Rapid Scale-up scenario, the largest amount of resources is required by South Africa (US$3.5 billion), followed by China (US$3.4 billion), India (US$2.4 billion) and Nigeria (US$2.0 billion). In total, these four countries account for 32 percent of the total for all 139 low- and middle-income countries of about US$35 billion in the Rapid Scale-up scenario in 2031.

Resources required can also be examined according to the amounts required by each intervention. Figure 11 displays the various prevention, care and treatment, OVC support, and national and international support interventions described in Table 1 for the Rapid Scale-up scenario for all 139 countries.

Figure 11. Resources required by intervention in the Rapid Scale-Up scenario



At the beginning of the time period, the three largest components of total resources required are ART (US$3.5 billion), national program support (US$2.1 billion), and VCT (US$0.8 billion).Together, these three interventions sum to over US$6 billion, accounting for 59 percent of the total expenditures in 2007 of US$10.9 billion. In order to reach high coverage levels by 2015 spending would have to triple in just five years, growing from almost US$13 billion in 2008 to over US$32 billion in 2013. By 2031, the largest component is still ART, totalling US$7.7 billion in 2031. This is followed closely by VCT at US$4.2 billion in 2031. Requirements for VCT are large because it is relatively expensive per person (the average cost is $15-$30) and is applied to a large proportion of the adult population (12% per year in the Rapid Scale-Up scenario). Most other general population interventions cost less per person reached. The third highest level of expenditure in 2031 is National Program Support at US$5.1 billion. In 2031, these three components account for US$17 billion in 2031, or 48 percent of total expenditures, lower than the previous share of 58 percent in 2007 (see Figure 12).

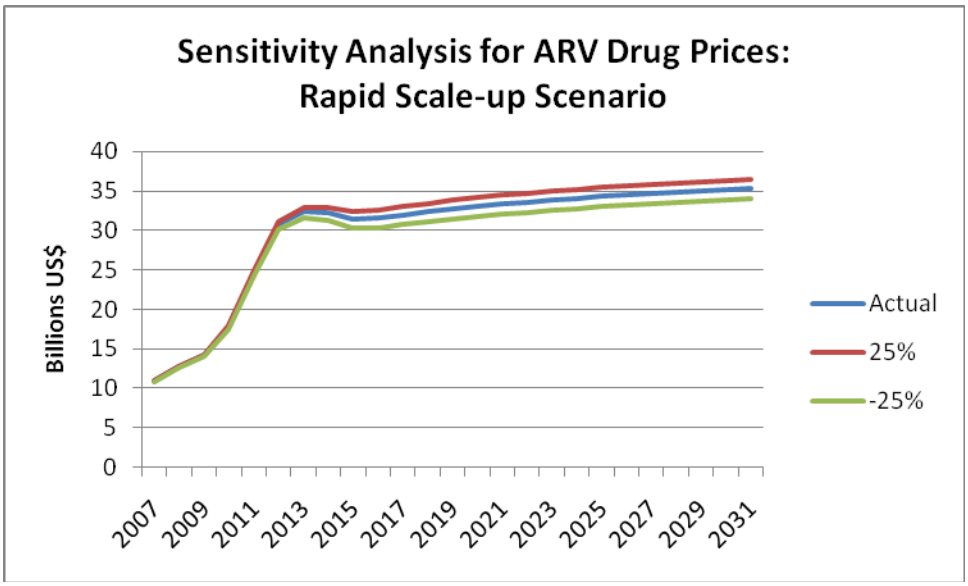
Figure 12: Relative contribution of top three prevention interventions to overall prevention resources required, 2007 and 2031 (Rapid Scale-up scenario)

Due to the high degree of uncertainty surrounding the costs of ARV drugs in the future, a sensitivity analysis was performed varying those costs. In the various scenarios, the initial price of ARV drugs is a weighted average of drug costs for four different first-line regimens and two different second-line regimens, weighted by the proportion of patients on each regimen[13]. Separate prices are available for low-income and middle-income countries, and drug costs for children are assumed to be equal to those for adults. The cost of first line drugs for low-income countries is assumed to increase to US$210 by 2015, and the cost of second line drugs for low-income countries is assumed to decrease to US$590 by 2015, based on the ARV prices recently announced by the Clinton Foundation[14]. The cost of both first and second line drugs for middle-income countries is assumed to increase/decrease at the same rate as the cost for low-income countries. The initial values of first-line and second-line ARVs for both low and middle income countries can be seen in Annex C. Here, we vary the prices of both first and second line drugs for both low and middle income countries by 25 percent in order to examine the impact on overall resource requirements for the Rapid Scale-up scenario (see Figure 13). Increasing the prices of ARV drugs by 25 percent increases the overall expenditures by three percent, from US$35 billion in 2031 to US$36.5 billion, with a similar impact when the prices of ARV drugs are decreased by 25 percent. Thus, even a significant change in the assumed prices of ARVs only affects the global resource needs by a few percentage points. Of course, at the country level the variation in prices paid by one country compared to another is very large and can be an important component of overall costs in countries with large numbers of patients on treatment.

[13] WHO, UNAIDS, UNICEF. Towards universal access: Scaling up priority HIV/AIDS interventions in the health sector, April 2007; F Renaud-Thery, BD Nguimfack, Current use of ARVs in selected Resource-Limited Countries, HIV/AIDS programme/WHO, presented at 15-16 February 2007 - Global Resource Needs Estimates Technical Working Group Meeting

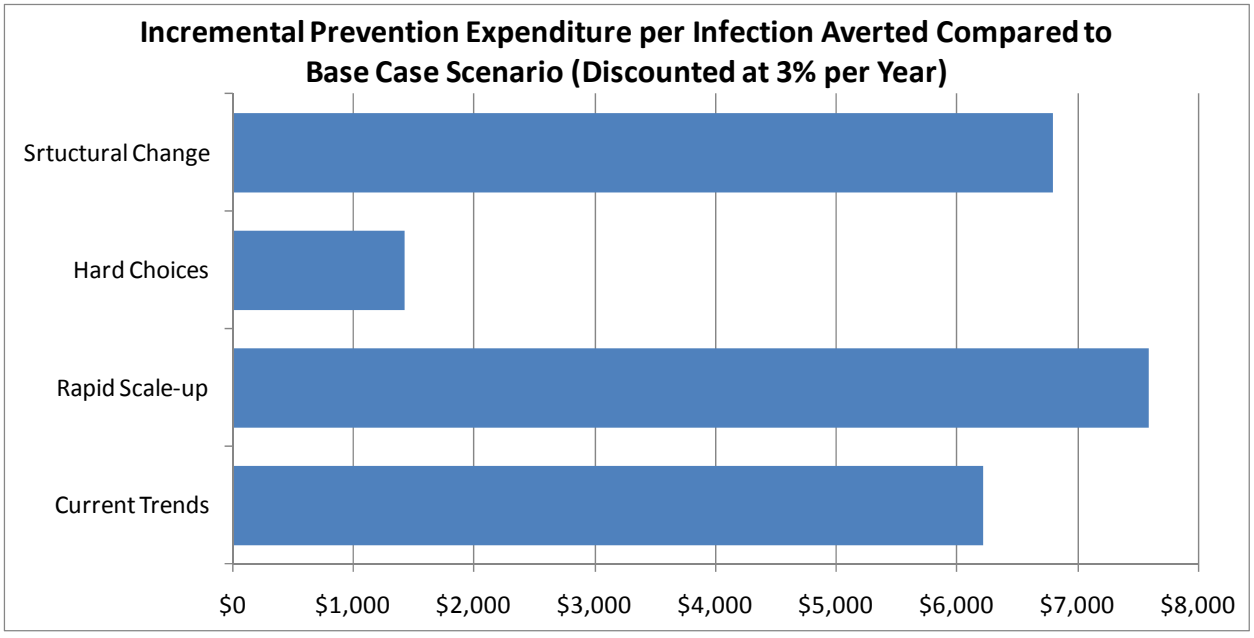
[14] See www.clintonfoundation.org for further details.

Figure 13: Sensitivity analysis for prices of ARV drugs for Rapid Scale-up scenario



Simple cost-effectiveness analysis can be performed for prevention interventions by calculating the incremental prevention expenditure per HIV infection averted fixing prevention expenditures at 2008 levels for the base scenario and discounting appropriately. The Current Trends scenario is more cost-effective for prevention expenditures relative to both Rapid Scale-up and Structural Change, with an incremental cost-effectiveness ratio (ICER) of US$7,600 per HIV infection averted for the Rapid Scale-up scenario and an ICER of US$6,800 per HIV infection averted for the Structural Change scenario compared to US$6,200 for Current Trends. The Hard Choices scenario, however, is much more cost-effective than the Current Trends scenario, with an ICER of US$1,400 per HIV infection averted, that is, the Hard Choices scenarios averts even more infections at a lower cost.

Figure 14. Incremental prevention expenditure per infection averted

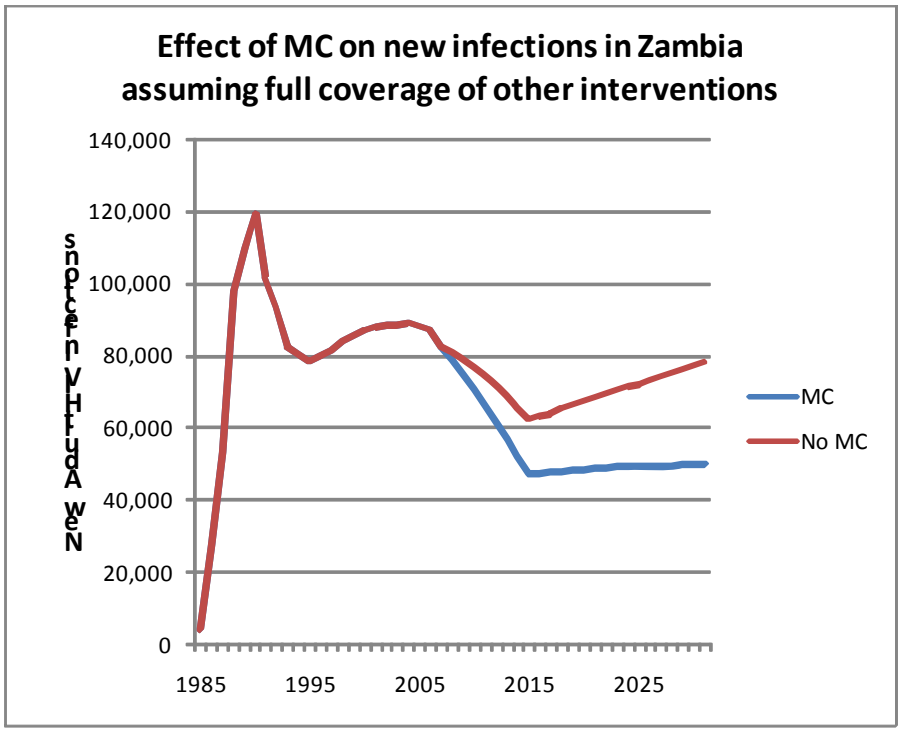


New Technologies[15]

As discussed above in relation to Figure 1, scaling-up current prevention and treatment interventions to the maximum feasible coverage levels still won't reduce the number of new adult HIV infections by more than 50 percent by 2031. In order to have an even more significant reduction in the number of new adult HIV infections, new approaches will be needed that lead to dramatic behavior change or new technologies will have to be invented and implemented. Male circumcision has recently been shown to be an effective prevention measure and plans are underway in a number of countries to scale-up male circumcision services. This is included in the scenarios described above. A number of new technologies are under development that may provide substantial benefits. These include pre-exposure prophylaxis (PrEP) and microbicides, which may become available between 2010 and 2015. There are some true game-changing scenarios as well, which may or may not occur: an AIDS vaccine, which at this point in time is not anticipated to be available until at least 2020; and treatment leading to a cure, with unknown feasibility and availability.

The potential impact of male circumcision can be seen in Figure 15, using Zambia as a case study. Currently only about 16% of adult males in Zambia are circumcised. In the Rapid Scale-Up scenario this increases to 60% by 2015. If male circumcision were not included in this projection there would be 60% more new infections in 2031.

Figure 15: The effect of male circumcision on new HIV infections in Zambia relative to the Rapid Scale-up scenario



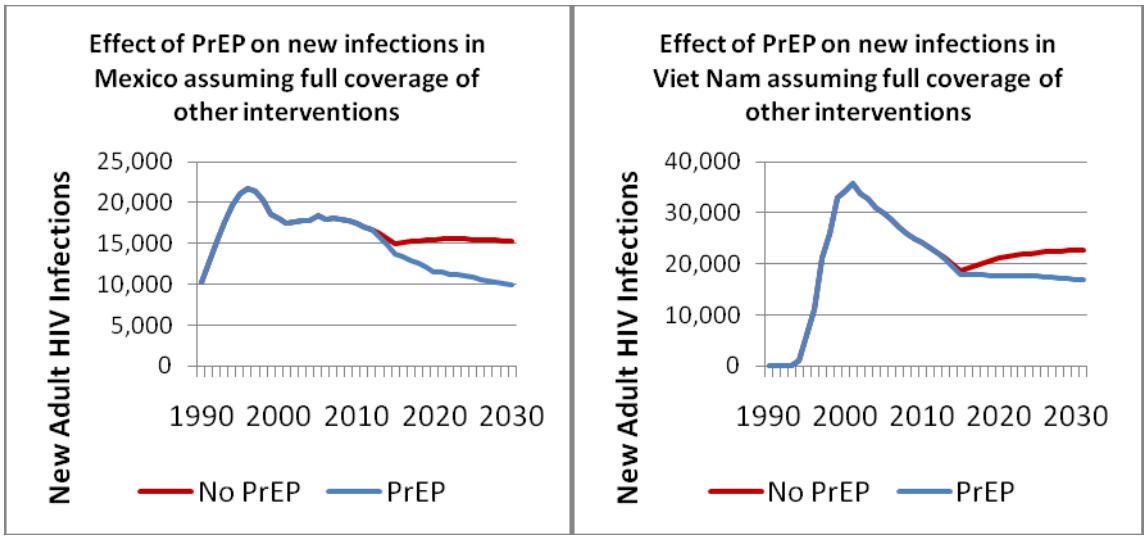
We examined separately the potential impact of technologies that are not yet available by assuming effectiveness rates and target coverage levels. For PrEP we assume effectiveness of 60 percent and maximum coverage of 50 percent in the medium and high risk groups but no

[15] This section builds on information discussed in the aids2031 Science and Technology Working Group final report.

use by low risk couples. We will not know what the effectiveness of PrEP might be until the first trials are completed. PrEP will require regular dosing and frequent testing to ensure that those who do become infected while on PrEP move quickly to triple therapy. Under these conditions it seems unlikely that use would be high among low-risk couples. For microbicides we assume an effectiveness of 80 percent and maximum coverage of 20 percent in all population groups Since microbicides act in a similar fashion to condoms we assume that the effectiveness would have to be nearly as good as condoms before they would be introduced. Since the Rapid Scale-up scenario already assumes that condom promotion efforts increase condom use to high levels, microbicide coverage of an additional 20% brings the combined coverage to very high levels. For vaccines, three different scenarios were assumed and compared to the base scenario of Rapid Scale-up varying assumptions about population coverage and reductions in infectiousness, susceptibility and progression to needing treatment; further details are provided below. The vaccine analysis was conducted only for Brazil, China, India, Mexico, Nigeria, Russia and South Africa and then scaled-up to represent the rest of the developing world. Finally, the impact of treatment leading to a cure was estimated for South Africa as a case study. The impact was modelled by assuming that 80% of those eligible for treatment could be cured of HIV infection in one year, after which they are again susceptible to re-infection.

The results for PrEP are disappointing overall (see Figure 16). When the impact is estimated for the top 22 countries in terms of disease burden, there is a minimal impact of PrEP, with a small decline in the number of new infections. This is partly due to the assumptions underlying the new scenario, that is, that PrEP would be provided to high- and medium-risk people. Because the Rapid Scale-up scenario scales-up all of the prevention interventions reaching high-risk populations in particular, most of the new infections in these 22 countries in this scenario come from the low-risk population (see Figure 2 above) thus there are few new infections in these population groups to be averted by PrEP. If PrEP were used by low risk couples then the impact would be much greater.

Figure 16: Effect of PrEP in Mexico and Viet Nam using Rapid Scale-up as the base scenario

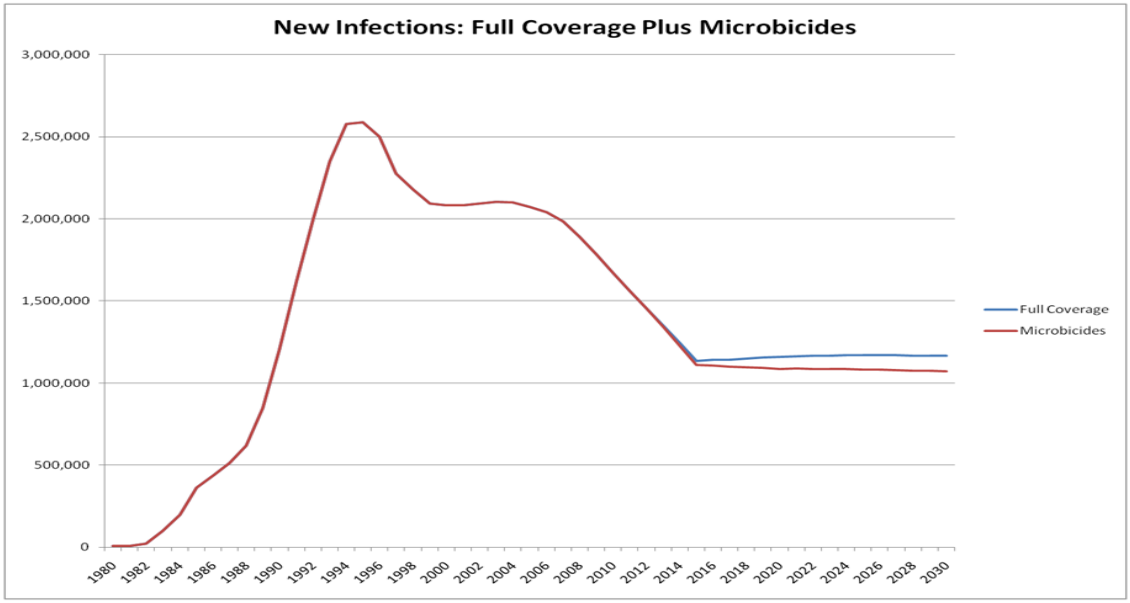


This prevention strategy could be more effective in epidemics that are concentrated in most at-risk populations, such as MSM or IDU. In a country like Mexico, where most of the new adult HIV infections are occurring in the MSM population, a prevention intervention providing PrEP to that group would have a more significant impact (see Figure 16). Adding PrEP coverage to the

Rapid Scale-up scenario, which contains 60 percent coverage of MSM outreach interventions, would result in a reduction from about 15,000 new infections in 2031 to less than 10,000, a further reduction of more than one-third. Similarly in Viet Nam, where IDU are the main source of new infections, adding PrEP would have a significant impact on the epidemic if PrEP proves effective for IDU-transmission (see Figure 16).

The overall impact of microbicides is also small due to our assumption that microbicide coverage would be additive to condom use. Of course microbicide use might substitute for condom use. That would increase the number of infections averted due to microbicides but not the overall impact of condoms and microbicides (see Figure 17). We assume that microbicide use among low risk couples would not exceed 20% for the same reasons that condom use is low among married couples: low perceived risk and reluctance to imply that the partner is unfaithful. Of course, the combined impact of both PrEP and microbicides would be much higher if extensive testing to identify discordant couples led to high levels of use by those couples.

Figure 17: Impact of microbicides in the Rapid Scale-up scenario



In addition to the two new technologies modeled above, we also modeled the impact of two other technologies that are less likely in the short term: an AIDS vaccine, and treatment leading to a cure.

Vaccines are consistently among the best tools for fighting infectious diseases. An AIDS vaccine should be considered one of the best hopes to end the spread of HIV. However, questions surrounding potential AIDS vaccines remain: is a vaccine against HIV scientifically possible – will we ever have one? How effective would an AIDS vaccine be? Would a vaccine still be needed if existing prevention programs and antiretroviral treatments (ARTs) are significantly expanded while a vaccine is still being developed? What will be the impact of first generation vaccines if they only provide partial protection against HIV? Earlier research has shown that in order to yield significant benefits, a vaccine would not have to be 100% effective

or reach 100% of an at- risk population[16]. Here, we explore three different vaccine scenarios, comparing the outcomes with the Rapid Scale-up scenario.

Although the exact level of protection that will be conferred by first generation vaccines is still unknown, scientists believe they may only be partially effective in protecting against the acquisition of HIV[17]. Based on the leading vaccine candidates currently being tested in clinical trials, an AIDS vaccine could have a combination of the following three mechanisms of action:

- Protect the vaccinated individual against HIV infection (i.e. reduced susceptibility);
- Reduce the probability that a vaccinated individual who later becomes infected will transmit his/her infection to others, (i.e. reduced infectiousness);
- Slow the rate of progression from HIV infection to death in vaccinated individuals (i.e. increase in average survival time following infection).

Here we assume three different scenarios - Low, Medium and High – by combining changes across three different parameters: increasing the coverage of those receiving the vaccine in the general population from 20% to 30% to 40%, increasing the reduction in the probability of becoming infected from 30% to 50% to 70%, and increasing the reduction in the probability of infecting someone else from 30% to 50% to 70%. Each of the scenarios assumes that there is an increase for everyone vaccinated in the average survival time following infection (see Table 4):

Table 4: Specification of AIDS vaccine scenarios

	Scenario		
	Low	Medium	High
General population coverage	20%	30%	40%
Reduction in susceptibility	30%	50%	70%
Reduction in infectiousness	30%	50%	70%
Increase in survival time	100%	100%	100%

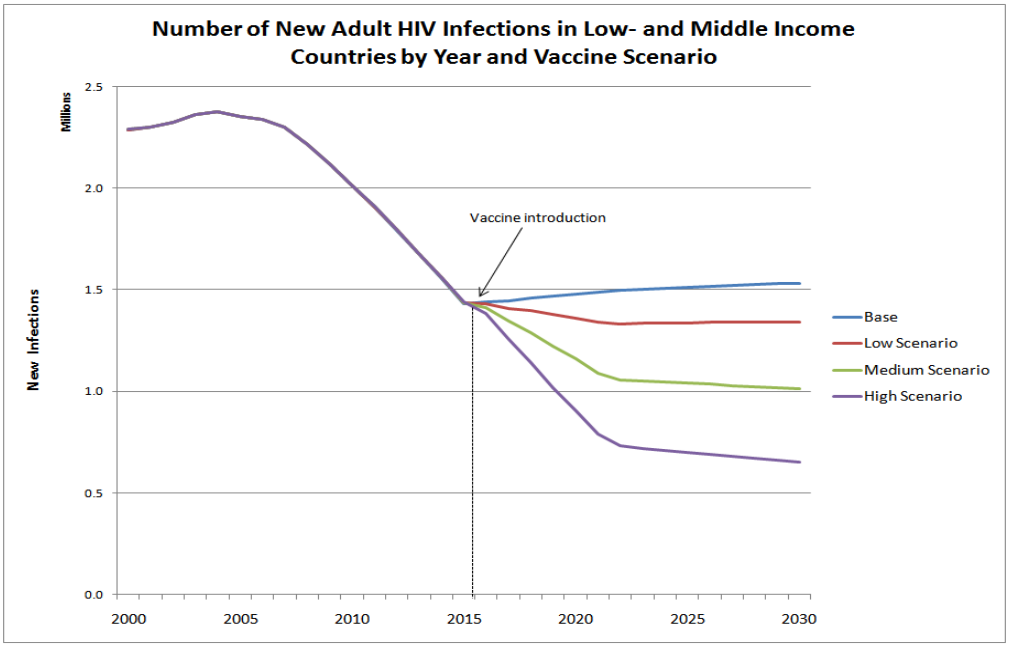
The impact differs across the various scenarios, but all are measurably different than the base scenario (see Figure 18).

By 2031, the introduction of an AIDS vaccine reduces the number of new adult HIV infections from approximately 1.5 million in the Base scenario to 0.6 million in the High scenario, a reduction of 60 percent. The other scenarios fall between the Base and High scenarios, in terms of impact. Note that the assumptions made regarding both population coverage and effectiveness of the vaccine for the High scenario are fairly reasonable at 40 percent coverage in the general population and 70 percent effectiveness for reductions in infectiousness and susceptibility.

[16] Stover J, Bollinger L, Hecht R, Williams C, Roca E. "The impact of an AIDS vaccine in developing countries: a new model and initial results." *Health Aff* (Millwood). 2007 Jul-Aug;26(4):1147-58.

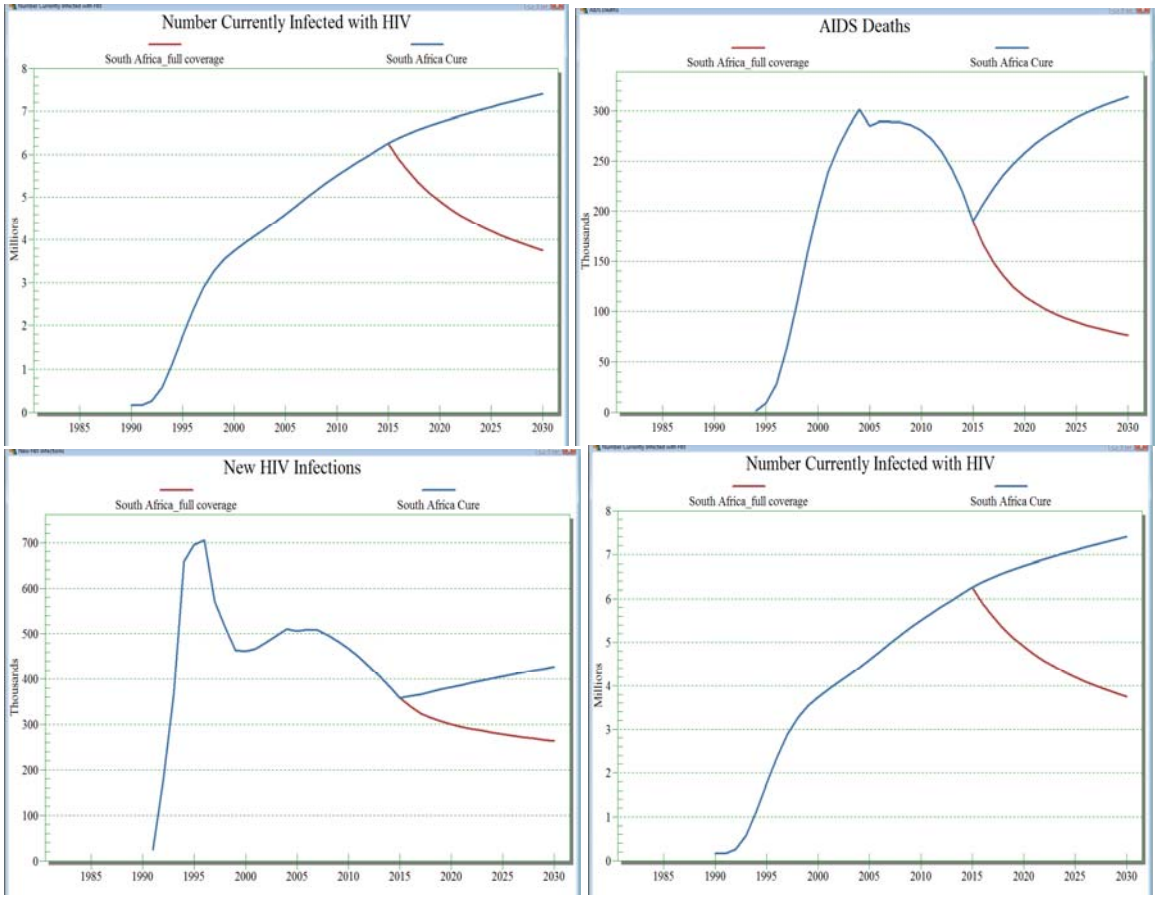
[17] IAVI. AIDS Vaccine Blueprint 2006: Actions to Strengthen Global Research and Development. New York: IAVI; 2006

Figure 18: Impact of three different vaccine scenarios on the number of new adult HIV infections



A final technology that may become available is treatment leading to a cure for HIV. We assume that the cure would become available in 2015, and would have the effect of curing 80 percent of those the first year they are on treatment, with the further result that they are placed back in the pool of susceptible people, subject to becoming infected again. Results for South Africa show that this would have a significant impact on the HIV/AIDS epidemic; the number of adult AIDS deaths declines dramatically, as does the number currently infected with HIV and the number of adults receiving ART. Note that there would also be significant financial savings if the number of adults receiving ART declines so dramatically.

Figure 19: Impact of treatment leading to a cure for South Africa



Finally, although most technology changes are assumed to improve the outlook of the epidemic, the possibility of increasing drug resistance as a side effect of changes in technology could have a negative impact. Increasing resistance to ARVs would likely raise the cost of treatment and the least expensive and most used drugs would have to be replaced with more expensive drugs from different classes. This could potentially double ARV costs in the short-term. The long-term impact would be dependent on the availability of alternative drugs and price negotiations.

Conclusion

By 2031, the HIV/AIDS epidemic will enter its 50th year. In 1981, no one expected that the epidemic would become the challenge that the world faces today, particularly sub-Saharan Africa. Efforts to address the epidemic have increased dramatically over the last decade, but the epidemic remains. Without a change in approach, it is likely that the epidemic will still be with us in 2031.

The purpose of the aids2031 project is to ask what could be done differently today to change the path of the HIV/AIDS epidemic by 2031. This paper incorporates results from several of the aids2031 working groups to examine the costs and financial implications of changing the current approach to fighting HIV/AIDS. Four different scenarios are examined, including Current Trends (current growth patterns), Rapid Scale-up (scaling-up rapidly reaching targets by 2015), Hard Choices for Prevention (targeting prevention monies) and Structural Change (scaling-up more

slowly but addressing basic structural issues). Depending on the strategic choices made today, the final resources required annually in 2031 vary between US$19 and US$35 billion for 139 low and middle income countries.

There are several factors that are important cost drivers in these scenarios. First, choosing to undertake the most cost-effective prevention interventions has significant implications for total expenditures required. If “Hard Choices” are made for prevention while maintaining full access to treatment, then the overall requirements drop to US$19 billion annually in 2031 from US$35 billion annually, the expenditures needed in the Rapid Scale-up scenario. Second, the cost of ART is the largest single component of total costs accounting for around 20% of resource needs. Although future drug prices are uncertain they are only expected to account for about a third of ART costs, with laboratory and service delivery costs accounting for most of the rest. Thus even significant variations in future drug prices from our assumptions here are not likely to dramatically change the estimates of future resources needed. Third, resources required for prevention are the largest of the different components; once these interventions are scaled-up and begin to change behavior, it may be possible to reduce prevention coverage, thus reducing required expenditures. Fourth, recent research indicates that significant technical inefficiencies exist in the implementation of both prevention and treatment and care interventions; if improvements can be made in the efficiency with which these interventions are implemented, there is scope for reducing the amount of resources required.

Another question asked at the beginning of this paper was whether there are “game changers” that could change the course of the HIV/AIDS epidemic by 2031. Model simulations show that even with both existing prevention and treatment interventions scaled-up fully and rapidly, the Rapid Scale-up scenario, the number of new infections is only reduced by 50 percent by 2031. The only true “game changers”, where the number of new adult HIV infections falls significantly below 50 percent of projected levels, is if there is either an AIDS vaccine or if a new treatment is invented that leads to a cure.

Given the above, what might be done differently today in order to affect the course of the epidemic? This work suggests several courses of action:

Focus on cost-effective prevention. The resources required to scale up all prevention, care and treatment interventions are three times the current level of expenditure. It will be difficult to achieve and sustain this level but there are alternative approaches. By focusing on just the most cost-effective prevention interventions we could achieve almost as much impact at half the cost. Even today, when global expenditures are over $13 billion we have not achieved full coverage of the most effective prevention efforts focused on most-at-risk groups. A renewed focus on the most cost-effective prevention interventions in each country context would prevent many new infections without such a huge increase in resource requirements.

Sustainability. Even if vast amounts of new resources are mobilized by 2015 and coverage of key interventions scale-up quickly the epidemic will not disappear. It will remain a long-term problem requiring resources and effort to 2031 and beyond. We need to recognize the long-term challenge and do more to address the societal factors that create vulnerability in order to seek long-term solutions. Indeed, an AIDS response that includes structural approaches is most likely to foster sustainable, long-lasting changes. In order to marshal the resources necessary to address the social and structural factors that drive vulnerability to HIV, it may be necessary to coordinate funding with other donors outside of the traditional AIDS response. The benefits of a more comprehensive approach to vulnerability will yield benefits beyond AIDS outcomes – including better overall health, economic well-being, increased social and political participation, and the protection of human rights for all.

New technologies. Rapid scale-up of existing prevention interventions will reduce the number of new infections by half, but will not eliminate them. New technologies such as PrEP and microbicides, if proved effective, can contribute to prevention efforts but are not likely to be enough by themselves. We need to support efforts to develop even better solutions such as AIDS vaccines and treatments that can lead to a cure.

Funding. Resources for HIV/AIDS programs have expanded rapidly in the past few years with many new sources of support including the Global Fund, PEPFAR, World Bank MAP, UNITAID, etc. The future resource needs to support the fight against AIDS will be large in any of the scenarios examined here. We need to make sure that we have sustainable funding mechanisms in place for the long-term. Although middle income countries may be able to afford much of the bill for HIV/AIDS through 2031, low income countries are unlikely to be able to afford the US$15-20 billion annual bill that will occur between 2010 and 2031 in the Rapid Scale-up scenario[18].

[18] See (need citation) for further discussion of resource mobilization issues.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