policy

June 2012

THE IMPACT OF DIFFERENT SCENARIOS OF PREVENTION, TREATMENT, AND MITIGATION COVERAGE IN GHANA

Analysis Using the Goals Model

This publication was prepared by Rudolph Chandler of the Health Policy Project.

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Suggested citation: Chandler, R 2012. *Impact of Different Scenarios of Prevention, Treatment, and Mitigation Coverage in Ghana: Analysis Using the Goals Model.* Washington, DC: Futures Group, Health Policy Project.

ISBN: 978-1-59560-002-8

The Health Policy Project is a five-year cooperative agreement funded by the U.S. Agency for International Development under Agreement No. AID-OAA-A-10-00067, beginning September 30, 2010. It is implemented by Futures Group, in collaboration with the Centre for Development and Population Activities (CEDPA), Futures Institute, Partners in Population and Development, Africa Regional Office (PPD ARO), Population Reference Bureau (PRB), RTI International, and the White Ribbon Alliance for Safe Motherhood (WRA).

The Impact of Different Scenarios of Prevention, Treatment, and Mitigation Coverage in Ghana

Analysis Using the Goals Model

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[1]Futures Institute

CONTENTS

ABBREVIATIONS

ART	antiretroviral therapy
ARV	antiretroviral
CMH	Commission on Macroeconomics and Health
DALY	disability adjusted life year
GNI	gross national income
HIV	human immunodeficiency virus
HPP	Health Policy Project
HTC	HIV testing and counseling
MARP	most-at-risk population
MSM	males who have sex with males
NSP	National Strategic Plan
OI	opportunistic infection
PEP	post-exposure prophylaxis
PMTCT	prevention of mother-to-child transmission
PrEP	pre-exposure prophlyaxis
PWID	people who inject drugs
STI	sexually transmitted infection
SW	sex worker
TB	tuberculosis
VCT	voluntary counseling and testing

INTRODUCTION

In 2010, the Health Policy Project (HPP) conducted a Goals Model exercise to inform the development of Ghana's 2011–2015 HIV and AIDS National Strategic Plan (NSP). Since then, new data for both beneficiary estimates—coverage and HIV and AIDS interventions and costs—have been released. Thus, in October 2011, a technical working group[1] asked HPP to develop eight different Goals scenarios based on an annual funding ceiling of $70[2] million for the plan. However, in February 2012, as HPP was about to present the Goals results, the project was informed that the NSP had been revised—now estimated to cost $443 million for the period 2011–2015, compared with the original $920 million. HPP also learned that the annual funding ceiling for the Goals exercise had been updated to $77 million. As a result, the project once again updated the Goals results based on the revised NSP costing and funding ceiling.

During a series of stakeholder meetings held in February 2012, the working group selected four scenarios for analysis based on the revised costed NSP and funding ceilings. HPP presented the results to Ghanaian stakeholders on February 13, 2012.

METHODOLOGY

The Goals Model supports strategic planning and decision making at the national level by linking program goals and funding.[3] It is a component of Spectrum, a suite of policy models used to project the need for family planning/reproductive health, maternal health, and HIV services. The Goals Model can help answer the following key questions:

- How much funding is required to achieve the goals of the strategic plan?
- What goals can be achieved with the available resources?
- What is the effect of alternate patterns of resource allocation on the achievement of program goals?

The Goals Model assists planners in understanding the effects of funding levels and allocation patterns on program impact, as well as how these patterns can lead to reductions in HIV incidence and prevalence and improved coverage of treatment, care, and support programs. The model does not, however, calculate the "optimum" allocation pattern or recommend a specific allocation of resources among prevention, care, and mitigation.

The HPP team populated the model for Ghana using all available data sources, specifying the distribution of the population by risk group and the behaviors for each risk group (number of partners, number of sexual acts per partner per year, condom use, and proportion married). The team used international studies to set values for the epidemiological parameters, such as the risk of HIV transmission per act and the variation in the risk of transmission by stage of infection, type of sex act, presence of sexually transmitted infections (STIs), use of condoms, etc.

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[1] The working group includes representatives of the Country Coordinating Mechanism, the National AIDS Control Program of the Ministry of Health, the Ghana AIDS Commission, and the Joint United Nations Program on HIV/AIDS, USAID/Ghana, as well as members of civil society organizations.

[2] All amounts in this report are in US dollars.

[3] The Goals Model can be found as part of the Spectrum suite, which is available at: http://www.healthpolicyproject.com/index.cfm?id=software.

The Goals Model produces outputs related to the needs of the general population, most-at-risk populations (MARPs), medical services, biomedical services, treatment and care, and support functions. Annex 1 provides the complete list of items for each category.

In most applications, the Goals Model calculates the support functions (administration, policy/advocacy/enabling environment, human resources, research, monitoring and evaluation, and other non-service categories) as a percentage of the direct costs of prevention and treatment and care activities. The percentages generally are determined from analyses of HIV and AIDS expenditures in the country. Since the revised NSP had already calculated the support functions, the HPP team used the revised amounts. The NSP costing team made a special effort to provide yearly amounts for each category: these amounts are non-linear and do not increase automatically every year, as they are calculated based on actual program needs.

The Goals Model does not use or project the costs of mitigation activities. For this area, the HPP team also used the revised NSP calculations and added them to the prevention, treatment, and support costs to provide the total costs of the different scenarios.

The team used the following sources for demographic, program parameter, and cost information:

- The 2010 Goals exercise
- The 2011–2015 National Strategic Plan
- The revised 2011–2015 costed strategic plan (provided to HPP in February 2012)
- The costing study conducted in 2010 on HIV and AIDS clinical care and treatment[4]
- Two costing studies completed after the Ghanaian stakeholders were introduced to Goals in October 2011:
    - A prevention of mother-to-child transmission (PMTCT) costing study, completed in December 2011
    - Key population costing studies, completed in January 2012

For the development of the scenarios, the Goals methodology requires the creation of a baseline projection that reflects the historical pattern of the epidemic in Ghana. The Goals Model extends the baseline projection into the future, assuming no further behavior changes or increases in coverage (no scale-up of any activities). The baseline projection often is referred to as the cost of not changing anything from the first year to the end year of the projection—that is, either targeting the same number of people on treatment and/or keeping coverage levels constant throughout the entire baseline period, allowing only for population increases.

Through the use of the baseline, the Goals Model develops scenarios via changes in coverage or the number of people who receive different kinds of services. The scenarios then are compared to the baseline through the improved outcomes, such as infections and deaths averted.

In addition, the Goals Model facilitates the creation of a best case scenario, in which most programs are scaled up to "universal access" or close to full scale-up. The desired scaled-up interventions, either whole categories (prevention, treatment, mitigation) or specific interventions (such as voluntary counseling and testing or HIV testing and counseling (HTC), PMTCT, treatment of STIs, blood safety, adult

[4] Rosen, J. and F. Asante. 2010. *Cost of HIV/AIDS Adult and Pediatric Clinical Care and Treatment in Ghana*. Washington, DC: Futures Group, Health Policy Initiative, Task Order 1.

antiretroviral therapy [ART], or pediatric ART) then are maintained in their full scaled-up amounts. When there is not enough funding for all activities, stakeholders may want to scale up (or increase) certain categories and/or specific interventions while reducing others.

Generally, the Goals Model relies on a funding ceiling established by stakeholders. The ceiling reflects available funding for the program, based on prior commitments from domestic and international sources. Model implementers use this ceiling to determine the end year of the projection (for example, 2015, in a 2011–2015 forecast) and not the intermediate years (2012–2014). In Ghana, HPP developed this scale-up by extrapolating the funding ceiling for the intermediate years up to the last year of the projection.

The model uses the ceiling only for the last year of the projection because of the assumption that it will take countries time to scale up to the level of the funding ceiling. In the case of Ghana, the 2011 baseline cost is $60 million, and the assumption is that it will take four years for Ghana to reach $77 million (2015). For example, one funding scenario could be to increase ART coverage, which would not leave enough funds to cover remaining categories or/and interventions; that is, it would be necessary to reduce funding for the remaining categories with this scenario. The methodology then uses a reallocation formula that reduces the funding for the remaining categories.

For each scenario, the Goals Model projects the number of infections and deaths averted, as well as the costs associated with these outputs, to allow comparisons of the costs between scenarios. The cost per infection averted is calculated by dividing the incremental total costs of the program by the number of infections averted and comparing the baseline and the intervention scenarios. The cost per death averted is calculated by dividing the incremental total costs of the program by the number of deaths averted, also comparing baseline and intervention scenarios. An article published by Stover et al. (2006) on the expected effects of scaling up prevention programs to reach universal access by 2010 estimated the average cost per infection averted in low- and middle-income countries as $3,900.[5]

Cost-effectiveness can be assessed as the cost per life year gained—the incremental cost of the program divided by the life years gained. Life years gained are calculated from the difference between the number of people alive each year in the baseline and the intervention scenarios. To estimate the cost-effectiveness in terms of infections averted, it is necessary to calculate the number of life years gained per each infection averted. To do this, the Goals Model converts infections averted into additional disability adjusted life years (DALYs). DALYs "… are the sum of the present value of future years of lifetime lost through premature mortality, and the present value of years of future lifetime adjusted for the average severity of any mental or physical disability caused by a disease or injury."[6] For HIV, HPP assumed that each infection averted results in 32 additional DALYs (see Annex 2).

The Commission on Macroeconomics and Health (CMH) suggests that a cost-effective intervention is one that provides one additional year of life for less than three times the gross national income (GNI) per capita.[7] CMH also suggests that interventions providing an additional year for less than the GNI per capita are highly cost-effective. For Ghana, the figures are $3,720 and $1,240 respectively, based on the World Bank Atlas method of estimating GNI per capita.[8] Multiplying these figures by 30 DALYs per

[5] Stover, J., S. Bertozzi, J.P. Gutierrez, N. Walker, K.A. Stanecki, R. Greener, E. Gouws, C. Hankins, G.P. Garnett, J.A. Salomon, J.T. Boerma, P. De Lay, and P.D. Ghys. March 10, 2006. "The Global Impact of Scaling Up HIV/AIDS Prevention Programs in Low- and Middle-income Countries." *Science* 311(5766): 1474–1476.
[6] Fox-Rushby, J.A. and K. Hanson. "Calculating and Presenting Disability Adjusted Life Years (DALYs) in Cost-effectiveness Analysis." *Health Policy and Planning* 16(3): 326–331.
[7] Commission on Macroeconomics and Health. 2001. Investing in Health for Economic Development. Center for International Development, Harvard University.
[8] World Bank. 2011. "Gross National Income per Capita 2010, Atlas Method and PPP. Retrieved May 17, 2012, from http://siteresources.worldbank.org/DATASTATISTICS/Resources/GNIPC.pdf.

infection averted means that any program with costs equal to or below $113,000 would be cost-effective. Any program whose costs are equal to or below $38,000 would be considered highly cost-effective.

SCENARIOS

In February 2012, the working group selected four scenarios to be compared against a $77 million funding ceiling.[9] This report presents the baseline scenario and comparisons with the following agreed-on scenarios.

Baseline Scenario

This scenario also is called the NSP baseline. As stated earlier, the baseline scenario extends current targets and coverage of specific interventions for the baseline year (2011) through 2015, without any changes.

NSP Scenario

The NSP scenario reflects the new costed NSP that scales up only a limited number of interventions compared to the Universal Access approach in the original NSP document. The main interventions of the new costed NSP are the following:

- Treatment and care (ART—first and second line, nutrition, cotrimoxazole prophylaxis, laboratory tests)
- PMTCT
- HTC
- Condoms
- Blood safety
- STI treatment
- MARPs
- Mitigation
- Support functions

This scenario, which is based on the revised NSP, does not cost the following interventions, nor are they costed in subsequent Goals scenarios: (1) AIDS patients hospital services (inpatient and outpatient), (2) mass media, (3) community mobilization, (4) AIDS education (both in and out of school), (5) workplace programs, and (6) safe medical injections and universal precautions.

The NSP scenario is not matched against the funding ceiling of $77 million, and each major category is used as the most desired output.

[9] As a comparison, the August 2011 Goals report used a ceiling amount of $130 million. The January 2012 report used an amount of $70 million, per an email sent by a representative of the Country Coordinating Mechanism to HPP in December 2011.

75 Percent ART Scenario

This scenario is based on the following:

- A treatment target of 75 percent by 2015 (a reduction of the treatment coverage from 85 percent in the revised NSP)
- Reducing support functions to 75 percent of the costs as set in the revised NSP—this reduction is intended to mirror the decrease in coverage in ART
- PMTCT, as per the Ghanaian stakeholders' decision, is kept at the revised NSP levels
- A proportional decrease in all other NSP components, based on the remaining funding available for these interventions

75 Percent MARPs Scenario

This scenario is based on the following:

- A reduction of the MARPs coverage target from 80 percent to 75 percent, reducing the NSP projected amounts to 75 percent of their value. The revised NSP costing does not include only the services to MARPs. It also includes sizeable cost estimates for support functions required by full development of the program for key populations, such as international consultancies, and development of standard operating procedures.[10] Reducing support functions to 75 percent of the costs as set in the revised NSP is intended to mirror the decrease in coverage of MARPs. PMTCT, as in the previous scenario, is kept at the revised NSP levels.

75 Percent ART and 75 Percent MARPs Scenario

This scenario is based on the following**:**

- A reduction of the treatment coverage target from 85 percent of people in need of ART, as set in the revised NSP, to 75 percent
- A reduction of the MARPs coverage target from 80 percent receiving services, as established in the NSP, to 75 percent
- PMTCT is kept at the NSP levels (i.e., scaled up to universal access), providing services to 16,259 women by 2015
- Reducing support functions to 75 percent of the costs, as set in the revised NSP—this reduction is intended to mirror the decrease in ART coverage and coverage for key populations
- A proportional decrease in all other revised NSP components, based on the remaining funding available for these interventions

[10] During the HPP presentation of the scenarios provided in this report, stakeholders stated that the NSP MARPs costing should have been communicated more effectively to all stakeholders.

SCENARIO RESULTS

Costs

Table 1 and Figure 1 present the costs of all of the scenarios for the period 2011–2015. Annex 3 presents the summary annual costs of each scenario.

Table 1: Costs, all scenarios, 2011–2015, in US$ millions

All scenarios	Annual Costs, 2011–2015, in US million				
	Baseline	*NSP*	*75% ART*	*75% MARPS*	*75% ART & MARPS*
Prevention	**106**	**204**	**166**	**168**	**162**
PMTCT	27	32	32	32	32
HTC	33	44	34	34	29
Blood Safety	7	7	7	6	6
High Risk Sexual Behavior/Condoms	26	31	28	28	25
STI	7	8	8	7	7
MARPS	6	82	58	62	62
Treatment & Care	**58**	**81**	**75**	**67**	**75**
Mitigation	**14**	**15**	**15**	**11**	**10**
Support Functions	**113**	**145**	**87**	**108**	**102**
	290	**444**	**345**	**354**	**350**

Scenarios

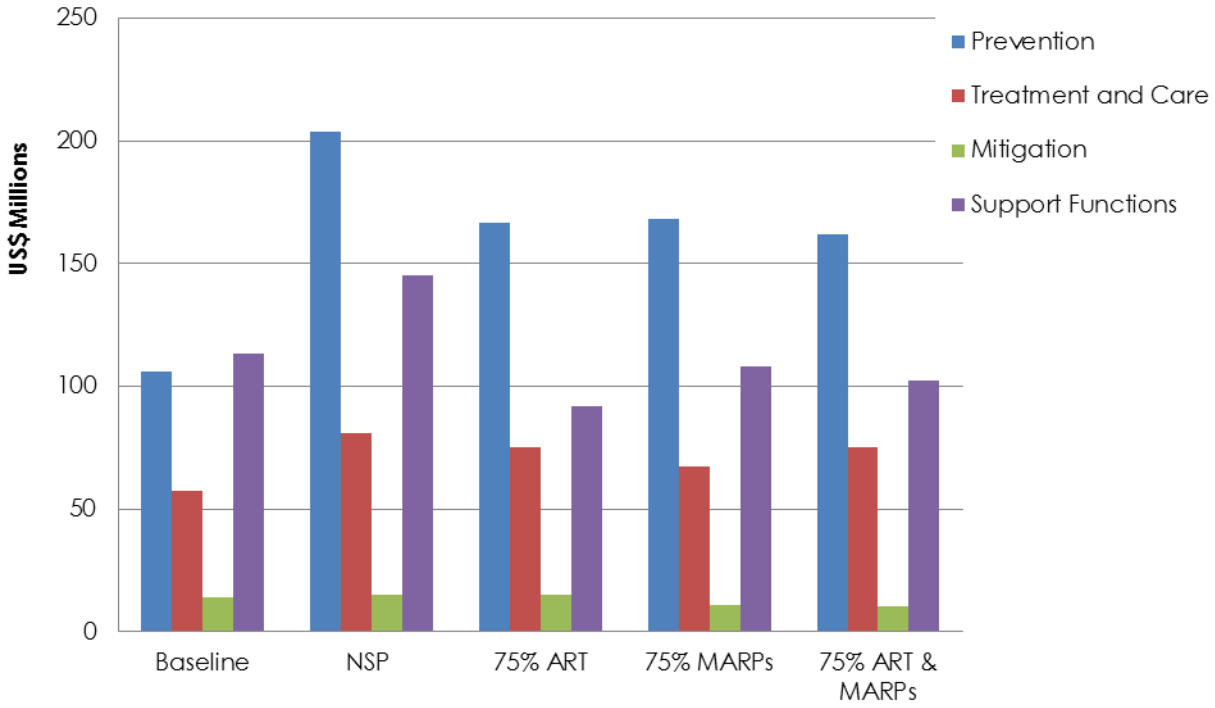
Baseline scenario

Total costs for the baseline scenario are estimated at $290 million for the period 2011–2015. The scenario does not increase the coverage of activities. Although coverage for key interventions is constant, the number of people reached grows for many other interventions as a result of population growth. The key features of this scenario are the following:

- Total prevention costs amount to $106 million, including costs for key populations (MARPs—$6 million) and PMTCT ($27 million). The PMTCT costs include the costs of Option B (triple prophylaxis for 14 weeks) for women during the prenatal stage. HTC and condoms are projected to amount to $33 million and $26 million, respectively.

- Treatment and care costs ($58 million) cover the cost of services to approximately 55,000 ART patients. This amount includes first- and second-line treatment, as well as treatment of opportunistic infections (OIs), laboratory services, and nutritional supplements.
- Mitigation costs targeting orphans and vulnerable children, including education, healthcare, family/social support, and administrative costs, amount to $14 million.
- Support functions amount to $113 million.

Figure 1: Scenario costs, in US$ millions, 2011–2015



NSP scenario

Total costs for the NSP scenario are estimated at $444 million for the period 2011–2015.[11] This scenario is 133 percent higher than the costs of the baseline scenario and reflects major program target increases in prevention and treatment programs, as established in the 2011–2015 NSP. The key features of this scenario are the following:

- Most categories show major increases in costs compared with the baseline projections. The costs of services for key populations and support functions are the two categories that contribute most to these increases.
- Costs for key populations are estimated at $82 million, the second largest cost in this scenario (after support functions). Notably, starting in 2012, the costs for key populations go beyond the costs of providing services for these populations. They include substantial costs of non-client-directed services, such as national and expatriate consultants' salaries, training, development of procedures, purchases of information and communication technology equipment, support to stakeholders groups, and other costs.

[11] The revised NSP costing estimates $444 million for the same period.

- Support functions also constitute a high cost for this scenario, at $145 million, which constitutes approximately a third of its total costs.

75 percent ART scenario

This scenario is constrained by the $77 million ceiling funding by 2015, and the total costs are $344 million for the period, a decrease of almost $100 million as compared to the NSP. The key features of this scenario are the following:

- A decrease for treatment and care from $81 million in the NSP to $75 million in this scenario; this is due to the reduction in coverage of those needing ART—from 85 percent to 75 percent.
- A reduction in all of the other categories, which include prevention (except PMTCT), mitigation, and support functions; the reduction results from the need to scale back these interventions to accommodate funding for two priorities of treatment and care reduced to 75 percent and keep PMTCT intact.

75 percent of MARPs scenario

Total costs for the 75 percent MARPs scenario are estimated at $354 million for the period 2011–2015. This represents $90 million less than the full NSP scenario. The salient points of this scenario are the following:

- The combination of the decrease in MARPs coverage from 80 percent to 75 percent and reducing non-client (i.e., key populations) services to 75 percent of the revised NSP levels result in MARP projected cost estimates of $62 million for the period 2011–2015.
- A decrease in the amount for treatment and care from $81 million in the NSP revised costing to $67 million as a result of resource allocation to accommodate the key populations funding.

75 percent ART and MARPs scenario

Total costs for the combined 75 percent ART and MARPs amount to $350 million for the period 2011–2015. This scenario retains the 75 percent decrease in coverage for ART and MARPs, but keeps PMTCT intact. This results in more reductions for the other components than any other scenario, compared with the revised NSP costing.

Scenario Outcomes and Cost-Effectiveness

Table 2 presents the outputs for key costs, coverage levels for ART, and impacts for all of the scenarios (also see Annex 4 for additional information on numbers of new infections and AIDS-related deaths).

Table 2: Coverage, scenario impacts, and cost-effectiveness indicators

Scenario	Number of adults on ART by 2015	Percentage of adults on ART by 2015	MARPs coverage	Decrease in the number of new infections (2011–2015)[12]	Decrease in the number of AIDS-related deaths (2011–2015)[13]	Cost per infection averted (in $)	Cost per death averted (in $)	Cost per Life year gained (in $)
Baseline	54,894	43%[14]	30%[15]	-	-	-	-	-
NSP	110,494	85%	80%	56%	62%	8,300	7,300	3,700
75% ART	97,936	75%	61%	46%	49%	3,500	3,200	1,600
75% MARPs	78,100	60%	75%	37%	26%	5,700	7,000	3,600
75% ART & MARPs	97,936	75%	75%	43%	49%	4,600	3,600	1,800

The scenarios show the following results:

- The **baseline scenario** indicates that the people receiving ART as a percentage of those in need of ART stay at a constant 43 percent, or 54,894 people, between 2011 and 2015. The coverage of key populations reached by 2015 is the same as in 2011 (30%).
- The **NSP scenario** would cover 85 percent of those in need of ART, or 110,494 persons on ART, by 2015. Key population coverage, as established by the 2011–2015 NSP, is set to reach 80 percent by 2015. Implementing the NSP scenario would result in a sharp decrease in the number of infections and deaths averted (56% and 62%, respectively), as shown in Table 2 and Figures 2 and 3. This is due to the massive scaling up, compared to the baseline scenario. The cost per life year gained is cost-effective at $3,700, according to the guidelines described above.[16]

[12] Compared to the baseline.
[13] Compared to the baseline.
[14] Based on the Goals outputs, which may be different from those of the Ghana National AIDS Control Program.
[15] Calculated as the average between the current coverage of services for sex workers (SWs) (25%) and males who have sex with males (MSM) (35%).
[16] The cost per infection averted is calculated by dividing the incremental total costs by the number of infections averted between the baseline and the other scenarios. The cost per death averted is calculated by dividing the incremental total costs by the number of deaths between the baseline and the other scenarios. The cost per life year gained is the incremental costs of the program divided by the number of lives saved. Lives saved are calculated from the difference between the adult population projections, comparing the baseline and the other scenarios.

Figure 2: Decline in the number of new infections, by scenario

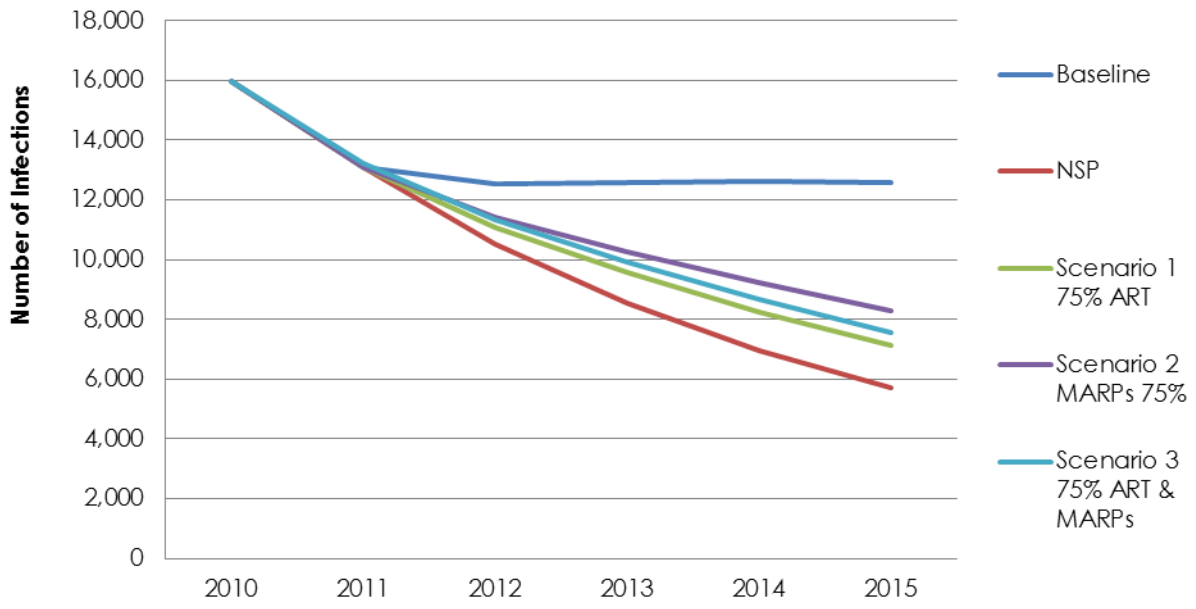
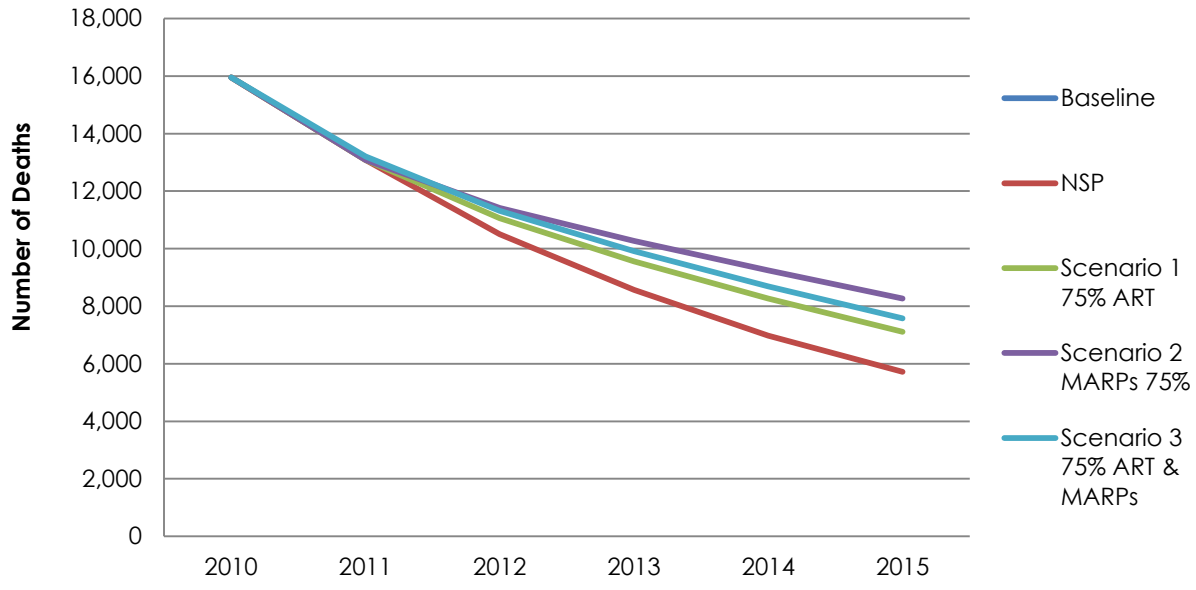


Figure 3: Decline in the number of new AIDS-related deaths, by scenario[17]



[17] The line graph for the 75 percent ART scenario does not appear, as its outputs are very similar to the combined 75 percent ART and MARPs scenario. Annex 4 provides the table for the number of deaths and infections for each scenario.

- The **75 percent ART scenario** would meet the ART needs of 75 percent of those in need; that is, it would result in provision of services to 97,936 patients by 2015. In this scenario, the coverage of MARPs at 61 percent is more than double the coverage at the baseline scenario. Compared to the baseline scenario, implementing the ART scenario would result in 46 percent fewer infections and 49 percent fewer AIDS-related deaths, as shown in Table 2 and Figures 2 and 3. However, the decrease is less when compared to the NSP scenario. The 75 percent ART scenario provides outputs with cost per infection averted ($3,500), cost per death averted ($3,200), and cost per life year gained ($1,600), the latter making this scenario cost-effective.
- Under the **75 percent MARPs scenario,** coverage is set at 75 percent of the NSP scenario level, and ART coverage is set at 60 percent of the adult population needing ART (78,100) by 2015, resulting in 78,100 ART patients by 2015. Compared to the baseline scenario, the MARPs scenario results in a 37 percent decline in the number of infections and a 26 percent decline in the number of deaths. Compared to the NSP and 75 percent ART scenarios, the decrease in the number of deaths and infections averted is less. Costs per infection and death averted are $5,600 and $7,000, respectively, both substantially higher than in the 75 percent ART scenario. At $3,600, the cost per life year gained is cost-effective.
- The **combined 75 percent ART and MARPs scenario** keeps the same number of people on ART as the 75 percent ART scenario, while the key population coverage is set as the 75 percent MARPs scenario. This scenario shows a decrease of 43 percent in the number of infections and 49 percent in deaths. The scenario is cost-effective at $4,600 per infection averted, $3,600 per death averted, and $1,800 per life year gained.
- With the DALYs benchmark, all of the scenarios, including the baseline and the NSP scenarios, are cost-effective, as they are below $112,712, and they even rank as highly cost-effective, as they are all under the benchmark of $77,572.

CONCLUSIONS

Through use of the Goals Model, this preliminary analysis aims to illustrate the results that can be achieved in different scenarios for prevention, treatment, and mitigation coverage for HIV and AIDS. In January 2012, Ghana received preliminary feedback and specific instructions from the Global Fund regarding priority programs it would like Ghana to consider. Ghana may not be able to pick up the preferred scenario (75 percent ART scenario) in its entirety. Through its National Strategy Application proposal, Ghana may be able to use part of the scenarios, in line with the Transitional Funding Mechanism requirements of the Global Fund, bearing in mind the impact of each option as presented by the Goals Model.

The conclusions derived from the analysis are as follows:

- The NSP scenario produces the most desired outcomes for new infections and deaths averted. It is the most expensive scenario but still meets the guidelines for cost-effectiveness.
- Reducing the costs for ART patients from the targeted 85 percent to 75 percent is not enough to decrease total program costs to $77 million by 2015. Also, reducing the costs of MARPs from 80 percent to 75 percent does not reduce the costs of the program by 2015. To reach $77 million by 2015, all other cost categories must be reduced proportionately.

- Mitigation and support functions costs were re-apportioned in the Goals Model at the aggregate levels, not at each sub-category level. Stakeholders should discuss the specific activities that could be reduced.
- In the scenarios, the largest reductions in prevention activities occurred in condoms and HTC, with minor reductions in blood safety and STI treatment. The analysis targeted condoms because this is the one category that shows the most potential for reductions. Even in the scenario in which condom costs were reduced the most (the combined 75 percent ART and MARPs scenario), the number of condoms projected for procurement was 174 million units. The number of condoms to be procured for 2011 was estimated at 120 million units, and the NSP estimated that by 2015, Ghana would need to purchase 236 million units—a remarkable increase in five years. Stakeholders may want to discuss whether the procurement estimates are valid.
- For the three ceiling-constrained scenarios (75 percent ART, 75 percent MARPs, and combined 75 percent ART and MARPs), the 75 percent ART scenario shows, by 2015, the largest number of infections averted (15,000), compared with 75 percent MARPs (11,000) and combined 75 percent ART and MARPs (13,000).
- The 75 percent ART scenario also shows the largest number of deaths averted (more than 16,000). Similarly, the combined 75 percent ART and MARPs scenario also averts approximately 16,000 deaths by 2015.
- Compared to the other two scenarios, 75 percent ART has the lowest cost per infections and deaths averted. However, under the DALYs benchmark, all of the scenarios are highly cost-effective in infections averted.
- Reiterating the conclusion of the 2010 Goals report, Ghana must continue to allocate resources to the most cost-effective prevention programs—PMTCT and MSM and SW outreach, along with care and treatment and impact mitigation. This will allow Ghana to continue reducing the number of new HIV infections beyond the 2015 horizon.
- In this report, the focus of the Goals projections is on the many direct costs of providing prevention, treatment, and, to a much lesser extent, the costs of mitigation and support services that do not have any direct impact on outcomes. Cost estimates for "health systems" interventions—especially hospital bed days for ART and OI patients, universal precautions, and safe medical infections—are not included either in the revised NSP costing or the Goals costs presented in this report. The costs of maintaining and increasing these interventions programs should be estimated and efforts made to ensure sufficient funding to support service delivery.

Costs of support functions constitute a high proportion of total program costs in all of the scenarios—between 25 and 39 percent. Some components of the support functions are essential to support the delivery of prevention, treatment, and mitigation services, as recognized by the United Nations Program on HIV/AIDS Investment Framework. In most costing exercises, the usual benchmark for support costs is approximately 15 percent. The Ghanaian stakeholders should explore the potential for efficiency gains and savings that could be redirected to programs either for the general population or key populations.

ANNEX 1: COMPLETE LIST OF GOALS OUTPUTS

General population

- Community mobilization
- Mass media
- VCT
- Condoms
- AIDS education
- Out-of-school youth
- Workplace programs

Most-at-risk populations

- Sex workers
- MSM: outreach
- MSM: lubricants
- PWID: outreach
- PWID: needle exchange
- PWID: drug substitution

Medical services

- STI management
- Blood safety
- PEP
- Safe medical injection
- Universal precautions

Biomedical

- PMTCT
- Male circumcision
- Microbicides
- PrEP

Treatment

- First-line ARV
- Second-line ARV
- TB-ARV
- Lab tests
- OI treatment
- Cotrimoxazole
- TB prophylaxis
- Nutrition
- First-line service delivery costs
- Second-line service delivery costs
- OI treatment service delivery costs

Support functions

- Policy
- Administration
- Research
- Monitoring and evaluation
- Communications
- Logistics
- Human resources
- Training

ANNEX 2: CALCULATION FOR ONE HIV INFECTION AVERTED

DALYs calculation for one HIV infection averted

1. Assume that death occurs 11 years after infection				
2. Assume disability occurs 9 years after infection, lasts for 2 years, and has a value of 0.5				
		1. Death	2. Disability	3. Combined
Constant	Const	0.16243		
Discount rate	Discount Rate	0.03		
Constant	b	0.04		
	e	2.71		
Disability weight (=1 for death)	D	1	0.5	
Year of onset of disability or death	a	11	9	
Years of life left after onset of disability or death	L	45	2	
	DALYs=	33.3	1.0	32.4

ANNEX 3: SUMMARY OF COSTS, BY SCENARIO

Baseline Scenario	Annual Costs, 2011–2015, in US$ millions				
	2011	*2012*	*2013*	*2014*	*2015*
Prevention	**20**	**21**	**21**	**22**	**22**
PMTCT	5	5	5	6	6
HTC	6	6	7	7	7
Blood Safety	1	1	1	1	1
High-Risk Sexual Behavior/Condoms	5	5	5	5	5
STIs	1	1	1	1	1
MARPs	1	1	1	1	1
Treatment and Care	**10**	**12**	**11**	**12**	**12**
Mitigation	**3**	**3**	**3**	**3**	**3**
Support Functions	**27**	**28**	**20**	**20**	**18**
Grand Total	**60**	**63**	**55**	**56**	**55**

NSP Scenario	Annual Costs, 2011–2015, in US$ millions				
	2011	*2012*	*2013*	*2014*	*2015*
Prevention	**20**	**35**	**51**	**46**	**52**
PMTCT	5	6	6	7	7
HTC	6	7	9	10	11
Blood Safety	1	1	1	1	1
High-Risk Sexual Behavior	5	6	6	7	7
STIs	1	2	2	2	2
MARPs	1	13	26	19	22.6
Treatment and Care	**10**	**14**	**16**	**19**	**21**
Mitigation	**3**	**3**	**3**	**3**	**3**
Support Functions	**27**	**33**	**29**	**29**	**28**
Grand Total	**60**	**85**	**98**	**97**	**104**

75% ART Scenario	Annual Costs, 2011–2015, in US$ millions				
	2011	*2012*	*2013*	*2014*	*2015*
Prevention	**20**	**30**	**40**	**36**	**40**
PMTCT	5	6	6	7	7
HTC	6	6	7	7	7
Blood Safety	1	1	1	1	1
High-Risk Sexual Behavior	5	5	6	6	6
STIs	1	2	2	2	2
MARPs	1	9	18	13	16
Treatment & Care	**10**	**14**	**15**	**17**	**19**
Mitigation	**3**	**3**	**3**	**3**	**3**
Support Functions	**27**	**17**	**15**	**15**	**14**
Grand Total	**60**	**63**	**73**	**71**	**77**

75% MARPs Scenario	Annual Costs, 2011–2015, in US$ millions				
	2011	*2012*	*2013*	*2014*	*2015*
Prevention	**20**	**30**	**41**	**37**	**40**
PMTCT	5	6	6	7	7
HTC	6	6	7	7	7
Blood Safety	1	1	1	1	1
High-Risk Sexual Behavior/Condoms	5	5	6	6	6
STIs	1	1	1	1	1
MARPs	1	10	20	14	17
Treatment & Care	**10**	**13**	**13**	**15**	**16**
Mitigation	**3**	**2**	**2**	**2**	**2**
Support Functions	**27**	**23**	**20**	**20**	**19**
Grand Total	**60**	**68**	**76**	**73**	**77**

75% ART & MARPs Scenario	Annual Costs, 2011–2015, in US$ millions				
	2011	*2012*	*2013*	*2014*	*2015*
Prevention	**20**	**29**	**40**	**35**	**38**
PMTCT	5	6	6	7	7
HTC	6	5	6	6	6
Blood Safety	1	1	1	1	1
High-Risk Sexual Behavior/Condoms	5	5	5	5	5
STIs	1	1	1	1	1
MARPs	1	10	20	14	17
Treatment & Care	**10**	**14**	**15**	**17**	**19**
Mitigation	**3**	**2**	**2**	**2**	**2**
Support Functions	**27**	**21**	**18**	**18**	**18**
Grand Total	**60**	**65**	**75**	**72**	**77**

ANNEX 4: INFECTIONS AND DEATHS OUTCOMES, BY SCENARIO

New HIV Infections

	NSP Baseline	NSP	Scenario 1 ART 75%	Scenario 2 MARPs 75%	Scenario 3 75% ART & MARPs
2010	15,951	15,951	15,951	15,951	15,951
2011	13,088	13,088	13,088	13,088	13,206
2012	12,534	10,507	11,062	11,412	11,315
2013	12,559	8,561	9,560	10,271	9,913
2014	12,607	6,976	8,262	9,243	8,686
2015	12,586	5,714	7,107	8,266	7,575

AIDS-Related Deaths

	NSP Baseline	NSP	Scenario 1 ART 75%	Scenario 2 MARPs 75%	Scenario 3 75% ART & MARPs
2010	16,744	16,744	16,744	16,744	16,744
2011	12,765	12,765	12,765	12,765	12,766
2012	12,069	9,995	10,517	11,231	10,521
2013	12,381	7,958	9,015	10,544	9,026
2014	12,766	6,238	7,726	9,982	7,752
2015	13,037	4,839	6,521	9,390	6,571

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