

Supplementary Appendix

This appendix has been provided by the authors to give readers additional information about their work.

Supplement to: Kappos L, Antel J, Comi G, et al. Case 28-2006: A 59-year-old man with masses in both kidneys. *N Engl J Med* 2006;355:xxxx-xx.

SUPPLEMENTARY APPENDIX

The supplementary appendix is divided into five sections; A. Methods; B. Data Inputs and Assumptions; C. Secondary Analysis; D. Sensitivity Analyses, and E. References.

A. METHODS

A.1. Overview

We modified a previously published model of the natural history of HIV disease¹ to assess the clinical benefits and costs associated with various treatment strategies for HIV-infected patients in resource-limited settings. Model outcomes included the number of opportunistic diseases, life expectancy, and lifetime costs for a representative cohort of HIV-infected individuals. The comparative performance of various strategies was assessed using incremental cost-effectiveness ratios, expressed as U.S. dollars (2002) per year of life saved.

A.2. Model

We used a first-order Monte Carlo simulation model in which disease progression in an individual patient was characterized as a sequence of monthly transitions from one “health state” to another.² Health states in the model, descriptive of each patient’s underlying true health, are defined by current and maximum HIV RNA, current and lowest CD4 lymphocyte count, and current and prior opportunistic diseases. A random number generator and a set of estimated probabilities are used to determine the sequence of clinical pathways that a given patient follows until death. The characteristics of simulated patients (age, sex, CD4 cell count, HIV RNA level) were randomly drawn from a distribution of patients similar to those enrolled in the placebo arm of the ANRS 059 trial:³ median age 33 years, 40% male, baseline CD4 count 331 cells/mm³. Each patient’s

clinical course was then tracked, with a running tally maintained of all acute clinical events, the length of time spent in each health state, and the cost associated with each health state. Upon a patient's death, summary statistics for that individual were recorded. One million patients were simulated, one at a time, in order to provide stable estimates of long term outcomes for each strategy. Overall performance measures (e.g., average life expectancy and average per-person lifetime costs) for the population were then computed.

The progression of underlying HIV disease is modeled as a function of both HIV RNA and CD4 cell counts, although in this analysis we do not examine treatment strategies that utilize HIV RNA testing.^{1,4,5} Opportunistic diseases were divided into 11 groups based on primary data from Côte d'Ivoire, including 8 groups of severe diseases (severe malaria, severe bacterial infections, severe fungal infections, tuberculosis, isosporiasis, cerebral toxoplasmosis, non-tuberculous mycobacteriosis (NTM), other severe illnesses) and 3 groups of mild diseases (mild bacterial infections, mild fungal infections, other mild illnesses); The diseases included in each of these groups are listed in Manuscript Table 1.^{6,7}

A.2.1. Clinic Visits and “True” vs. “Observed” Clinical Events and Laboratory Markers

While the model updates CD4 cell counts and HIV RNA levels monthly and determines disease progression based on these values, we assumed that clinical decisions were made based on less frequent CD4 cell measurements and other clinical information obtained at these clinic visits. In the model, all simulated patients attend an initial clinic visit. In the base case, patients then return for regular clinic visits every 6 months when prophylaxis or antiretroviral therapy (ART) is available or every 12 months when treatment is not available, and also return to the clinic upon

the occurrence of an acute opportunistic disease. Decisions regarding treatment initiation and discontinuation may only be made if a patient's clinical status is "observed" to meet the specified treatment initiation or discontinuation criteria by the model's clinic. It is important to note that the model distinguishes between "true" and "observed" clinical events and laboratory markers of immunologic and virologic status. "True" measures of CD4 cell count, HIV RNA, and opportunistic disease status are estimates based on data from Côte d'Ivoire and dictate each patient's disease progression and current clinical status, while "observed" measures, which represent the results of monitoring tests and exams performed at a clinic visit, serve to inform treatment decision-making.

For example, the model defines a simulated patient's "true" CD4 cell count based on his underlying immune function, and this "true" CD4 declines at a rate dependent on viral load. In addition, a patient's probability of acquiring an opportunistic disease is based on his or her "true" CD4 cell count. The model incorporates biological heterogeneity by drawing each patient's CD4 changes from a distribution. We have assumed that rates of clinical events are constant within clinically important CD4 strata, reducing the impact of measurement error in a model-based evaluation of disease progression. As such, the "true" CD4 cell count defines the patient's risk of opportunistic disease and death each month, regardless of whether a monitoring test is performed and the CD4 cell count is "observed" at a clinic visit. Only when a CD4 monitoring test is performed may the model's clinic "observe" a patient's CD4 cell count. All CD4-based clinical decisions in the model are made based solely on this "observed" CD4 cell count, rather than on a patient's "true" underlying CD4. Since CD4 was measured only every 6 months in the base case analysis, if a patient visited the clinic in between CD4 monitoring appointments,

clinical decisions made at that appointment were based upon the patient's most recent CD4 measurement rather than the patient's "true" CD4 cell count. The frequency of CD4 measurements was examined in sensitivity analyses.

A.2.2. ART Efficacy: Viral Suppression and CD4 Gains

In the model, the efficacy of an ART regimen is defined by the absence of that regimen's actual failure. Antiretroviral failure and efficacy are defined both virologically (viral suppression) and immunologically (CD4 gain on effective ART).

Viral suppression and virologic failure: When a patient fails a regimen, viral load begins to increase back to the patient's viral setpoint. An efficacious ART regimen will cause the patient's viral load either to stay the same or to decrease towards suppression. Complete viral suppression is defined as an HIV RNA of <500 copies/mL.

In any given month that a patient is receiving efficacious ART, the model performs a random draw to determine the regimen's effect on the patient's current "true" (i.e., not "observed") viral load. For each combination of the patient's starting viral setpoint and current "true" viral load stratum, probabilities are assigned that dictate how likely it is that the patient's viral load will either: 1) stay in the current viral load stratum, 2) drop to any of the lower strata, or 3) move up to one of the higher strata (i.e., fail). The sets of monthly viral transition probabilities for each ART regimen have been consolidated into a single "efficacy matrix." The failure probabilities are computed by the model based on this ART efficacy matrix, which is derived from a single representative ART regimen: the 3-drug arm of ACTG 320.⁸ Rather than deriving an entire

efficacy matrix for each ART regimen included in the model, the model adjusts this primary matrix to reflect the differences in ART regimens using an ART efficacy “failure multiplier.” Each ART regimen is assigned a failure multiplier that is based on the reported virologic efficacy of that particular regimen. This failure multiplier is applied to the primary matrix’s failure probabilities. Further discussion of methods pertaining to the ART efficacy matrix may be found in the technical appendix of Weinstein, et al., *Annals of Internal Medicine*.⁹

Published data suggest that ART regimens have multiple temporal stages of effect.¹⁰⁻¹² As such, the magnitude of CD4 or viral load change in certain months can be dramatically different from the magnitude of these changes in other months. Virologically, the model simulates this time-dependent change by separating the primary ART efficacy matrix into different periods of viral transition probabilities. The model user is able to specify the amount of time ART’s viral efficacy will depend on the transition probabilities within each of these time periods. Currently, we specify a 10 year limit on the time that a simulated patient’s viral load may continue to improve. Therefore, after 10 years, if a patient has not yet started to fail his current ART regimen, the ART efficacy matrix will trigger the initiation of ART failure. The patient’s time to complete failure will then be governed by the failure probabilities within the ART efficacy matrix. The 10 year time limit was examined in sensitivity analyses.¹⁰⁻¹²

Immunologic efficacy and failure: In addition to basing ART efficacy on viral suppression, the model also defines ART efficacy by the number of CD4 cells a patient gains over a specified time period. This “CD4 gain on effective ART” defines the changes in a patient’s CD4 cell count until the patient’s viral load begins to increase, at which point virologic failure triggers the initiation of immunologic failure. After the patient’s viral load begins to increase, changes in the

patient's CD4 cell count are governed by a "lag time" change in CD4. In the base case analysis, this lag time is set to 12 months, throughout which time the CD4 cell count remains constant. Both the time period and the CD4 change for this lag were examined in sensitivity analyses. After the specified lag period expires, the model defines the CD4 of a patient who has failed a particular ART regimen using the natural history CD4 cell count decline.

A.2.3. Independent Effect of ART

An increasing body of evidence suggests that ART has a protective effect on opportunistic disease incidence and AIDS mortality,^{7,13} independent of CD4 cell count. An independent protective effect of ART was modeled as a multiplier which decreases the monthly incidence of opportunistic diseases and mortality from AIDS for all patients with CD4 cell count >50 cells/mm³.^{7,13} To model the independent effect of ART in patients with CD4 ≥ 50 /mm,³ a rate ratio of 0.24 was applied to chronic mortality rates and rate ratios of 0.62-0.66 were applied to the incidence of severe opportunistic diseases while patients were receiving antiretroviral treatment.¹⁴

A.2.4. Clinical Decision-making

ART Initiation: In the model, ART may be initiated using any of the following 6 decision rules:

1. When observed CD4 cell count is within a user-specified range *OR*
2. When observed HIV RNA is within a user-specified range *OR*
3. When observed CD4 cell count is within a user-specified range AND when observed HIV RNA is within a user-specified range *OR*
4. By a series of N observed primary or secondary opportunistic diseases, where both N and

the particular opportunistic diseases to be counted must be specified by the user *OR*

5. When observed CD4 cell count is within a given range AND by any one of the primary or secondary observed particular opportunistic diseases that the user specifies *OR*
6. After a given number of months, counted from the time that a patient enters the model

ART Discontinuation: The model makes a distinction between patients experiencing “true” virologic and immunologic failure on a particular ART regimen and patients being diagnosed as failing that regimen. “True” failure is the point at which the regimen stops providing any biological benefit to the patient, while diagnosed (“observed”) failure is the clinical observation of the regimen’s lack of continued benefit, at which point the failed regimen may be discontinued. It is important to emphasize that a patient can only be taken off a regimen if immunologic, virologic, or clinical failure is *observed*; “true” failure will not trigger ART discontinuation.

A patient may be “observed” as failing an ART regimen in one of three ways:

1. Observation of virologic failure via viral load test
2. Observation of immunologic failure via a CD4 test
3. Observation of clinical failure via opportunistic disease detection

Virologic failure is defined as an “observed” increase in viral load. The model user must specify how many strata viral load must increase for a patient to be considered failing a regimen (a viral load increase of 1 stratum is equivalent to a 0.5 log increase in HIV RNA copies/mL). In addition, the model will automatically consider an “observed” return to viral load setpoint to be

sufficient for failure diagnosis. However, in the current analysis, we did not consider viral load testing. As such, virologic failure could never be detected.

Immunologic failure is defined as an “observed” percent decrease in CD4 from peak on-treatment CD4. This percent decrease must be specified by the model user.

The ability to discontinue ART based on clinical criteria (the observation of opportunistic diseases) is crucial for analyses based in settings where CD4 and viral load monitoring may not always be available. Currently, the model permits ART discontinuation based on the following clinical criteria:

1. By a series of N “observed” primary opportunistic diseases, where both N and the particular opportunistic diseases to be counted must be specified by the user
2. By a series of N “observed” secondary opportunistic diseases, where both N and the particular opportunistic diseases to be counted must be specified by the user
3. By a series of N “observed” primary or secondary opportunistic diseases, where both N and the particular opportunistic diseases to be counted must be specified by the user

In addition to specifying how many opportunistic diseases should be included in the series, the user must also specify how many months after ART is initiated the program should begin counting these opportunistic diseases. This time lag before starting the opportunistic disease count is included in order to allow ART sufficient time to boost the simulated patient’s immune function (opportunistic disease incidence depends on CD4; the lower a patient’s CD4 count, the higher the probability of developing an opportunistic disease). With the time lag in place, we aim to avoid counting opportunistic diseases that occur during the period of immune

reconstitution toward the clinical diagnosis of ART failure.¹⁵ The length of this time lag was examined in sensitivity analyses.

A.3. Cost-effectiveness Analysis

A.3.1. Overview

A decision analysis that compares the relative health and economic consequences associated with different interventions is considered a cost-effectiveness analysis. In a cost-effectiveness analysis, we are asking: how much health improvement can be gained, dollar for dollar, compared to an alternative use of those resources.¹⁶ The underlying principle guiding the valuation of resources is opportunity cost, which reflects competing societal demands for resources. Cost-effectiveness analysis takes a utilitarian approach to health care policy since it explores the maximization of aggregate population health. Many additional criteria, however, must be considered in health care priority setting, such as affordability, equity, public preferences, and political and cultural consequences of decisions.¹⁷ To improve the quality and comparability of cost-effectiveness analyses there have been several published guidelines advocating for standard methods and assumptions¹⁶⁻²³ and to the extent possible our analysis reflects these recommendations. Several core principles are described below.

A.3.2. Cost-effectiveness Ratio

Results of cost-effectiveness analyses are summarized using a cost-effectiveness ratio. In the ratio, health outcomes (compared to an alternative) are included in the denominator, while costs or changes in resource use (compared to an alternative) are included in the numerator. Cost-

effectiveness analyses are always comparative, where ratios compare the costs and benefits of each strategy to the next most effective strategy. As such, the costs and clinical benefits associated with the intervention of interest should be compared to every other reasonable option.

In addition, the choice of a baseline comparator may vary depending on both the setting and the objective of the analysis. When the baseline comparator is specified as no intervention, the incremental cost-effectiveness ratio calculated for the first intervention of interest is sometimes referred to as an average cost-effectiveness ratio. For analyses which will be used for local decision making, it may be more appropriate to use the current standard of care as the baseline comparator. In our analysis, however, the comparator is the “do nothing” or “no treatment” alternative.

In order to for ratios to be comparable across different interventions and diseases, the denominator of the cost-effectiveness ratio must be expressed using a common metric, such as life-expectancy, years of life lost (a measure of the impact of an adverse health event, calculated by subtracting the age at which death occurs from life expectancy at that age), quality-adjusted life years (a unit for measuring the *health gain* associated with a clinical or public health intervention; calculated as the number of years of life saved adjusted for the quality of life during those years), or disability-adjusted life years (unit for measuring the *health lost* because of a particular disease, calculated as the future years of disability-free life that are lost as the result of the premature deaths or cases of disability occurring in a particular year). In our analysis, due to data limitations on quality and disability weights suitable for the health states in our model, we used life-expectancy gains as a measure of effectiveness.

We did not include non-health benefits in our analysis. Traditionally, non-health benefits are not captured in standard cost-effectiveness analyses; examples of this type of benefit range from a reduction in catastrophic out-of-pocket payments or impoverishment due to improvements in earning capacity to increases in the probability that a child would remain in school. Currently, no consensus exists on how to measure and quantify non-health benefits for inclusion in a cost-effectiveness analysis, but in the case of HIV-related interventions, their consideration, at least in a qualitative manner, will be important to consider in future analyses.

The numerator of the cost-effectiveness ratio represents the difference in resources used to implement one strategy compared to those used to implement the next best strategy. For analyses conducted from a societal perspective, costs must reflect resource use, not only for the intervention itself, but also for the downstream events that follow. Key cost categories include: (1) direct health care costs (e.g., clinic visits; laboratory tests; drug costs; consequent health care visits for treatment; further tests and treatment); (2) direct non-health care costs (e.g., patient transportation costs; child or dependent care; time spent by family for care-giving); (3) patient time costs (e.g., the time spent by the patient receiving care); and (4) programmatic costs (e.g., costs incurred at the administrative levels rather than the point of care delivery). In our analysis, we included only direct medical costs, but we emphasize that data must be collected to inform these other categories and future analyses should include a broader array of costs.

Costs are presented in currency units that remove price inflation. For analyses intended to inform resource allocation and compare studies from multiple countries, costs should be

expressed as international dollars.¹⁹ In this analysis, we chose to express costs in U.S. dollars since we limited our analyses to a single country within this paper.

Prices in local currency are converted to U.S. dollars by exchange rates (or to international dollars using purchasing-power parity rates). While the former may reflect under- or overvaluation of the local currency, they represent what is actually paid for locally produced inputs. Purchasing-power parity rates, in contrast, attempt to represent what local currency is worth in purchasing power, and therefore account for differences in price levels across countries. The exchange rate for domestic currency into international dollars is the amount of domestic currency required to purchase the same quantity of goods and services as \$1 could purchase in the U.S.^{19,20}

Future costs and benefits are discounted to their present values to reflect inherent uncertainty about the future and preferences for timing of consumption. Although there is consensus about the need to discount costs, controversy remains regarding the discounting of benefits, the appropriate discount rate to use, and whether the rate should be constant. For the base case, we used a constant 3% discount rate for costs and benefits; however, we examined constant rates of 0% and 5% in sensitivity analysis.

Costs (aside from drug prices) that are of particular relevance to HIV treatment strategies include costs of delivery strategies, costs attributable to wastage, and the costs of achieving incremental increases in coverage. Empiric data do not yet exist on any of these costs, however, we anticipate data will become available in the future from rollout programs. With “scale-up” and

increases in treatment coverage, an additional important issue to consider is how the rate of change in costs compares with changes in benefits. Scale-up refers to the changes in an intervention's effectiveness and costs as coverage is expanded to larger percentages of the eligible population.¹⁷ For some costs, economies of scale might be achieved (i.e., the per-person cost of delivering an intervention is reduced as coverage is increased) with, for example, bulk manufacturing and supply chain management. However, diseconomies of scale may also occur; for example, increased costs of distribution and staffing in remote locations. The functional relationship between cost and scale is frequently ignored but is worthy of further empirical study. We do not address these important issues in this paper but, as better data become available, they are worthy of aggressive investigation.

A.3.3. Reporting and Interpreting the Results of a Cost-effectiveness Analysis

Cost-effectiveness results are often displayed in the format of an efficiency curve as shown in Manuscript Figure 2. Strategies lying on the efficiency curve dominate those lying to the right of the curve because they are more effective, and either cost less or have a more attractive cost-effectiveness ratio than the next best strategy. The slope between two strategies is steeper when the net gain in health per unit cost is greater.

Consistent with the recommendations, we stress that while interventions that improve health at a cost ideally should be compared with other interventions that compete for the same potentially scarce resources, there is no universal criterion that defines a threshold cost-effectiveness ratio, below which an intervention would be considered cost-effective. A commonly cited rule of thumb, as we mention in the paper, is based on a report by the Commission on Macroeconomics

and Health (CMH), following which others suggested that interventions are “very cost-effective” and “cost-effective” if they have cost-effectiveness ratios less than the per capita Gross Domestic Product (GDP) or three-times the per capita GDP, respectively.²⁴ Because of the interaction between cost-effectiveness, disease burden, and available funds, sole consideration of the cost-effectiveness ratio is an inadequate guide to priority setting. Additional criteria such as affordability, distributional impacts and equity considerations, capacity to deliver interventions, and public preferences can often be more influential.

That being said, provided there is acknowledgement that cost-effectiveness is only one relevant input for policy decisions, and when comparable methods are used to conduct analyses, use of the per capita GDP as a rough indicator of monetary resource constraints is not unreasonable. On the *single dimension* of cost-effectiveness, having some threshold range (e.g., 1 – 3 times the per capita GDP) allows us to loosely classify interventions into broad categories of very cost-effective, not cost-effective, or potentially cost-effective. It also allows us to conduct uncertainty analyses that identify the probability that a cost-effectiveness ratio will fall below some threshold.

For interventions being considered for very poor countries in particular, there may indeed be a lower “threshold ratio” that an intervention would need to fall under in order to compete for scarce resources if existing interventions that were adopted and already implemented (e.g., childhood immunization) had ratios much lower than the GDP rule of thumb cited above. For example, if the resources currently allocated to the provision of HIV treatment were competing with the same pot of resources being used for childhood vaccinations, one might argue that the

ratio under which new interventions would be considered “competitive and good value for money” would be those ratios associated with childhood vaccinations. In the real world, however, this is not quite the case. If it were, we might only consider prophylaxis alone (at \$240 per YLS) or prophylaxis and ART using clinical criteria (at \$590 per YLS) to be competitive. One reason for conducting cost-effectiveness analysis though, is to demonstrate which interventions provide the most health for the dollar in order to point donors and funders to those interventions most worthy of support. Based on our analysis, ART for HIV-infected patients is such an intervention.

B. DATA INPUTS AND ASSUMPTIONS

B.1. Opportunistic Diseases and Mortality Data

Selected data are shown in Manuscript Table 1.^{3, 6, 7, 13, 25-38} Estimates for the initial viral load distribution were derived using data obtained from the Cotrame ANRS 1203 cohort, a continuation of ANRS 059.²⁵ The objective of the ANRS 059 double-blinded placebo-controlled randomized trial was to assess the efficacy of co-trimoxazole prophylaxis (800/160 mg once a day) in adults in Côte d’Ivoire at early clinical stages of HIV-infection. The trial took place in Abidjan between 1996 and 1998. Although CD4 count was not part of the inclusion criteria, it was systematically measured after randomization and every six months thereafter. Five hundred forty five HIV-infected adults at WHO clinical stage 2 or 3 were randomized into two study arms (co-trimoxazole 800/160 mg once a day, and placebo) and followed up a mean of 9.6 months. The main outcome was severe morbidity (defined as any event leading to hospitalization or death). The results were as follows: (i) co-trimoxazole led to a 53% reduction

in severe morbidity compared with the placebo; (ii) this morbidity reduction was partly due to the efficacy of co-trimoxazole in reducing severe bacterial morbidity and severe malaria; (iii) morbidity reduction was statistically significant in all CD4 strata, including the 200-500/mm³ CD4 stratum and the >500 CD4/mm³ stratum; (iv) cotrimoxazole tolerance was very good.

After the ANRS 059 trial ended in 1998, 723 study participants, including participants from a separate trial assessing the efficacy of a short term zidovudine regimen in reducing mother-to-child HIV transmission, continued to be followed up in the Cotrame ANRS 1203 cohort study.

Throughout the study, patients were asked to return monthly to the trial center. Blood cell count and CD4 cell count were measured every 6 months and care was free of charge. Co-trimoxazole prophylaxis was initiated in patients with CD4 cell count <500/mm³ or at WHO clinical stage ≥ 2 and highly active antiretroviral therapy was initiated in patients with CD4 cell count <200/mm³, or at WHO clinical stage 4, or with CD4 cell count 200-350/mm³ and WHO stage 3. Within this cohort, 187 adults (69% women) were followed up while receiving ART for a median of 19 months. At ART initiation, median age, CD4 count and VL were 36 years, 174/mm³ and 5.3 log₁₀ copies/ml, respectively. Initial ART regimens were two nucleoside reverse transcriptase inhibitors (NRTIs) plus one protease inhibitor in 81 patients, two NRTIs plus one non-nucleoside reverse transcriptase inhibitor in 95 patients, and two NRTIs in 11 patients. After 1 year, 51% of patients had undetectable VL and the median gain in CD4 was +115/mm³. No patients were lost to follow-up.

Estimates for the monthly incidence of opportunistic diseases and death were derived using data obtained from the placebo arm of the ANRS 059 trial and estimated as functions of four CD4 cell count strata (≤ 50 , 51–200, 201–500, and >500 cells/mm³) using methods previously

described.^{1, 3, 7, 35} Mortality rates from causes other than HIV were from country-specific life tables for Côte d'Ivoire.³⁹

B.2. ART Efficacy and Toxicity Data

For first-line ART, efficacy and toxicity parameters were based on the Cotrame ANRS 1203 cohort in Côte d'Ivoire.²⁵ After one year, 51% of these patients had undetectable viral load and the median gain in CD4 count was 115 cells/mm³. Incidence of severe adverse events causing discontinuation of at least one drug was 6.5 per 100 person-years.

In sensitivity analyses incorporating a second line of ART, we assumed that 43.2% of patients receiving a second regimen would have undetectable viral load at one year. This estimate represents the lower bound of the 95% confidence interval reported for 12-month viral suppression in a meta-analysis on ART in resource-poor settings.⁴⁰ Toxicity rates and CD4 gains for second-line ART were assumed to be identical to those used for first-line ART.

Based on a literature review, we established a plausible range for an upper and lower bound for ART efficacy and toxicity.^{26-30,40} For example, we varied the percentage of patients achieving HIV RNA suppression at one year from approximately 30% to 90%, and varied the probability of major toxicity from ART between 2% and 18%. Since rates of minor toxicity were not reported in the Cotrame ANRS 1203 cohort, we assumed the ratio of minor to major events would be similar to that observed for co-trimoxazole (~ 2.5 to 1). The efficacy of co-trimoxazole prophylaxis in preventing opportunistic diseases and rates of toxic events were derived from the ANRS 059 trial using methods described elsewhere.^{3,6}

B.3. Cost Data

Selected costs are shown in Manuscript Table 1. Direct medical costs of HIV-related care were obtained from the placebo arm of ANRS 059 trial,³ and included inpatient hospitalizations, outpatient medical consultations, laboratory tests, clinical procedures, and medications. Total costs attributable to inpatient care included the mean cost of each inpatient day multiplied by the length of stay, while those attributable to outpatient care included the mean cost of each visit, the total number of laboratory tests, dosage and quantity of medications, and total number of procedures. Costs prior to 2002 were inflated to 2002 price levels using the GDP deflator for Côte d'Ivoire, and costs in local currency were converted to U.S. dollars based on prevailing exchange rates.^{41,42}

Average costs per day for inpatient care were from Youpougnon University Hospital in Abidjan, Côte d'Ivoire. Average costs per outpatient medical consultation were from urban community clinics in Abidjan. Unit costs for laboratory tests and procedures were from the CeDReS laboratory of the Treichville University Hospital cost database. Medication costs, aside from ART and co-trimoxazole, were from the pharmacy records of Médecins sans Frontières-Logistique (Bordeaux, France), Pharmacie de Santé Publique de Côte d'Ivoire (the national public drug supplier), or private drug suppliers in Côte d'Ivoire. Using methods previously described, costs were estimated for treatment of acute opportunistic diseases and for routine chronic care in patients with different CD4 cell counts.⁶

The costs of first-line ART, reflecting recent negotiated prices for generic fixed dose

combinations for developing countries, and of co-trimoxazole, were based on published estimates.³¹⁻³⁴ We assumed first-line ART cost \$24.33 per person per month (\$292 per year), which represents the cost of a fixed dose regimen consisting of 2 NRTIs and one NNRTI manufactured by Ranbaxy in India.³³ We used \$12.17 per month (\$146 per year) for the lower bound in sensitivity analysis, based on the price negotiated by the Clinton Foundation.³¹ We assumed a second-line ART cost of \$56.83 per person per month (\$682 per year), which represents the cost of a boosted protease inhibitor regimen (\$500 per year; manufactured by Abbott) plus the cost of a two-NRTI background regimen, which we assumed would be recycled after first-line failure (\$82 per year; manufactured by Cipla).⁴³

C. SECONDARY ANALYSIS

We conducted a secondary analysis to assess the impact of the availability of a second ART regimen to follow first-line failure. Second-line ART provided an additional 10 discounted months of life expectancy, increased lifetime costs by \$1,080, and had an incremental cost-effectiveness ratio of \$1,300 per years of life saved (YLS), compared to the next most effective single-line ART strategy. Life expectancy (discounted and undiscounted), total lifetime costs, and cost-effectiveness ratio results of this analysis (Panel B), as well as for the base case analysis (Panel A) can be found in **Appendix Table C.1**.

D. SENSITIVITY ANALYSES

We conducted extensive sensitivity analyses on the structural assumptions of the model, ART efficacy and cost, treatment policy decisions, and other non-ART costs parameters. In the following section, we present the sensitivity analyses for the base case, where we assume

availability of only a single ART regimen, and for our secondary analysis, where we assume that a second-line ART regimen is also available. Selected results from these sensitivity analyses are presented below. The results are shown in **Appendix Tables D.1 – D.14**. These tables are organized in the following manner: panel A (upper) shows results for the base case assumption that a single ART regimen is available, and panel B (lower), shows these results for the secondary analysis in which a second-line ART regimen was assumed to be available; in each table, cost-effectiveness results in 2002 US\$ per YLS are presented first, followed by results for total lifetime costs in 2002 US\$, and life expectancy in months.

D.1 Sensitivity Analyses on ART Efficacy

We performed sensitivity analyses on the rate of viral suppression for first-line ART, results of which are shown in **Appendix Table D.1 Panel A**. In the base case, we assumed that 51% of patients receiving a single ART regimen will attain a viral load of <500 copies/mL by 48 weeks.²⁵ In sensitivity analyses, we decreased this suppression rate by 25% to 38.25% suppressed, and improved it by 25%, 50%, and 75% to 63.75%, 76.5%, and 89.25%, respectively. These suppression rates roughly approximate the range of 12-month suppression rates considered in a meta-analysis of ART programs in resource-poor settings by Ivers, *et al.* (range: 0.370–0.842; mean 0.573; 95% CI: 0.432–0.715).⁴⁰ The base case viral suppression rate of 51% yielded a life expectancy gain of 38.2 months compared to no treatment. Decreasing this rate by 25% and increasing it by 75% yielded life expectancy gains of 32.4 months and 54.0 months, respectively, compared to no treatment. Despite these dramatic changes in life expectancy gains, the parallel increases in costs resulted in a <10% improvement in the cost-effectiveness ratio of the most effective non-dominated strategy when the suppression rate of

first-line therapy was varied from 38.25% to 89.25% suppressed.

In addition, when second-line ART was made available, we performed a one-way sensitivity analysis on the second-line viral suppression rate, results of which are shown in **Appendix Table D.1 Panel B**. In the base case, we assumed a suppression rate of 43.2% for second-line ART.⁴⁰ In sensitivity analyses, we decreased this suppression rate by 25% to 32.4% suppressed, and improved it by 25% and 50% to 54.0% and 64.8%, respectively. Decreasing the 2nd-line ART viral suppression rate by 25% caused the life expectancy gains for the most effective strategy to decrease from 48.1 months to 46.6 months, compared with no treatment, while increasing the 2nd-line suppression rate by 50% increased the life expectancy gain to 51.3 months. As the life expectancy gains decreased and increased, costs changed in parallel, yielding changes of <8% in the cost-effectiveness of the most effective strategy and changes of <1% in the cost-effectiveness of all other strategies.

D.2 Sensitivity Analysis on First-line ART Cost

In the base case, we assumed that first-line ART cost \$24.33 per person per month (\$292 per year).³³ In a sensitivity analysis, we decreased this cost by 50% to \$146 per year and increased it by 100% and 300% to \$548 and \$1,168 per year, respectively. The lower bound of this sensitivity analysis is based on the price negotiated by the Clinton Foundation.³¹ Decreasing the cost of ART to \$146 per year decreased the lifetime cost of the most effective strategy by \$659, while increasing the cost to \$548 and \$1,168 per year increased the lifetime cost by \$1,320 and \$3,958, respectively. The cost-effectiveness of the most effective strategy ranged from \$994 per YLS when the price of ART was decreased by 50% to \$3,707 per YLS when the price of ART

was increased by 300%. Results of this sensitivity analysis, which was conducted only for the base case (assuming the availability of a single ART regimen) are shown in **Appendix Table D.2**. Since variations in cost do not impact life expectancy, the table includes only cost-effectiveness ratios and total lifetime costs for the different strategies.

D.3. Two-way Sensitivity Analysis on ART Efficacy and Cost

To further explore the impact of both cost and efficacy on the cost-effectiveness of an ART program that offers two lines of therapy, we conducted a two-way sensitivity analysis on the annual cost of ART and viral suppression. We decreased the yearly cost of ART by 50% to \$146 and \$341/yr for first- and second-line ART, respectively, and by 25% to \$219 and \$512/yr, respectively.^{33, 43} Yearly ART costs were also increased by 25% to \$365 and \$853/yr for first- and second-line ART, respectively, and by 50% to \$438 and \$1,023/yr, respectively. In parallel, we decreased the viral suppression rates for both first- and second-line ART by 25% and increased the rates by up to 50%. In the best case scenario (decreasing ART costs by 50% and increasing viral suppression by 50%), the most effective strategy yielded a lifetime cost of \$3,900, life expectancy gains of 58.5 months compared to no treatment, and a cost-effectiveness ratio of \$890 per YLS. In the worst case scenario (increasing ART costs by 50% and decreasing viral suppression by 25%), the most effective strategy yielded a lifetime cost of \$5,100, life expectancy gains of 41.7 months compared to no treatment, and a cost-effectiveness ratio of \$1,800 per YLS. Cost-effectiveness ratios, total lifetime costs, and life expectancy results of this two way sensitivity analysis, performed using the base case assumption of only a single available ART regimen, are presented in **Appendix Table D.3**.

D.4. Sensitivity Analyses on Structural ART Assumptions

In the model, ART efficacy is governed by four main assumptions: (1) the duration of ART efficacy, in the absence of virologic failure, was 10 years;¹⁰⁻¹² (2) after virologic failure, a patient's CD4 cell count will remain constant for 12 months prior to reverting back to a natural history rate of CD4 decline; (3) ART provides a protective effect on opportunistic disease incidence and chronic AIDS mortality in patients with $CD4 \geq 50/mm^3$;^{13, 14} and (4) when a patient begins a new ART regimen, any ODs accrued during the patient's first 6 months on the regimen will not be counted towards clinically defined ART failure.¹⁵ We examined each of these assumptions in sensitivity analyses.

D.4.1. Sensitivity Analysis on the Temporal Stages of ART Efficacy

When we assumed the duration of ART efficacy, in the absence of virologic failure, was 2 years, 10 years (base case), or infinite,¹⁰⁻¹² life expectancy gains for the most effective strategy (ART and prophylaxis using CD4 testing), were 28.7, 38.2, and 41.1 months, respectively, compared to no treatment. In this case, the corresponding cost-effectiveness ratios for the most effective strategy differed by less than 10%. Cost-effectiveness ratios, total lifetime costs and life expectancy results of this sensitivity analysis, performed using the base case assumptions of availability of only a single ART regimen are presented in **Appendix Table D.4**.

D.4.2. Sensitivity Analysis on the Delay to CD4 Decline After Virologic ART Failure

When we assumed the delay to CD4 cell decline following virologic failure was 6, 12 (base case), or 24 months, life expectancy gains for the most effective strategy (ART and prophylaxis using CD4 testing), were 36.1, 38.2, and 41.9 months, respectively, compared to no treatment.

The corresponding cost-effectiveness ratios differed by less than 5%. Cost-effectiveness ratios, total lifetime costs, and life expectancy results of this sensitivity analysis, performed using the base case assumptions of availability of a single ART regimen, are presented in **Appendix Table D.5 Panel A**. Corresponding results for the secondary analysis, conducted assuming availability of two ART regimens, are shown in **Appendix Table D.5 Panel B**.

D.4.3. Sensitivity Analysis on the Independent Protective Effect of ART

The most influential assumption examined was that of the independent effect of ART on opportunistic disease incidence and chronic AIDS mortality in patients with $CD4 \geq 50/mm^3$.^{13, 14} For the most effective strategy (ART and prophylaxis using CD4 testing), when we assumed there would be no benefit of ART in the absence of complete suppression, life expectancy gains were decreased by 18.1 months and cost-effectiveness ratio of the most effective strategy incorporating CD4 testing was nearly twice that of the base case. Cost-effectiveness ratios, total lifetime costs, and life expectancy results of this sensitivity analysis, performed using the base case assumptions of availability of a single ART regimen, are presented in **Appendix Table D.6**.

D.4.4. Sensitivity Analysis on the Delay to Opportunistic Disease Count Towards ART

Failure

For scenarios in which CD4 testing was not available, ART discontinuation decisions were made based on clinical criteria (i.e., a specified number of observed opportunistic diseases occurring after ART initiation). To avoid counting opportunistic diseases towards treatment failure during the period of immune reconstitution,¹⁵ we incorporated a time lag before beginning the opportunistic disease count. In the base case, this lag was 6 months, which we increased to 12

months in sensitivity analyses. Increasing this time lag resulted in minimal changes in costs, life expectancy gains, and cost-effectiveness. Cost-effectiveness ratios, total lifetime costs, and life expectancy results of this sensitivity analysis, performed using the base case assumptions of availability of a single ART regimen, are presented in **Appendix Table D.7 Panel A**.

Corresponding results for the secondary analysis, conducted assuming availability of two ART regimens, are shown in **Appendix Table D.7 Panel B**.

D.5. Sensitivity Analyses on Policy Decisions

D.5.1. Sensitivity Analysis on CD4 Testing Frequency

We also conducted sensitivity analyses on CD4 testing for scenarios in which only one line of ART was available (**Appendix Table D.8 Panel A**) and for scenarios in which two lines of ART were available (**Appendix Table D.8 Panel B**). Decreasing the frequency of CD4 testing from every 6 months to every 12 months resulted in changes of <5% in costs, life expectancy gains, and cost-effectiveness ratios when only one line of ART was available, and in changes of <8% when two lines of ART were available.

D.5.2. Sensitivity Analysis on Opportunistic Diseases Included in Clinical ART Initiation Criteria

In the base case, the following severe opportunistic diseases were included in the clinical ART initiation criteria: severe fungal infections, isosporiasis, cerebral toxoplasmosis, NTM, or other severe illnesses. In a sensitivity analysis, we expanded this set of opportunistic diseases for ART initiation to incrementally include severe malaria, tuberculosis, severe bacterial disease and all three diseases together.

Manuscript Table 3 shows the implied CD4 cell count at which ART was initiated and the incremental life expectancy gains compared to no treatment as the disease set for ART initiation was expanded for three ART treatment strategies with different initiation criteria. **Appendix Table D.9** depicts the cost-effectiveness, lifetime cost, and life expectancy for four strategies which rely solely on clinical criteria, and two strategies which incorporate CD4 test information. As the set of opportunistic diseases for ART initiation was expanded to incrementally include severe malaria, tuberculosis, severe bacterial disease and then all three, the greatest differences in life expectancy and cost were noted for those strategies relying solely on clinical criteria. Differences were less extreme for strategies relying on CD4 test information. Accordingly, the incremental cost-effectiveness ratios for strategies relying solely on clinical criteria changed by less than 10%, since the additional costs of starting ART earlier were offset by the life expectancy gains. In contrast, the incremental cost-effectiveness ratio for the most effective strategy – a strategy which incorporates CD4 test information – increased from \$1,180 to \$1,570 per YLS.

D.5.3. Consideration of Adherence Interventions

Lack of strict ART adherence is considered to be one of the key challenges to AIDS care worldwide. Given the relevance of treatment adherence to improving life expectancy and preventing the spread of drug-resistant strains of HIV, we considered the impact of three adherence intervention scenarios. The three scenarios considered were: (1) an adherence intervention to maintain current levels of adherence; (2) an adherence intervention to improve adherence levels; and (3) no adherence intervention, leading to a decrease in adherence levels.

Cost-effectiveness ratios, total lifetime costs, and life expectancy results of this sensitivity analysis, performed using the base case assumptions of availability of a single ART regimen, are presented in **Appendix Table D.10**. The adherence intervention to maintain current levels of adherence increased the cost of the most effective strategy by \$330 and the incremental cost-effectiveness ratio by \$197 per YLS. The intervention to improve adherence levels increased the cost of the most effective strategy by \$584, the life expectancy by 4.2 months, and the incremental cost-effectiveness ratio by \$157 per YLS. The absence of an intervention, with decreasing levels of adherence, decreased the life expectancy of the most effective strategy by 5.8 months and increased the incremental cost-effectiveness ratio by \$55 per YLS.

D.6. Sensitivity Analyses on Non-ART Costs

D.6.1. Sensitivity Analysis on CD4 Test Costs

In the base case, the cost of CD4 monitoring was \$25 per test. We varied this cost in sensitivity analyses from \$6.25 to \$100 per test. Cost-effectiveness ratios and total lifetime costs for this sensitivity analysis, performed using the base case assumptions of availability of a single ART regimen, are presented in **Appendix Table D.11 Panel A**. Corresponding results for the secondary analysis, conducted assuming availability of two ART regimens, are shown in **Appendix Table D.11 Panel B**. Since variations in cost do not impact life expectancy, the table includes only cost-effectiveness ratios and total lifetime costs for the different strategies. When a single ART regimen was available, decreasing the cost of a CD4 test to \$6.25 per test resulted in a less than 5% change in the incremental cost-effectiveness ratio of the most effective strategy. In addition, decreasing the cost of CD4 testing allowed an additional CD4-based strategy to become non-dominated. Accordingly, increasing the cost of a CD4 test to \$75 and \$100 per test

caused the incremental cost-effectiveness to increase by nearly 50% and 70%, respectively. Scenarios in which a second line of ART was made available showed a similar pattern but the incremental cost-effectiveness ratios were slightly less sensitive to changes in the cost of CD4 testing.

D.6.2. Sensitivity Analysis on Routine Care Costs

The base case costs for routine cases are listed in Manuscript Table 1. We decreased these costs by 50% and increased them by 100% in sensitivity analyses both for all patients and, in a separate analysis, for patients with CD4 cell count <100 cells/mm³. Cost-effectiveness ratios and total lifetime costs for this sensitivity analysis, performed using the base case assumptions of availability of a single ART regimen, are presented in **Appendix Table D.12**. Since variations in cost do not impact life expectancy, the table includes only cost-effectiveness ratios and total lifetime costs for the different strategies. The incremental cost-effectiveness ratios of scenarios in which treatment decisions were made based solely on clinical criteria were more sensitive to changes in the cost of acute opportunistic disease treatment than were scenarios in which treatment decisions were also guided by CD4 testing. When routine care costs were increased for patients with CD4 cell counts <100 /mm³, all scenarios which rely on clinical criteria to make treatment decisions became dominated.

D.6.3. Sensitivity Analysis on Acute Opportunistic Disease Costs

The base case cost of treatment for acute opportunistic diseases are listed in Manuscript Table 1. We decreased these costs by 50% and increased them by 100% in sensitivity analyses. These variations yielded minimal changes in the incremental cost-effectiveness ratios. Cost-

effectiveness ratios and total lifetime costs for this sensitivity analysis, performed using the base case assumptions of availability of a single ART regimen, are presented in **Appendix Table**

D.13.

D.6.4. Sensitivity Analysis on Discount Rate

Cost-effectiveness ratios, total lifetime costs, and life expectancy results of this sensitivity analysis, performed using the base case assumptions of availability of a single ART regimen, are presented in **Appendix Table D.14.**

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APPENDIX TABLES*

Appendix Table C.1: Results of Secondary Analysis (Including Availability of Second Line of ART)

Panel A: Single Line of ART Available

	CD4 available?	1st-line ART Starting Criteria	1st-line ART Stopping Criteria	Undiscounted Life Expectancy (months)	Discounted Life Expectancy (months)	Discounted Lifetime Costs (2002 US\$)	ICER (\$ per YLS)
No Treatment	---	---	---	33.6399	31.4086	783	---
CTX only	No	---	---	35.2454	32.8148	811	240
CTX and ART	No	2 ODs from subset	1 OD	45.9814	41.3731	1,233	590
CTX and ART	No	1 OD from subset	1 OD	57.2883	50.6996	1,716	620
CTX and ART	No	1 OD from subset	3 ODs	65.5831	56.8151	2,171	890
CTX and ART	No	1 OD from subset	5 ODs	67.1231	57.8712	2,264	1,100
CTX and ART	Yes	CD4<200, CD4<350 and 1 severe OD, or 1 OD from subset	CD4 drops 90%	81.1667	69.6337	3,423	1,200

Panel B: Two Lines of ART Available

No Treatment	---	---	---	33.6399	31.4086	783	---
CTX only	No	---	---	35.2454	32.8148	811	240
CTX and ART	No	2 ODs from subset	5 ODs	51.6475	45.3674	1,535	690
CTX and ART	No	1 OD from subset	5 ODs	68.1474	58.4927	2,331	730
CTX and ART	Yes	CD4<200, CD4<350 and 1 severe OD, or 1 OD from subset	CD4 drops 90%	84.5857	71.9188	3,689	1,200
CTX and ART	Yes	CD4<200, CD4<350 and 1 severe OD, or 1 OD from subset	CD4 drops 50%	96.0876	79.5153	4,499	1,300

Appendix Table D.1: One-way Sensitivity Analyses on ART Efficacy

Panel A: First-Line ART Efficacy (single line available) – Cost-effectiveness (\$/YLS)

	CD4 available?	1 st -line ART Starting Criteria	1 st -line ART Stopping/Switching Criteria	Decrease 25%	Base Case	Viral Suppression Rate			
						Increase 25%	Increase 50%	Increase 75%	
No Treatment	No	---	---	---	---	---	---	---	---
CTX only	No	---	---	240	240	240	240	240	240
CTX and ART	No	2 ODs from subset	1 OD	620	590	580	560	550	
CTX and ART	No	1 OD from subset	1 OD	650	620	610	590	570	
CTX and ART	No	1 OD from subset	3 ODs	980	890	850	810	760	
CTX and ART	No	2 ODs from subset	5 ODs	Dom	Dom	Dom	Dom	Dom	Dom
CTX and ART	No	1 OD from subset	5 ODs	1,100	1,100	980	960	910	
CTX and ART	Yes	CD4<200, CD4<350 and 1 severe OD, or 1 OD from subset	CD4 drops 50%	Dom	Dom	Dom	1,100	1,100	
CTX and ART	Yes	CD4<200, CD4<350 and 1 severe OD, or 1 OD from subset	CD4 drops 90%	1,200	1,200	1,200	1,200	1,100 [†]	

Panel B: Second-line ART Efficacy (Two lines available) – Cost-effectiveness (\$/YLS)

No Treatment	No	---	---	---	---	---	---	---	---
CTX only	No	---	---	240	240	240	240	---	---
CTX and ART	No	2 ODs from subset	1 OD	Dom	Dom	Dom	Dom	---	---
CTX and ART	No	1 OD from subset	1 OD	Dom	Dom	Dom	Dom	---	---
CTX and ART	No	1 OD from subset	3 ODs	Dom	Dom	Dom	Dom	---	---
CTX and ART	No	2 ODs from subset	5 ODs	690	690	690	690	---	---
CTX and ART	No	1 OD from subset	5 ODs	730	730	730	730	---	---
CTX and ART	Yes	CD4<200, CD4<350 and 1 severe OD, or 1 OD from subset	CD4 drops 90%	1,200	1,200	1,200	1,200 [‡]	---	---
CTX and ART	Yes	CD4<200, CD4<350 and 1 severe OD, or 1 OD from subset	CD4 drops 50%	1,300	1,300	1,300	1,200 [§]	---	---

Appendix Table D.1: One-way Sensitivity Analyses on ART Efficacy (cont.)

Panel A: First-Line ART Efficacy (single line available) – Total Lifetime Costs (2002 US\$)

	CD4 available?	1 st -line ART Starting Criteria	1 st -line ART Stopping/Switching Criteria	Decrease 25%	Viral Suppression Rate			
					Base Case	Increase 25%	Increase 50%	Increase 75%
No Treatment	No	---	---	783	783	783	783	783
CTX only	No	---	---	811	811	811	811	811
CTX and ART	No	2 ODs from subset	1 OD	1,199	1,233	1,256	1,285	1,315
CTX and ART	No	1 OD from subset	1 OD	1,643	1,716	1,770	1,833	1,900
CTX and ART	No	1 OD from subset	3 ODs	2,024	2,171	2,271	2,408	2,551
CTX and ART	No	2 ODs from subset	5 ODs	Dom	Dom	Dom	Dom	Dom
CTX and ART	No	1 OD from subset	5 ODs	2,100	2,264	2,385	2,541	2,713
CTX and ART	Yes	CD4<200, CD4<350 and 1 severe OD, or 1 OD from subset	CD4 drops 50%	Dom	Dom	Dom	3,775	4,124
CTX and ART	Yes	CD4<200, CD4<350 and 1 severe OD, or 1 OD from subset	CD4 drops 90%	3,108	3,423	3,650	3,947	4,277

Panel B: Second-line ART Efficacy (Two lines available) – Total Lifetime Costs (2002 US\$)

No Treatment	No	---	---	783	783	783	783	---
CTX only	No	---	---	811	811	811	811	---
CTX and ART	No	2 ODs from subset	1 OD	Dom	Dom	Dom	Dom	---
CTX and ART	No	1 OD from subset	1 OD	Dom	Dom	Dom	Dom	---
CTX and ART	No	1 OD from subset	3 ODs	Dom	Dom	Dom	Dom	---
CTX and ART	No	2 ODs from subset	5 ODs	1,531	1,535	1,537	1,539	---
CTX and ART	No	1 OD from subset	5 ODs	2,329	2,331	2,336	2,344	---
CTX and ART	Yes	CD4<200, CD4<350 and 1 severe OD, or 1 OD from subset	CD4 drops 90%	3,667	3,689	3,723	3,747	---
CTX and ART	Yes	CD4<200, CD4<350 and 1 severe OD, or 1 OD from subset	CD4 drops 50%	4,365	4,499	4,638	4,785	---

Appendix Table D.1: One-way Sensitivity Analyses on ART Efficacy (cont.)

Panel A: First-Line ART Efficacy (single line available) – Discounted Life Expectancy (months)

	CD4 available?	1 st -line ART Starting Criteria	1 st -line ART Stopping/Switching Criteria	Decrease 25%	Base Case	Viral Suppression Rate		
						Increase 25%	Increase 50%	Increase 75%
No Treatment	No	---	---	31.4086	31.4086	31.4086	31.4086	31.4086
CTX only	No	---	---	32.8148	32.8148	32.8148	32.8148	32.8148
CTX and ART	No	2 ODs from subset	1 OD	40.3798	41.3731	42.0503	42.9083	43.7837
CTX and ART	No	1 OD from subset	1 OD	48.5558	50.6996	52.2511	54.0957	56.0182
CTX and ART	No	1 OD from subset	3 ODs	53.2289	56.8151	59.2898	62.6715	66.2369
CTX and ART	No	2 ODs from subset	5 ODs	Dom	Dom	Dom	Dom	Dom
CTX and ART	No	1 OD from subset	5 ODs	54.0377	57.8712	60.6866	64.3271	68.3779
CTX and ART	Yes	CD4<200, CD4<350 and 1 severe OD, or 1 OD from subset	CD4 drops 50%	Dom	Dom	Dom	77.5413	83.7707
CTX and ART	Yes	CD4<200, CD4<350 and 1 severe OD, or 1 OD from subset	CD4 drops 90%	63.8144	69.6337	73.847	79.322	85.4078

Panel B: Second-line ART Efficacy (Two lines available) – Discounted Life Expectancy (months)

No Treatment	No	---	---	31.4086	31.4086	31.4086	31.4086	---
CTX only	No	---	---	32.8148	32.8148	32.8148	32.8148	---
CTX and ART	No	2 ODs from subset	1 OD	Dom	Dom	Dom	Dom	---
CTX and ART	No	1 OD from subset	1 OD	Dom	Dom	Dom	Dom	---
CTX and ART	No	1 OD from subset	3 ODs	Dom	Dom	Dom	Dom	---
CTX and ART	No	2 ODs from subset	5 ODs	45.3020	45.3674	45.3786	45.4488	---
CTX and ART	No	1 OD from subset	5 ODs	58.4981	58.4927	58.5743	58.7066	---
CTX and ART	Yes	CD4<200, CD4<350 and 1 severe OD, or 1 OD from subset	CD4 drops 90%	71.7150	71.9188	72.3571	72.5840	---
CTX and ART	Yes	CD4<200, CD4<350 and 1 severe OD, or 1 OD from subset	CD4 drops 50%	77.9840	79.5153	81.0771	82.6975	---

Appendix Table D.2: One-Way Sensitivity Analyses on First Line ART Monthly Costs

Cost-effectiveness (\$/YLS)

	CD4 available?	1 st -line ART Starting Criteria	1 st -line ART Stopping Criteria	Decrease by 50% (\$146/yr)	First-line ART Monthly Costs		
					Base case (\$292/yr)	Increase by 100% (\$584/yr)	Increase by 300% (\$1,168/yr)
No Treatment	No	---	---	---	---	---	---
CTX only	No	---	---	240	240	240	240
CTX and ART	No	2 ODs from subset	1 OD	420	590	930	1,600
CTX and ART	No	1 OD from subset	1 OD	430	620	1,000	1,800
CTX and ART	No	1 OD from subset	3 ODs	570	890	Dom	Dom
CTX and ART	No	1 OD from subset	5 ODs	650	1,100	Dom	Dom
CTX and ART	Yes	CD4<200, CD4<350 and 1 severe OD, or 2 ODs from subset	CD4 drops 50%	Dom	Dom	1,500	2,400
CTX and ART	Yes	CD4<200, CD4<350 and 1 severe OD, or 1 OD from subset	CD4 drops 50%	Dom	Dom	1,600	2,900
CTX and ART	Yes	CD4<200, CD4<350 and 1 severe OD, or 1 OD from subset	CD4 drops 90%	1,000	1,200	2,000	3,700
Total Lifetime Costs (2002 US\$)							
No Treatment	No	---	---	783	783	783	783
CTX only	No	---	---	811	811	811	811
CTX and ART	No	2 ODs from subset	1 OD	1,110	1,233	1,477	1,966
CTX and ART	No	1 OD from subset	1 OD	1,444	1,716	2,261	3,352
CTX and ART	No	1 OD from subset	3 ODs	1,733	2,171	3,047	4,799
CTX and ART	No	1 OD from subset	5 ODs	1,790	2,264	3,075	5,104
CTX and ART	Yes	CD4<200, CD4<350 and 1 severe OD, or 2 ODs from subset	CD4 drops 50%	2,547	3,085	4,162	6,317
CTX and ART	Yes	CD4<200, CD4<350 and 1 severe OD, or 1 OD from subset	CD4 drops 50%	2,628	3,211	4,376	6,706
CTX and ART	Yes	CD4<200, CD4<350 and 1 severe OD, or 1 OD from subset	CD4 drops 90%	2,764	3,423	4,743	7,381

Appendix Table D.3: Two-way Sensitivity Analyses on ART Efficacy and Cost

Cost-effectiveness Ratios (\$/YLS)

	CD4 available?	First-line ART Starting Criteria	First-line ART Switching Criteria	50%	75%	ART Cost		
						Base Case	125%	150%
ART Efficacy Reduced 25%								
CTX only	No	---	---	240	240	240	240	240
CTX and ART	No	2 ODs from subset	5 ODs	490	600	720	840	960
CTX and ART	No	1 OD from subset	5 ODs	500	630	760	890	1,000
CTX and ART	No	1 OD from subset	3 ODs	890	Dom	Dom	Dom	Dom
CTX and ART	Yes	CD4<200, CD4<350 and 1 severe OD, or 2 ODs from subset	CD4 drops 90%	Dom	Dom	Dom	Dom	1,500
CTX and ART	Yes	CD4<200, CD4<350 and 1 severe OD, or 1 OD from subset	CD4 drops 90%	Dom	Dom	1,300 ^{ll}	1,400	1,600
CTX and ART	Yes	CD4<200, CD4<350 and 1 severe OD, or 1 OD from subset	CD4 drops 50%	960	1,100	1,300 ^{**}	1,500	1,800
Base Case ART Efficacy								
CTX only	No	---	---	240	240	240	240	240
CTX and ART	No	2 ODs from subset	5 ODs	470	580	690	800	910
CTX and ART	No	1 OD from subset	5 ODs	480	610	730	850	970
CTX and ART	No	1 OD from subset	3 ODs	870	Dom	Dom	Dom	Dom
CTX and ART	Yes	CD4<200, CD4<350 and 1 severe OD, or 2 ODs from subset	CD4 drops 90%	Dom	Dom	Dom	Dom	Dom
CTX and ART	Yes	CD4<200, CD4<350 and 1 severe OD, or 1 OD from subset	CD4 drops 90%	Dom	Dom	1,200	1,300	1,400
CTX and ART	Yes	CD4<200, CD4<350 and 1 severe OD, or 1 OD from subset	CD4 drops 50%	930	1,100	1,300	1,500	1,700

Appendix Table D.3: Two-way Sensitivity Analysis on ART Efficacy and Cost (cont.)

Cost-effectiveness Ratios (\$/YLS)

	CD4 available?	First-line ART Starting Criteria	First-line ART Switching Criteria	50%	75%	ART Cost		
						Base Case	125%	150%
ART Efficacy Increased 25%								
CTX only	No	---	---	240	240	240	240	240
CTX and ART	No	2 ODs from subset	5 ODs	460	570	680	790	890
CTX and ART	No	1 OD from subset	5 ODs	470	590	710	820	940
CTX and ART	No	1 OD from subset	3 ODs	Dom	Dom	Dom	Dom	Dom
CTX and ART	Yes	CD4<200, CD4<350 and 1 severe OD, or 2 ODs from subset	CD4 drops 90%	Dom	Dom	Dom	Dom	Dom
CTX and ART	Yes	CD4<200, CD4<350 and 1 severe OD, or 1 OD from subset	CD4 drops 90%	Dom	Dom	1,200	1,300	1,400
CTX and ART	Yes	CD4<200, CD4<350 and 1 severe OD, or 1 OD from subset	CD4 drops 50%	910	1,100	1,300	1,500	1,700
ART Efficacy Increased 50%								
CTX only	No	---	---	240	240	240	240	240
CTX and ART	No	2 ODs from subset	5 ODs	460 ^{††}	560	660	770	870
CTX and ART	No	1 OD from subset	5 ODs	460 ^{††}	580	690	800	910
CTX and ART	No	1 OD from subset	3 ODs	Dom	Dom	Dom	Dom	Dom
CTX and ART	Yes	CD4<200, CD4<350 and 1 severe OD, or 2 ODs from subset	CD4 drops 90%	Dom	Dom	Dom	Dom	Dom
CTX and ART	Yes	CD4<200, CD4<350 and 1 severe OD, or 1 OD from subset	CD4 drops 90%	Dom	Dom	1,100	1,300	1,400
CTX and ART	Yes	CD4<200, CD4<350 and 1 severe OD, or 1 OD from subset	CD4 drops 50%	890	1,000	1,200	1,500	1,700

Appendix Table D.3: Two-way Sensitivity Analysis on ART Efficacy and Cost (cont.)

Total Lifetime Costs (2002 US\$)								
	CD4 available?	First-line ART Starting Criteria	First-line ART Switching Criteria	50%	75%	ART Cost		
						Base Case	125%	150%
ART Efficacy Reduced 25%								
CTX only	No	---	---	811	811	811	811	811
CTX and ART	No	2 ODs from subset	5 ODs	1,234	1,337	1,439	1,541	1,644
CTX and ART	No	1 OD from subset	5 ODs	1,702	1,926	2,150	2,374	2,598
CTX and ART	No	1 OD from subset	3 ODs	1,765	Dom	Dom	Dom	Dom
CTX and ART	Yes	CD4<200, CD4<350 and 1 severe OD, or 2 ODs from subset	CD4 drops 90%	Dom	Dom	Dom	Dom	3,850
CTX and ART	Yes	CD4<200, CD4<350 and 1 severe OD, or 1 OD from subset	CD4 drops 90%	Dom	Dom	3,374	3,719	4,064
CTX and ART	Yes	CD4<200, CD4<350 and 1 severe OD, or 1 OD from subset	CD4 drops 50%	3,178	3,664	4,150	4,636	5,122
Base Case ART Efficacy								
CTX only	No	---	---	811	811	811	811	811
CTX and ART	No	2 ODs from subset	5 ODs	1,303	1,419	1,535	1,651	1,767
CTX and ART	No	1 OD from subset	5 ODs	1,831	2,081	2,331	2,581	2,831
CTX and ART	No	1 OD from subset	3 ODs	1,911	Dom	Dom	Dom	Dom
CTX and ART	Yes	CD4<200, CD4<350 and 1 severe OD, or 2 ODs from subset	CD4 drops 90%	Dom	Dom	Dom	Dom	Dom
CTX and ART	Yes	CD4<200, CD4<350 and 1 severe OD, or 1 OD from subset	CD4 drops 90%	Dom	Dom	3,689	4,070	4,451
CTX and ART	Yes	CD4<200, CD4<350 and 1 severe OD, or 1 OD from subset	CD4 drops 50%	3,446	3,973	4,499	5,026	5,553

Appendix Table D.3: Two-way Sensitivity Analysis on ART Efficacy and Cost (cont.)

Total Lifetime Costs (2002 US\$)								
	CD4 available?	First-line ART Starting Criteria	First-line ART Switching Criteria	50%	75%	ART Cost		
						Base Case	125%	150%
ART Efficacy Increased 25%								
CTX only	No	---	---	811	811	811	811	811
CTX and ART	No	2 ODs from subset	5 ODs	1,351	1,477	1,603	1,729	1,854
CTX and ART	No	1 OD from subset	5 ODs	1,931	2,202	2,472	2,743	3,013
CTX and ART	No	1 OD from subset	3 ODs	Dom	Dom	Dom	Dom	Dom
CTX and ART	Yes	CD4<200, CD4<350 and 1 severe OD, or 2 ODs from subset	CD4 drops 90%	Dom	Dom	Dom	Dom	Dom
CTX and ART	Yes	CD4<200, CD4<350 and 1 severe OD, or 1 OD from subset	CD4 drops 90%	Dom	Dom	3,921	4,328	4,736
CTX and ART	Yes	CD4<200, CD4<350 and 1 severe OD, or 1 OD from subset	CD4 drops 50%	3,648	4,206	4,765	5,323	5,882
ART Efficacy Increased 50%								
CTX only	No	---	---	811	811	811	811	811
CTX and ART	No	2 ODs from subset	5 ODs	1,417	1,556	1,695	1,835	1,974
CTX and ART	No	1 OD from subset	5 ODs	2,061	2,358	2,655	2,952	3,248
CTX and ART	No	1 OD from subset	3 ODs	Dom	Dom	Dom	Dom	Dom
CTX and ART	Yes	CD4<200, CD4<350 and 1 severe OD, or 2 ODs from subset	CD4 drops 90%	Dom	Dom	Dom	Dom	Dom
CTX and ART	Yes	CD4<200, CD4<350 and 1 severe OD, or 1 OD from subset	CD4 drops 90%	Dom	Dom	4,207	4,646	5,086
CTX and ART	Yes	CD4<200, CD4<350 and 1 severe OD, or 1 OD from subset	CD4 drops 50%	3,873	4,462	5,051	5,641	6,230

Appendix Table D.3: Two-way Sensitivity Analysis on ART Efficacy and Cost (cont.)

Discounted Life Expectancy (months)				ART Cost				
	CD4 available?	First-line ART Starting Criteria	First-line ART Switching Criteria	50%	75%	Base Case	125%	150%
ART Efficacy Reduced 25%								
CTX only	No	---	---	32.8148	32.8148	32.8148	32.8148	32.8148
CTX and ART	No	2 ODs from subset	5 ODs	43.2730	43.2730	43.2730	43.2730	43.2730
CTX and ART	No	1 OD from subset	5 ODs	54.5323	54.5323	54.5323	54.5323	54.5323
CTX and ART	No	1 OD from subset	3 ODs	55.3798	Dom	Dom	Dom	Dom
CTX and ART	Yes	CD4<200, CD4<350 and 1 severe OD, or 2 ODs from subset	CD4 drops 90%	Dom	Dom	Dom	Dom	64.3480
CTX and ART	Yes	CD4<200, CD4<350 and 1 severe OD, or 1 OD from subset	CD4 drops 90%	Dom	Dom	66.0018	66.0018	66.0018
CTX and ART	Yes	CD4<200, CD4<350 and 1 severe OD, or 1 OD from subset	CD4 drops 50%	73.1074	73.1074	73.1074	73.1074	73.1074
Base Case ART Efficacy								
CTX only	No	---	---	32.8148	32.8148	32.8148	32.8148	32.8148
CTX and ART	No	2 ODs from subset	5 ODs	45.3674	45.3674	45.3674	45.3674	45.3674
CTX and ART	No	1 OD from subset	5 ODs	58.4927	58.4927	58.4927	58.4927	58.4927
CTX and ART	No	1 OD from subset	3 ODs	59.5969	Dom	Dom	Dom	Dom
CTX and ART	Yes	CD4<200, CD4<350 and 1 severe OD, or 2 ODs from subset	CD4 drops 90%	Dom	Dom	Dom	Dom	Dom
CTX and ART	Yes	CD4<200, CD4<350 and 1 severe OD, or 1 OD from subset	CD4 drops 90%	Dom	Dom	71.9188	71.9188	71.9188
CTX and ART	Yes	CD4<200, CD4<350 and 1 severe OD, or 1 OD from subset	CD4 drops 50%	79.5153	79.5153	79.5153	79.5153	79.5153

Appendix Table D.3: Two-way Sensitivity Analysis on ART Efficacy and Cost (cont.)

Discounted Life Expectancy (months)

	CD4 available?	First-line ART Starting Criteria	First-line ART Switching Criteria	50%	75%	ART Cost		
						Base Case	125%	150%
ART Efficacy Increased 25%								
CTX only	No	---	---	32.8148	32.8148	32.8148	32.8148	32.8148
CTX and ART	No	2 ODs from subset	5 ODs	46.8175	46.8175	46.8175	46.8175	46.8175
CTX and ART	No	1 OD from subset	5 ODs	61.5787	61.5787	61.5787	61.5787	61.5787
CTX and ART	No	1 OD from subset	3 ODs	Dom	Dom	Dom	Dom	Dom
CTX and ART	Yes	CD4<200, CD4<350 and 1 severe OD, or 2 ODs from subset	CD4 drops 90%	Dom	Dom	Dom	Dom	Dom
CTX and ART	Yes	CD4<200, CD4<350 and 1 severe OD, or 1 OD from subset	CD4 drops 90%	Dom	Dom	76.2644	76.2644	76.2644
CTX and ART	Yes	CD4<200, CD4<350 and 1 severe OD, or 1 OD from subset	CD4 drops 50%	84.3062	84.3062	84.3062	84.3062	84.3062
ART Efficacy Increased 50%								
CTX only	No	---	---	32.8148	32.8148	32.8148	32.8148	32.8148
CTX and ART	No	2 ODs from subset	5 ODs	48.8018	48.8018	48.8018	48.8018	48.8018
CTX and ART	No	1 OD from subset	5 ODs	65.5265	65.5265	65.5265	65.5265	65.5265
CTX and ART	No	1 OD from subset	3 ODs	Dom	Dom	Dom	Dom	Dom
CTX and ART	Yes	CD4<200, CD4<350 and 1 severe OD, or 2 ODs from subset	CD4 drops 90%	Dom	Dom	Dom	Dom	Dom
CTX and ART	Yes	CD4<200, CD4<350 and 1 severe OD, or 1 OD from subset	CD4 drops 90%	Dom	Dom	81.7466	81.7466	81.7466
CTX and ART	Yes	CD4<200, CD4<350 and 1 severe OD, or 1 OD from subset	CD4 drops 50%	89.9502	89.9502	89.9502	89.9502	89.9502

Appendix Table D.4: One-Way Sensitivity Analyses on the Temporal Stages of ART Efficacy

Cost-effectiveness (\$/YLS)

	CD4 available?	1 st -line ART Starting Criteria	1 st -line ART Stopping Criteria	Time Period			
				2 years	5 years	10 years	Unexpiring
No Treatment	No	---	---	---	---	---	---
CTX only	No	---	---	240	240	240	240
CTX and ART	No	2 ODs from subset	1 OD	620	600	590	590
CTX and ART	No	1 OD from subset	1 OD	670	640	620	620
CTX and ART	No	1 OD from subset	3 ODs	1,200	1,000	890	840
CTX and ART	No	1 ODs from subset	5 ODs	Dom	Dom	1,100	860
CTX and ART	Yes	CD4<200, CD4<350 and 1 severe OD, or 1 OD from subset	CD4 drops 50%	Dom	Dom	Dom	1,200 ^{ss}
CTX and ART	Yes	CD4<200, CD4<350 and 1 severe OD, or 1 OD from subset	CD4 drops 90%	1,300	1,200	1,200	1,200 ^{lll}

Total Lifetime Costs (2002 US\$)

	CD4 available?	1 st -line ART Starting Criteria	1 st -line ART Stopping Criteria	Time Period			
				2 years	5 years	10 years	Unexpiring
No Treatment	No	---	---	783	783	783	783
CTX only	No	---	---	811	811	811	811
CTX and ART	No	2 ODs from subset	1 OD	1,192	1,219	1,233	1,237
CTX and ART	No	1 OD from subset	1 OD	1,623	1,684	1,716	1,725
CTX and ART	No	1 OD from subset	3 ODs	1,944	2,079	2,171	2,212
CTX and ART	No	1 ODs from subset	5 ODs	Dom	Dom	2,264	2,334
CTX and ART	Yes	CD4<200, CD4<350 and 1 severe OD, or 1 OD from subset	CD4 drops 50%	Dom	Dom	Dom	3,383
CTX and ART	Yes	CD4<200, CD4<350 and 1 severe OD, or 1 OD from subset	CD4 drops 90%	2,907	3,187	3,423	3,581

Discounted Life Expectancy (months)

	CD4 available?	1 st -line ART Starting Criteria	1 st -line ART Stopping Criteria	Time Period			
				2 years	5 years	10 years	Unexpiring
No Treatment	No	---	---	31.4086	31.4086	31.4086	31.4086
CTX only	No	---	---	32.8148	32.8148	32.8148	32.8148
CTX and ART	No	2 ODs from subset	1 OD	40.1975	40.9845	41.3731	41.4907
CTX and ART	No	1 OD from subset	1 OD	47.974	49.7681	50.6996	50.9571
CTX and ART	No	1 OD from subset	3 ODs	51.1327	54.4664	56.8151	57.8824
CTX and ART	No	1 ODs from subset	5 ODs	Dom	Dom	57.8712	59.5804
CTX and ART	Yes	CD4<200, CD4<350 and 1 severe OD, or 1 OD from subset	CD4 drops 50%	Dom	Dom	Dom	70.4869
CTX and ART	Yes	CD4<200, CD4<350 and 1 severe OD, or 1 OD from subset	CD4 drops 90%	60.1106	65.2986	69.6337	72.5297

Appendix Table D.5: One-way Sensitivity Analyses on the Delay to CD4 Decline After Virologic ART Failure

Panel A: One Line of ART Available– Cost-effectiveness (\$/YLS)

	CD4 available?	1 st -line ART Starting Criteria	1 st -line ART Stopping/Switching Criteria	Lag to CD4 Decline (base case)		
				6 months	12 months	24 months
No Treatment	No	---	---	---	---	---
CTX only	No	---	---	240	240	240
CTX and ART	No	2 ODs from subset	1 OD	610	590	570
CTX and ART	No	2 ODs from subset	5 OD	Dom	Dom	Dom
CTX and ART	No	1 OD from subset	1 OD	640	620	590
CTX and ART	No	1 OD from subset	3 ODs	880	890	930
CTX and ART	No	1 OD from subset	5 ODs	1,000	1,100	1,100
CTX and ART	Yes	CD4<200, CD4<350 and 1 severe OD, or 1 OD from subset	CD4 drops 50%	Dom	Dom	Dom
CTX and ART	Yes	CD4<200, CD4<350 and 1 severe OD, or 1 OD from subset	CD4 drops 90%	1,200	1,200	1,200

Panel B: Two Lines of ART Available – Cost-effectiveness (\$/YLS)

No Treatment	No	---	---	---	---	---
CTX only	No	---	---	240	240	240
CTX and ART	No	2 ODs from subset	1 OD	Dom	Dom	Dom
CTX and ART	No	2 ODs from subset	5 OD	700	690	680
CTX and ART	No	1 OD from subset	1 OD	Dom	Dom	Dom
CTX and ART	No	1 OD from subset	3 ODs	Dom	Dom	Dom
CTX and ART	No	1 OD from subset	5 ODs	740	730	710
CTX and ART	Yes	CD4<200, CD4<350 and 1 severe OD, or 1 OD from subset	CD4 drops 90%	1,200	1,200	1,200
CTX and ART	Yes	CD4<200, CD4<350 and 1 severe OD, or 1 OD from subset	CD4 drops 50%	1,300	1,300	1,300

Appendix Table D.5: One-way Sensitivity Analyses on the Delay to CD4 Decline After Virologic ART Failure (cont.)

Panel A: One Line of ART Available – Total Lifetime Costs (2002 US\$)

	CD4 available?	1 st -line ART Starting Criteria	1 st -line ART Stopping/Switching Criteria	Lag to CD4 Decline (base case)		
				6 months	12 months	24 months
No Treatment	No	---	---	783	783	783
CTX only	No	---	---	811	811	811
CTX and ART	No	2 ODs from subset	1 OD	1,212	1,233	1,265
CTX and ART	No	2 ODs from subset	5 OD	Dom	Dom	Dom
CTX and ART	No	1 OD from subset	1 OD	1,677	1,716	1,784
CTX and ART	No	1 OD from subset	3 ODs	2,115	2,171	2,268
CTX and ART	No	1 OD from subset	5 ODs	2,206	2,264	2,374
CTX and ART	Yes	CD4<200, CD4<350 and 1 severe OD, or 1 OD from subset	CD4 drops 50%	Dom	Dom	Dom
CTX and ART	Yes	CD4<200, CD4<350 and 1 severe OD, or 1 OD from subset	CD4 drops 90%	3,309	3,423	3,625

Panel B: Two Lines of ART Available – Total Lifetime Costs (2002 US\$)

No Treatment	No	---	---	783	783	783
CTX only	No	---	---	811	811	811
CTX and ART	No	2 ODs from subset	1 OD	Dom	Dom	Dom
CTX and ART	No	2 ODs from subset	5 OD	1,499	1,535	1,598
CTX and ART	No	1 OD from subset	1 OD	Dom	Dom	Dom
CTX and ART	No	1 OD from subset	3 ODs	Dom	Dom	Dom
CTX and ART	No	1 OD from subset	5 ODs	2,266	2,331	2,459
CTX and ART	Yes	CD4<200, CD4<350 and 1 severe OD, or 1 OD from subset	CD4 drops 90%	3,578	3,689	3,893
CTX and ART	Yes	CD4<200, CD4<350 and 1 severe OD, or 1 OD from subset	CD4 drops 50%	4,363	4,499	4,729

Appendix Table D.5: One-way Sensitivity Analyses on the Delay to CD4 Decline After Virologic ART Failure (cont.)

Panel A: One Line of ART Available – Discounted Life Expectancy (months)

	CD4 available?	1 st -line ART Starting Criteria	1 st -line ART Stopping/Switching Criteria	Lag to CD4 Decline (base case)		
				6 months	12 months	24 months
No Treatment	No	---	---	31.4086	31.4086	31.4086
CTX only	No	---	---	32.8148	32.8148	32.8148
CTX and ART	No	2 ODs from subset	1 OD	40.6966	41.3731	42.4584
CTX and ART	No	2 ODs from subset	5 OD	Dom	Dom	Dom
CTX and ART	No	1 OD from subset	1 OD	49.4558	50.6996	52.9646
CTX and ART	No	1 OD from subset	3 ODs	55.4510	56.8151	59.2364
CTX and ART	No	1 OD from subset	5 ODs	56.5350	57.8712	60.4219
CTX and ART	Yes	CD4<200, CD4<350 and 1 severe OD, or 1 OD from subset	CD4 drops 50%	Dom	Dom	Dom
CTX and ART	Yes	CD4<200, CD4<350 and 1 severe OD, or 1 OD from subset	CD4 drops 90%	67.5143	69.6337	73.3380

Panel B: Two Lines of ART Available – Discounted Life Expectancy (months)

No Treatment	No	---	---	31.4086	31.4086	31.4086
CTX only	No	---	---	32.8148	32.8148	32.8148
CTX and ART	No	2 ODs from subset	1 OD	Dom	Dom	Dom
CTX and ART	No	2 ODs from subset	5 OD	44.5854	45.3674	46.7582
CTX and ART	No	1 OD from subset	1 OD	Dom	Dom	Dom
CTX and ART	No	1 OD from subset	3 ODs	Dom	Dom	Dom
CTX and ART	No	1 OD from subset	5 ODs	57.0823	58.4927	61.2849
CTX and ART	Yes	CD4<200, CD4<350 and 1 severe OD, or 1 OD from subset	CD4 drops 90%	69.8770	71.9188	75.7747
CTX and ART	Yes	CD4<200, CD4<350 and 1 severe OD, or 1 OD from subset	CD4 drops 50%	77.0886	79.5153	83.7540

Appendix Table D.6: One-Way Sensitivity Analyses on the Independent Protective Effect of ART

Cost-effectiveness (\$/YLS)						
	CD4 available?	1st-line ART Starting Criteria	1st-line ART Stopping Criteria	Base Case (with ART Effect)	No ART Effect	
No Treatment	No	---	---	---	---	---
CTX only	No	---	---	240	240	
CTX and ART	No	2 ODs from subset	1 OD	590	660	
CTX and ART	No	1 OD from subset	1 OD	620	720	
CTX and ART	No	1 OD from subset	3 ODs	890	Dom	
CTX and ART	No	1 OD from subset	5 ODs	1,100	Dom	
CTX and ART	Yes	CD4<200, CD4<350 and 1 severe ODs, or 2 ODs from subset	CD4 drops 50%	Dom	1,400	
CTX and ART	Yes	CD4<200, CD4<350 and 1 severe OD, or 1 OD from subset	CD4 drops 50%	Dom	2,400	
CTX and ART	Yes	CD4<200, CD4<350 and 1 severe OD, or 1 OD from subset	CD4 drops 90%	1,200	Dom	
Total Lifetime Costs (2002 US\$)						
	CD4 available?	1st-line ART Starting Criteria	1st-line ART Stopping Criteria	Base Case (with ART Effect)	No ART Effect	
No Treatment	No	---	---	783	783	
CTX only	No	---	---	811	811	
CTX and ART	No	2 ODs from subset	1 OD	1,233	1,075	
CTX and ART	No	1 OD from subset	1 OD	1,716	1,380	
CTX and ART	No	1 OD from subset	3 ODs	2,171	Dom	
CTX and ART	No	1 OD from subset	5 ODs	2,264	Dom	
CTX and ART	Yes	CD4<200, CD4<350 and 1 severe ODs, or 2 ODs from subset	CD4 drops 50%	Dom	2,405	
CTX and ART	Yes	CD4<200, CD4<350 and 1 severe OD, or 1 OD from subset	CD4 drops 50%	Dom	2,471	
CTX and ART	Yes	CD4<200, CD4<350 and 1 severe OD, or 1 OD from subset	CD4 drops 90%	3,423	Dom	
Discounted Life Expectancy (months)						
	CD4 available?	1st-line ART Starting Criteria	1st-line ART Stopping Criteria	Base Case (with ART Effect)	No ART Effect	
No Treatment	No	---	---	31.4086	31.4086	
CTX only	No	---	---	32.8148	32.8148	
CTX and ART	No	2 ODs from subset	1 OD	41.3731	37.6488	
CTX and ART	No	1 OD from subset	1 OD	50.6996	42.7037	
CTX and ART	No	1 OD from subset	3 ODs	56.8151	Dom	
CTX and ART	No	1 OD from subset	5 ODs	57.8712	Dom	
CTX and ART	Yes	CD4<200, CD4<350 and 1 severe ODs, or 2 ODs from subset	CD4 drops 50%	Dom	51.2144	
CTX and ART	Yes	CD4<200, CD4<350 and 1 severe OD, or 1 OD from subset	CD4 drops 50%	Dom	51.5404	
CTX and ART	Yes	CD4<200, CD4<350 and 1 severe OD, or 1 OD from subset	CD4 drops 90%	69.6337	Dom	

Appendix Table D.7: One-Way Sensitivity Analyses on the Delay to OD Count Towards ART Failure

Panel A: One Line of ART Available – Cost-effectiveness (\$/YLS)

	CD4 available?	1 st -line ART Starting Criteria	1 st -line ART Stopping/Switching Criteria	Lag to OD Count		
				3 months	6 months (base case)	12 months
No Treatment	No	---	---	---	---	---
CTX only	No	---	---	240	240	240
CTX and ART	No	2 ODs from subset	1 OD	580	590	600
CTX and ART	No	2 ODs from subset	5 ODs	Dom	Dom	Dom
CTX and ART	No	1 OD from subset	1 OD	620	620	630
CTX and ART	No	1 OD from subset	3 ODs	880	890	900
CTX and ART	No	1 OD from subset	5 ODs	1,100	1,100	1,100
CTX and ART	Yes	CD4<200, CD4<350 and 1 severe OD, or 1 OD from subset	CD4 drops 50%	Dom	Dom	Dom
CTX and ART	Yes	CD4<200, CD4<350 and 1 severe OD, or 1 OD from subset	CD4 drops 90%	1,200	1,200	1,200

Panel B: Two Lines of ART Available

No Treatment	No	---	---	---	---	---
CTX only	No	---	---	240	240	240
CTX and ART	No	2 ODs from subset	1 OD	Dom	Dom	Dom
CTX and ART	No	2 ODs from subset	5 ODs	690	690	690
CTX and ART	No	1 OD from subset	1 OD	Dom	Dom	Dom
CTX and ART	No	1 OD from subset	3 ODs	Dom	Dom	Dom
CTX and ART	No	1 OD from subset	5 ODs	730	730	730
CTX and ART	Yes	CD4<200, CD4<350 and 1 severe OD, or 1 OD from subset	CD4 drops 90%	1,200	1,200	1,200
CTX and ART	Yes	CD4<200, CD4<350 and 1 severe OD, or 1 OD from subset	CD4 drops 50%	1,300	1,300	1,300

Appendix Table D.7: One-Way Sensitivity Analyses on the Delay to OD Count Towards ART Failure (cont.)

Panel A: One Line of ART Available – Cost (2002 US\$)

	CD4 available?	1 st -line ART Starting Criteria	1 st -line ART Stopping/Switching Criteria	Lag to OD Count		
				3 months	6 months (base case)	12 months
No Treatment	No	---	---	783	783	783
CTX only	No	---	---	811	811	811
CTX and ART	No	2 ODs from subset	1 OD	1,217	1,233	1,261
CTX and ART	No	2 ODs from subset	5 ODs	Dom	Dom	Dom
CTX and ART	No	1 OD from subset	1 OD	1,686	1,716	1,774
CTX and ART	No	1 OD from subset	3 ODs	2,164	2,171	2,182
CTX and ART	No	1 OD from subset	5 ODs	2,261	2,264	2,265
CTX and ART	Yes	CD4<200, CD4<350 and 1 severe OD, or 1 OD from subset	CD4 drops 50%	Dom	Dom	Dom
CTX and ART	Yes	CD4<200, CD4<350 and 1 severe OD, or 1 OD from subset	CD4 drops 90%	3,423	3,423	3,423

Panel B: Two lines of ART available

No Treatment	No	---	---	783	783	783
CTX only	No	---	---	811	811	811
CTX and ART	No	2 ODs from subset	1 OD	Dom	Dom	Dom
CTX and ART	No	2 ODs from subset	5 ODs	1,534	1,535	1,529
CTX and ART	No	1 OD from subset	1 OD	Dom	Dom	Dom
CTX and ART	No	1 OD from subset	3 ODs	Dom	Dom	Dom
CTX and ART	No	1 OD from subset	5 ODs	2,332	2,331	2,332
CTX and ART	Yes	CD4<200, CD4<350 and 1 severe OD, or 1 OD from subset	CD4 drops 90%	3,689	3,689	3,689
CTX and ART	Yes	CD4<200, CD4<350 and 1 severe OD, or 1 OD from subset	CD4 drops 50%	4,499	4,499	4,499

Appendix Table D.7: One-Way Sensitivity Analyses on the Delay to OD Count Towards ART Failure (cont.)

Panel A: One Line of ART Available – Discounted Life Expectancy (months)

	CD4 available?	1 st -line ART Starting Criteria	1 st -line ART Stopping/Switching Criteria	Lag to OD Count		
				3 months	6 months (base case)	12 months
No Treatment	No	---	---	31.4086	31.4086	31.4086
CTX only	No	---	---	32.8148	32.8148	32.8148
CTX and ART	No	2 ODs from subset	1 OD	41.1521	41.3731	41.7988
CTX and ART	No	2 ODs from subset	5 ODs	Dom	Dom	Dom
CTX and ART	No	1 OD from subset	1 OD	50.2424	50.6996	51.5253
CTX and ART	No	1 OD from subset	3 ODs	56.7286	56.8151	56.9394
CTX and ART	No	1 OD from subset	5 ODs	57.8062	57.8712	57.8267
CTX and ART	Yes	CD4<200, CD4<350 and 1 severe OD, or 1 OD from subset	CD4 drops 50%	Dom	Dom	Dom
CTX and ART	Yes	CD4<200, CD4<350 and 1 severe OD, or 1 OD from subset	CD4 drops 90%	69.6337	69.6337	69.6337

Panel B: Two Lines of ART Available

No Treatment	No	---	---	31.4086	31.4086	31.4086
CTX only	No	---	---	32.8148	32.8148	32.8148
CTX and ART	No	2 ODs from subset	1 OD	Dom	Dom	Dom
CTX and ART	No	2 ODs from subset	5 ODs	45.3427	45.3674	45.2722
CTX and ART	No	1 OD from subset	1 OD	Dom	Dom	Dom
CTX and ART	No	1 OD from subset	3 ODs	Dom	Dom	Dom
CTX and ART	No	1 OD from subset	5 ODs	58.5016	58.4927	58.5634
CTX and ART	Yes	CD4<200, CD4<350 and 1 severe OD, or 1 OD from subset	CD4 drops 90%	71.9188	71.9188	71.9188
CTX and ART	Yes	CD4<200, CD4<350 and 1 severe OD, or 1 OD from subset	CD4 drops 50%	79.5153	79.5153	79.5153

Appendix Table D.8: One-Way Sensitivity Analyses on CD4 Testing Frequency

Panel A: One Line of ART Available – Cost-effectiveness (\$/YLS)

	CD4 available?	1 st -line ART Starting Criteria	1 st -line ART Stopping/Switching Criteria	CD4 Testing Frequency	
				6 months (base case)	12 months
No Treatment	No	---	---	---	---
CTX only	No	---	---	240	240
CTX and ART	No	2 ODs from subset	1 OD	590	590
CTX and ART	No	2 ODs from subset	5 ODs	Dom	Dom
CTX and ART	No	1 OD from subset	1 OD	620	620
CTX and ART	No	1 OD from subset	3 ODs	890	890
CTX and ART	No	1 OD from subset	5 ODs	1,100	1,100 ^{***}
CTX and ART	Yes	CD4<200, CD4<350 and 1 severe OD, or 1 OD from subset	CD4 drops 50%	Dom	1,100 ^{†††}
CTX and ART	Yes	CD4<200, CD4<350 and 1 severe OD, or 1 OD from subset	CD4 drops 90%	1,200	1,200

Panel B: Two Lines of ART Available

No Treatment	No	---	---	---	---
CTX only	No	---	---	240	240
CTX and ART	No	2 ODs from subset	1 OD	Dom	Dom
CTX and ART	No	2 ODs from subset	5 ODs	690	690
CTX and ART	No	1 OD from subset	1 OD	Dom	Dom
CTX and ART	No	1 OD from subset	3 ODs	Dom	Dom
CTX and ART	No	1 OD from subset	5 ODs	730	730
CTX and ART	Yes	CD4<200, CD4<350 and 1 severe OD, or 1 OD from subset	CD4 drops 90%	1,200	1,100
CTX and ART	Yes	CD4<200, CD4<350 and 1 severe OD, or 1 OD from subset	CD4 drops 50%	1,300	1,200

Appendix Table D.8: One-Way Sensitivity Analyses on CD4 Testing Frequency (cont.)

Panel A: One Line of ART Available – Total Lifetime Costs (2002 US\$)

	CD4 available?	1 st -line ART Starting Criteria	1 st -line ART Stopping/Switching Criteria	CD4 Testing Frequency	
				6 months (base case)	12 months
No Treatment	No	---	---	783	783
CTX only	No	---	---	811	811
CTX and ART	No	2 ODs from subset	1 OD	1,233	1,233
CTX and ART	No	2 ODs from subset	5 ODs	Dom	Dom
CTX and ART	No	1 OD from subset	1 OD	1,716	1,716
CTX and ART	No	1 OD from subset	3 ODs	2,171	2,171
CTX and ART	No	1 OD from subset	5 ODs	2,264	2,264
CTX and ART	Yes	CD4<200, CD4<350 and 1 severe OD, or 1 OD from subset	CD4 drops 50%	Dom	3,080
CTX and ART	Yes	CD4<200, CD4<350 and 1 severe OD, or 1 OD from subset	CD4 drops 90%	3,423	3,255

Panel B: Two Lines of ART Available

No Treatment	No	---	---	783	783
CTX only	No	---	---	811	811
CTX and ART	No	2 ODs from subset	1 OD	Dom	Dom
CTX and ART	No	2 ODs from subset	5 ODs	1,535	1,535
CTX and ART	No	1 OD from subset	1 OD	Dom	Dom
CTX and ART	No	1 OD from subset	3 ODs	Dom	Dom
CTX and ART	No	1 OD from subset	5 ODs	2,331	2,331
CTX and ART	Yes	CD4<200, CD4<350 and 1 severe OD, or 1 OD from subset	CD4 drops 90%	3,689	3,453
CTX and ART	Yes	CD4<200, CD4<350 and 1 severe OD, or 1 OD from subset	CD4 drops 50%	4,499	4,157

Appendix Table D.8: One-Way Sensitivity Analyses on CD4 Testing Frequency (cont.)

Panel A: One Line of ART Available – Discounted Life Expectancy (months)

	CD4 available?	1 st -line ART Starting Criteria	1 st -line ART Stopping/Switching Criteria	CD4 Testing Frequency	
				6 months (base case)	12 months
No Treatment	No	---	---	31.4086	31.4086
CTX only	No	---	---	32.8148	32.8148
CTX and ART	No	2 ODs from subset	1 OD	41.3731	41.3731
CTX and ART	No	2 ODs from subset	5 ODs	Dom	Dom
CTX and ART	No	1 OD from subset	1 OD	50.6996	50.6996
CTX and ART	No	1 OD from subset	3 ODs	56.8151	56.8151
CTX and ART	No	1 OD from subset	5 ODs	57.8712	57.8712
CTX and ART	Yes	CD4<200, CD4<350 and 1 severe OD, or 1 OD from subset	CD4 drops 50%	Dom	67.0468
CTX and ART	Yes	CD4<200, CD4<350 and 1 severe OD, or 1 OD from subset	CD4 drops 90%	69.6337	68.7503

Panel B: Two Lines of ART Available

No Treatment	No	---	---	31.4086	31.4086
CTX only	No	---	---	32.8148	32.8148
CTX and ART	No	2 ODs from subset	1 OD	Dom	Dom
CTX and ART	No	2 ODs from subset	5 ODs	45.3674	45.3674
CTX and ART	No	1 OD from subset	1 OD	Dom	Dom
CTX and ART	No	1 OD from subset	3 ODs	Dom	Dom
CTX and ART	No	1 OD from subset	5 ODs	58.4927	58.4927
CTX and ART	Yes	CD4<200, CD4<350 and 1 severe OD, or 1 OD from subset	CD4 drops 90%	71.9188	70.4362
CTX and ART	Yes	CD4<200, CD4<350 and 1 severe OD, or 1 OD from subset	CD4 drops 50%	79.5153	77.2562

Appendix Table D.9: One-Way Sensitivity Analyses on ODs Included in Clinical ART Initiation Criteria

Cost-effectiveness (\$/YLS)									
	CD4 available?	1 st -line ART Starting Criteria	1 st -line ART Stopping Criteria	Base Case	<u>ODs included in Clinical ART Starting Criteria</u>				
					Severe Bacterial	Severe Malaria	Tuberculosis	Severe Malaria, Severe Bacterial	Severe Malaria, Severe Bacterial, & Tuberculosis
No Treatment	No	---	---	---	---	---	---	---	---
CTX only	No	---	---	240	240	240	240	240	240
CTX and ART	No	2 OD from subset	1 OD	590	600	590	600	600	600
CTX and ART	No	1 OD from subset	1 OD	620	630	620	630	640	640
CTX and ART	No	1 OD from subset	3 ODs	890	900	900	900	920	910
CTX and ART	No	1 OD from subset	5 ODs	1,100	1,100	1,100	1,000	1,000	1,000
CTX and ART	Yes	CD4<200, CD4<350 and 1 severe OD, or 1 OD from subset	CD4 drops 50%	Dom	Dom	Dom	Dom	Dom	Dom
CTX and ART	Yes	CD4<200, CD4<350 and 1 severe OD, or 1 OD from subset	CD4 drops 90%	1,200	1,400	1,200	1,300	1,400	1,600

Appendix Table D.9: One-Way Sensitivity Analyses on ODs Included in Clinical ART Initiation Criteria (cont.)

Total Lifetime Costs (2002 US\$)

	CD4 available?	1 st -line ART Starting Criteria	1 st -line ART Stopping Criteria	Base Case	<u>ODs included in Clinical ART Starting Criteria</u>				
					Severe Bacterial	Severe Malaria	Tuberculosis	Severe Malaria, Severe Bacterial	Severe Malaria, Severe Bacterial, & Tuberculosis
No Treatment	No	---	---	783	783	783	783	783	783
CTX only	No	---	---	811	811	811	811	811	811
CTX and ART	No	2 OD from subset	1 OD	1,233	1,377	1,254	1,326	1,394	1,477
CTX and ART	No	1 OD from subset	1 OD	1,716	1,875	1,751	1,807	1,903	1,970
CTX and ART	No	1 OD from subset	3 ODs	2,171	2,399	2,221	2,300	2,436	2,538
CTX and ART	No	1 OD from subset	5 ODs	2,264	2,511	2,318	2,406	2,552	2,654
CTX and ART	Yes	CD4<200, CD4<350 and 1 severe OD, or 1 OD from subset	CD4 drops 50%	Dom	Dom	Dom	Dom	Dom	Dom
CTX and ART	Yes	CD4<200, CD4<350 and 1 severe OD, or 1 OD from subset	CD4 drops 90%	3,423	3,493	3,453	3,460	3,514	3,540

Appendix Table D.9: One-Way Sensitivity Analyses on ODs Included in Clinical ART Initiation Criteria (cont.)

Discounted Life Expectancy (months)

	CD4 available?	1 st -line ART Starting Criteria	1 st -line ART Stopping Criteria	Base Case	<u>ODs included in Clinical ART Starting Criteria</u>				
					Severe Bacterial	Severe Malaria	Tuberculosis	Severe Malaria, Severe Bacterial	Severe Malaria, Severe Bacterial, & Tuberculosis
No Treatment	No	---	---	31.4086	31.4086	31.4086	31.4086	31.4086	31.4086
CTX only	No	---	---	32.8148	32.8148	32.8148	32.8148	32.8148	32.8148
CTX and ART	No	2 OD from subset	1 OD	41.3731	44.2141	41.7614	43.2097	44.5508	46.1426
CTX and ART	No	1 OD from subset	1 OD	50.6996	53.6565	51.3341	52.3742	54.1381	55.4063
CTX and ART	No	1 OD from subset	3 ODs	56.8151	60.6191	57.6251	58.9283	61.1067	62.8628
CTX and ART	No	1 OD from subset	5 ODs	57.8712	61.8896	58.6909	60.1924	62.5051	64.1944
CTX and ART	Yes	CD4<200, CD4<350 and 1 severe OD, or 1 OD from subset	CD4 drops 50%	Dom	Dom	Dom	Dom	Dom	Dom
CTX and ART	Yes	CD4<200, CD4<350 and 1 severe OD, or 1 OD from subset	CD4 drops 90%	69.6337	70.434	69.973	70.0511	70.6835	70.9562

Appendix Table D.10: Sensitivity Analyses on Consideration of Adherence Interventions

Cost-effectiveness (\$/YLS)

	CD4 available?	1 st -line ART Starting Criteria	1 st -line ART Stopping Criteria	Base Case	Adherence Interventions		No Intervention, Decreasing Adherence
					Intervention to Maintain Current Adherence	Intervention to Improve Adherence	
No Treatment	No	---	---	---	---	---	---
CTX only	No	---	---	240	240	240	240
CTX and ART	No	2 ODs from subset	1 OD	590	680	660	620
CTX and ART	No	1 OD from subset	1 OD	620	720	700	650
CTX and ART	No	1 OD from subset	3 ODs	890	1,100	1,000	1,000
CTX and ART	No	1 OD from subset	5 ODs	1,100	1,300 ^{†††}	1,200	1,100
CTX and ART	Yes	CD4<200, CD4<350 and 1 severe OD, or 1 OD from subset	CD4 drops 50%	Dom	1,300 ^{§§§}	1,200 ^{****}	Dom
CTX and ART	Yes	CD4<200, CD4<350 and 1 severe OD, or 1 OD from subset	CD4 drops 90%	1,200	1,400	1,300	1,200

Appendix Table D.10: Sensitivity Analyses on Consideration of Adherence Interventions (cont.)

Total Lifetime Costs (2002 US\$)

	CD4 available?	1 st -line ART Starting Criteria	1 st -line ART Stopping Criteria	Base Case	Adherence Interventions		No Intervention, Decreasing Adherence
					Intervention to Maintain Current Adherence	Intervention to Improve Adherence	
No Treatment	No	---	---	783	783	783	783
CTX only	No	---	---	811	811	811	811
CTX and ART	No	2 ODs from subset	1 OD	1,233	1,294	1,319	1,199
CTX and ART	No	1 OD from subset	1 OD	1,716	1,852	1,912	1,643
CTX and ART	No	1 OD from subset	3 ODs	2,171	2,390	2,504	2,024
CTX and ART	No	1 OD from subset	5 ODs	2,264	2,500	2,638	2,100
CTX and ART	Yes	CD4<200, CD4<350 and 1 severe OD, or 1 OD from subset	CD4 drops 50%	Dom	3,502	3,772	Dom
CTX and ART	Yes	CD4<200, CD4<350 and 1 severe OD, or 1 OD from subset	CD4 drops 90%	3,423	3,753	4,007	3,108

Appendix Table D.10: Sensitivity Analyses on Consideration of Adherence Interventions (cont.)

Discounted Life Expectancy (months)

	CD4 available?	1 st -line ART Starting Criteria	1 st -line ART Stopping Criteria	Base Case	<u>Adherence Interventions</u>		No Intervention, Decreasing Adherence
					Intervention to Maintain Current Adherence	Intervention to Improve Adherence	
No Treatment	No	---	---	31.4086	31.4086	31.4086	31.4086
CTX only	No	---	---	32.8148	32.8148	32.8148	32.8148
CTX and ART	No	2 ODs from subset	1 OD	41.3731	41.3731	42.0503	40.3798
CTX and ART	No	1 OD from subset	1 OD	50.6996	50.6996	52.2511	48.5558
CTX and ART	No	1 OD from subset	3 ODs	56.8151	56.8151	59.2898	53.2289
CTX and ART	No	1 OD from subset	5 ODs	57.8712	57.8712	60.6866	54.0377
CTX and ART	Yes	CD4<200, CD4<350 and 1 severe OD, or 1 OD from subset	CD4 drops 50%	Dom	67.4488	71.7406	Dom
CTX and ART	Yes	CD4<200, CD4<350 and 1 severe OD, or 1 OD from subset	CD4 drops 90%	69.6337	69.6337	73.847	63.8144

Appendix Table D.11: One-Way Sensitivity Analyses on CD4 Test Costs

Panel A: One Line of ART Available – Cost-effectiveness (\$/YLS)

	CD4 available?	1 st -line ART Starting Criteria	1 st -line ART Stopping/Switching Criteria	Decrease by 75%	Decrease by 50%	CD4 Test Costs			
						Base case	Increase by 100%	Increase by 200%	Increase by 300%
No Treatment	No	---	---	---	---	---	---	---	---
CTX only	No	---	---	240	240	240	240	240	240
CTX and ART	No	2 ODs from subset	1 OD	590	590	590	590	590	590
CTX and ART	No	2 ODs from subset	5 ODs	Dom	Dom	Dom	Dom	Dom	Dom
CTX and ART	No	1 OD from subset	1 OD	620	620	620	620	620	620
CTX and ART	No	1 OD from subset	3 ODs	890	890	890	890	890	890
CTX and ART	No	1 OD from subset	5 ODs	Dom	Dom	1,100	1,100	1,100	1,100
CTX and ART	Yes	CD4<200, CD4<350 and 1 severe OD, or 1 OD from subset	CD4 drops 50%	950	1,000	Dom	Dom	Dom	Dom
CTX and ART	Yes	CD4<200, CD4<350 and 1 severe OD, or 1 OD from subset	CD4 drops 90%	1,100	1,100	1,200	1,500	1,700	2,000

Panel B: Two Lines of ART Available

No Treatment	No	---	---	---	---	---	---	---	---
CTX only	No	---	---	240	240	240	240	240	240
CTX and ART	No	2 ODs from subset	1 OD	Dom	Dom	Dom	Dom	Dom	Dom
CTX and ART	No	2 ODs from subset	5 ODs	690	690	690	690	690	690
CTX and ART	No	1 OD from subset	1 OD	Dom	Dom	Dom	Dom	Dom	Dom
CTX and ART	No	1 OD from subset	5 ODs	730	730	730	730	730	730
CTX and ART	No	1 OD from subset	3 ODs	Dom	Dom	Dom	Dom	1,500	1,500
CTX and ART	Yes	CD4<200, CD4<350 and 1 severe OD, or 1 OD from subset	CD4 drops 90%	1,000	1,100	1,200	Dom	Dom	Dom
CTX and ART	Yes	CD4<200, CD4<350 and 1 severe OD, or 1 OD from subset	CD4 drops 50%	1,200	1,300	1,300	1,400	1,600	1,800

Appendix Table D.11: One-Way Sensitivity Analyses on CD4 Test Costs (cont.)

Panel A: One Line of ART Available – Total Lifetime Costs (2002 US\$)

	CD4 available?	1 st -line ART Starting Criteria	1 st -line ART Stopping/Switching Criteria	Decrease by 75%	Decrease by 50%	CD4 Test Costs			
						Base case	Increase by 100%	Increase by 200%	Increase by 300%
No Treatment	No	---	---	783	783	783	783	783	783
CTX only	No	---	---	811	811	811	811	811	811
CTX and ART	No	2 ODs from subset	1 OD	1,233	1,233	1,233	1,233	1,233	1,233
CTX and ART	No	2 ODs from subset	5 ODs	Dom	Dom	Dom	Dom	Dom	Dom
CTX and ART	No	1 OD from subset	1 OD	1,716	1,716	1,716	1,716	1,716	1,716
CTX and ART	No	1 OD from subset	3 ODs	2,171	2,171	2,171	2,171	2,171	2,171
CTX and ART	No	1 OD from subset	5 ODs	2,264	2,264	2,264	2,264	2,264	2,264
CTX and ART	Yes	CD4<200, CD4<350 and 1 severe OD, or 1 OD from subset	CD4 drops 50%	3,014	3,080	3,211	3,473	3,734	3,996
CTX and ART	Yes	CD4<200, CD4<350 and 1 severe OD, or 1 OD from subset	CD4 drops 90%	3,221	3,289	3,423	3,693	3,963	4,232

Panel B: Two Lines of ART Available

No Treatment	No	---	---	783	783	783	783	783	783
CTX only	No	---	---	811	811	811	811	811	811
CTX and ART	No	2 ODs from subset	1 OD	Dom	Dom	Dom	Dom	Dom	Dom
CTX and ART	No	2 ODs from subset	5 ODs	1,535	1,535	1,535	1,535	1,535	1,535
CTX and ART	No	1 OD from subset	1 OD	Dom	Dom	Dom	Dom	Dom	Dom
CTX and ART	No	1 OD from subset	5 ODs	2,331	2,331	2,331	2,331	2,331	2,331
CTX and ART	No	1 OD from subset	3 ODs	Dom	Dom	Dom	Dom	2,468	2,468
CTX and ART	Yes	CD4<200, CD4<350 and 1 severe OD, or 1 OD from subset	CD4 drops 90%	3,481	3,551	3,689	Dom	Dom	Dom
CTX and ART	Yes	CD4<200, CD4<350 and 1 severe OD, or 1 OD from subset	CD4 drops 50%	4,270	4,346	4,499	4,806	5,112	5,419

Appendix Table D.12: One-Way Sensitivity Analyses on Routine Care Costs

Cost-effectiveness (\$/YLS)

Base Case	CD4 available?	1 st -line ART Starting Criteria	1 st -line ART Stopping/Switching Criteria	x0.5	Routine Care Costs (all patients)		
					Base case	x2	x3
No Treatment	No	---	---	---	---	---	---
CTX only	No	---	---	160	240	420	580
CTX and ART	No	2 ODs from subset	1 OD	510	590	760	930
CTX and ART	No	1 OD from subset	1 OD	540	620	790	960
CTX and ART	No	1 OD from subset	3 ODs	810	890	1,100	1,200
CTX and ART	No	1 OD from subset	5 ODs	Dom	1,100	1,200	1,400
CTX and ART	Yes	CD4<200, CD4<350 and 1 severe OD, or 2 ODs from subset	CD4 drops 50%	Dom	Dom	Dom	Dom
CTX and ART	Yes	CD4<200, CD4<350 and 1 severe OD, or 1 OD from subset	CD4 drops 50%	930	Dom	Dom	Dom
CTX and ART	Yes	CD4<200, CD4<350 and 1 severe OD, or 1 OD from subset	CD4 drops 90%	1,100	1,200	1,600	2,100

Routine Care Costs for Patients with CD4<100 cells/mm³

				Base Case	x2	x5	x10
No Treatment	No	---	---	---	Dom	Dom	Dom
CTX only	No	---	---	240	Dom	Dom	Dom
CTX only	Yes	---	---	Dom	---	---	---
CTX and ART	No	2 ODs from subset	1 OD	590	Dom	Dom	Dom
CTX and ART	No	1 OD from subset	1 OD	620	Dom	Dom	Dom
CTX and ART	No	1 OD from subset	3 ODs	890	Dom	Dom	Dom
CTX and ART	No	1 OD from subset	5 ODs	1,100	Dom	Dom	Dom
CTX and ART	Yes	CD4<200, CD4<350 and 1 severe OD, or 2 ODs from subset	CD4 drops 50%	Dom	740	740	730
CTX and ART	Yes	CD4<200, CD4<350 and 1 severe OD, or 1 OD from subset	CD4 drops 50%	Dom	930	930	930
CTX and ART	Yes	CD4<200, CD4<350 and 1 severe OD, or 1 OD from subset	CD4 drops 90%	1,200	1,300	1,600	2,200

Appendix Table D.12: One-Way Sensitivity Analyses on Routine Care Costs (cont.)

Total Lifetime Costs (2002 US\$)

	CD4 available?	1 st -line ART Starting Criteria	1 st -line ART Stopping Criteria	x0.5	Routine Care Costs (all patients)		
					Base case	x2	x3
No Treatment	No	---	---	560	783	1,228	1,674
CTX only	No	---	---	579	811	1,277	1,742
CTX and ART	No	2 ODs from subset	1 OD	939	1,233	1,819	2,406
CTX and ART	No	1 OD from subset	1 OD	1,357	1,716	2,435	3,154
CTX and ART	No	1 OD from subset	3 ODs	1,768	2,171	2,977	3,782
CTX and ART	No	1 OD from subset	5 ODs	1,853	2,264	3,084	3,905
CTX and ART	Yes	CD4<200, CD4<350 and 1 severe OD, or 2 ODs from subset	CD4 drops 50%	Dom	Dom	Dom	Dom
CTX and ART	Yes	CD4<200, CD4<350 and 1 severe OD, or 1 OD from subset	CD4 drops 50%	2,593	3,211	4,447	5,682
CTX and ART	Yes	CD4<200, CD4<350 and 1 severe OD, or 1 OD from subset	CD4 drops 90%	2,790	3,423	4,690	5,958
Routine Care Costs for Patients with CD4>100 cells/mm³							
				Base Case	x2	x5	x10
No Treatment	No	---	---	783	1,228	2,565	4,791
CTX only	No	---	---	811	1,277	2,673	4,999
CTX only	Yes	---	---	1,067	1,139	1,356	1,716
CTX and ART	No	2 ODs from subset	1 OD	1,233	1,819	3,579	6,513
CTX and ART	No	1 OD from subset	1 OD	1,716	2,435	4,592	8,186
CTX and ART	No	1 OD from subset	3 ODs	2,171	2,977	5,393	9,422
CTX and ART	No	1 OD from subset	5 ODs	2,264	3,084	5,546	9,649
CTX and ART	Yes	CD4<200, CD4<350 and 1 severe OD, or 2 ODs from subset	CD4 drops 50%	3,085	3,153	3,358	3,698
CTX and ART	Yes	CD4<200, CD4<350 and 1 severe OD, or 1 OD from subset	CD4 drops 50%	3,211	3,279	3,484	3,825
CTX and ART	Yes	CD4<200, CD4<350 and 1 severe OD, or 1 OD from subset	CD4 drops 90%	3,423	3,512	3,777	4,219

Appendix Table D.13: One-Way Sensitivity Analyses on Acute Opportunistic Disease Costs

Cost-effectiveness (\$/YLS)

	CD4 available?	1 st -line ART Starting Criteria	1 st -line ART Stopping Criteria	Decrease by 50%	Acute OI Costs	
					Base case	Increase by 100%
No Treatment	No	---	---	---	---	Dom
CTX only	No	---	---	390	240	---
CTX and ART	No	2 ODs from subset	1 OD	570	590	640
CTX and ART	No	1 OD from subset	1 OD	610	620	660
CTX and ART	No	1 OD from subset	3 ODs	870	890	940
CTX and ART	No	1 OD from subset	5 ODs	1,000	1,100	1,100
CTX and ART	Yes	CD4<200, CD4<350 and 1 severe OD, or 1 OD from subset	CD4 drops 50%	Dom	Dom	1,200
CTX and ART	Yes	CD4<200, CD4<350 and 1 severe OD, or 1 OD from subset	CD4 drops 90%	1,200	1,200	1,300
Total Lifetime Costs (2002 US\$)						
No Treatment	No	---	---	646	783	1,058
CTX only	No	---	---	692	811	1,049
CTX and ART	No	2 ODs from subset	1 OD	1,096	1,233	1,505
CTX and ART	No	1 OD from subset	1 OD	1,566	1,716	2,017
CTX and ART	No	1 OD from subset	3 ODs	2,008	2,171	2,496
CTX and ART	No	1 OD from subset	5 ODs	2,099	2,264	2,593
CTX and ART	Yes	CD4<200, CD4<350 and 1 severe OD, or 1 OD from subset	CD4 drops 50%	3,029	3,211	3,574
CTX and ART	Yes	CD4<200, CD4<350 and 1 severe OD, or 1 OD from subset	CD4 drops 90%	3,234	3,423	3,802

Appendix Table D.14: One-way Sensitivity Analysis on Discount Rate
Cost-Effectiveness Ratios (\$/YLS)

	CD4 available?	1 st -line ART Starting Criteria	1 st -line ART Stopping Criteria	Discount Rate		
				0%	3%	5%
No Treatment	No	---	---	---	---	---
CTX alone	No	---	---	250	240	240
CTX and ART	No	2 ODs from subset	1 OD	570	590	600
CTX and ART	No	1 OD from subset	1 OD	600	620	640
CTX and ART	No	1 OD from subset	3 ODs	860	890	920
CTX and ART	No	1 OD from subset	5 ODs	1,000	1,100	1,100
CTX and ART	Yes	CD4<200, CD4<350 and 1 severe OD, or 1 OD from subset	CD4 drops 90%	1,200	1,200	1,200
Total Lifetime Costs (2002 US\$)						
	CD4 available?	1 st -line ART Starting Criteria	1 st -line ART Stopping Criteria	0%	3%	5%
No Treatment	No	---	---	840	783	750
CTX alone	No	---	---	873	811	776
CTX and ART	No	2 ODs from subset	1 OD	1,386	1,233	1,148
CTX and ART	No	1 OD from subset	1 OD	1,949	1,716	1,589
CTX and ART	No	1 OD from subset	3 ODs	2,540	2,171	1,976
CTX and ART	No	1 OD from subset	5 ODs	2,670	2,264	2,051
CTX and ART	Yes	CD4<200, CD4<350 and 1 severe OD, or 1 OD from subset	CD4 drops 90%	4,020	3,423	3,109
Discounted Life Expectancy (months)						
	CD4 available?	1 st -line ART Starting Criteria	1 st -line ART Stopping Criteria	0%	3%	5%
No Treatment	No	---	---	33.6399	31.4086	30.0963
CTX alone	No	---	---	35.2454	32.8148	31.3900
CTX and ART	No	2 ODs from subset	1 OD	45.9814	41.3731	38.8211
CTX and ART	No	1 OD from subset	1 OD	57.2883	50.6996	47.1058
CTX and ART	No	1 OD from subset	3 Ods	65.5831	56.8151	52.1644
CTX and ART	No	1 OD from subset	5 Ods	67.1231	57.8712	52.9969
CTX and ART	Yes	CD4<200, CD4<350 and 1 severe OD, or 1 OD from subset	CD4 drops 90%	81.1667	69.6337	63.5533

Appendix Tables Notes:

- * CTX: co-trimoxazole prophylaxis; ICER: incremental cost-effectiveness ratio; ART: antiretroviral therapy; YLS: years of life saved; OD: opportunistic disease. All cost effectiveness ratios have been rounded to two significant figures.
 - † The value prior to rounding was 1,121.
 - ‡ The value prior to rounding was 1,213.
 - § The value prior to rounding was 1,232.
 - || The value prior to rounding was 1,281.
 - ** The value prior to rounding was 1,311.
 - †† The value prior to rounding was 455.
 - ‡‡ The value prior to rounding was 462.
 - §§ The value prior to rounding was 1,154.
 - ||| The value prior to rounding was 1,163.
 - *** The value prior to rounding was 1,057.
 - ††† The value prior to rounding was 1,067.
 - ‡‡‡ The value prior to rounding was 1,250.
 - §§§ The value prior to rounding was 1,255.
 - |||| The value prior to rounding was 1,151.
 - **** The value prior to rounding was 1,231.
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