

Supplementary Appendix

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

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APPENDIX

A. SUPPLEMENTAL COST INFORMATION

A.1 Currency Conversion, Inflation, and Inter-country Comparability

Costs are reported in international dollars to facilitate more meaningful comparisons across regions. Costs in local currency units were converted to international dollars by use of purchasing power parity (PPP) exchange rates rather than official exchange rates. A purchasing power parity exchange rate is a rate of currency conversion that equalizes the purchasing power of different currencies by eliminating the differences in price levels between countries.¹

Conceptually, such an exchange rate reflects the number of units of a country's currency required to buy the same amounts of goods and services in the domestic market as a U.S. dollar would buy in the United States. Thus, reflecting costs in international dollars provides a means of comparing costs that accounts for differences in purchasing power between countries. We utilized a quantity-and-price approach for costing, in which quantities of each input and cost per input were estimated and total cost was then computed by multiplying price per unit and number of units per service to calculate price per service. Wherever possible, we estimated these items from country-specific data and, when necessary, supplemented with published literature. A series of standardized assumptions, using consensus meetings involving representatives from all five countries, was established for supplies and equipment needs, clinician time, and protocols of care. For all countries, costs were inflated to year 2000 levels and then converted to international dollars by means of PPP exchange rates.¹⁻³

A.2 Screening Visit/Sample Collection

South African estimates were based on actual nationally-standardized fee schedules for services currently provided and detailed micro-costing estimates in previously published work.⁴ For all countries except South Africa, the following methodology was followed. We assumed fifteen minutes of a nurse's time would be needed to perform visual inspection (VIA), collect a cervical sample, or collect a human papillomavirus (HPV) DNA sample. A common set of equipment including a light source, a Graves speculum, and latex gloves was assumed for all three screening procedures. Certain supplies differed according to each procedure: VIA required acetic acid and cotton swabs, cytology required the supplies necessary to prepare glass slides, and HPV DNA testing required a specialized collection kit. These variations in supplies used for each screening method were the main sources of cost differences between the initial screening visits, presented below.

Cost of Screening/Sample Collection

Costs (2000 International \$)	India	Kenya	Peru	Thailand
Visual inspection (VIA)	1.51	1.83	3.52	1.62
Cytology	2.34	2.67	3.65	2.21
HPV DNA	4.22	5.60	6.21	4.71

A.3 Laboratory-Related Costs

Cervical Cytology Laboratory

Laboratory costs for cervical cytology were estimated in two ways. First, micro-costing estimates were made based on expert assessment of time, equipment, and supply needs. Second, we adapted a published methodology for estimating cervical cytology laboratory costs at different capacity levels to approximate cervical cytology laboratory costs requiring fewer country-specific data items.⁵ For this second method, data from multiple sources were used. Country-specific national civil service data and hospital pay rates informed salaries for cytotechnologists and pathologists. WHO-CHOICE regional data provided estimates for costs of facilities.² The calculation of laboratory costs included the cost of supervision necessary to maintain quality assurance/quality control (QA/QC) at an adequate level. We used the second estimation method to parameterize the model, after validating this estimate against the results from the micro-costing method.

Cervical Cytology Laboratory Costs: Estimates from Two Methods

Costs (2000 International \$)	India	Kenya	Peru	Thailand
Cytotechnologist (per slide)	0.99	1.39	1.77	1.39
Pathologist (per slide)	0.11	0.16	0.18	0.08
Supplies (per slide)	0.25	0.25	0.25	0.25
Facilities (per slide)	0.23	0.10	0.37	0.12
Total cytology lab cost (per slide)	1.58	1.90	2.57	1.84
Micro-estimate comparison (per slide)	1.47	1.93	2.32	2.04

HPV DNA Laboratory

We generated the micro-costing estimates for HPV DNA laboratories using expert assessments of time, equipment, and supply needs. To supplement these estimates, the second method (utilizing multiple data sources to determine laboratory facilities costs) was adapted to compute facilities costs for HPV DNA laboratories based on the appropriate mix of technicians, pathologists, and equipment. Aside from the differences in equipment and staff mix between cervical cytology laboratories and HPV DNA laboratories, the largest cost difference is the HPV DNA test kit. A standardized value of \$5.33 was used for the HPV DNA test kit. (Digene Corporation offered the international sale price of \$5.00, and we assumed an additional \$0.33 for breakage.) Supply and equipment costs for items such as microplate luminometers, pipette tips, and multichannel racks added another \$0.33.

HPV DNA Laboratory Costs

Costs (2000 International \$)	India	Kenya	Peru	Thailand
Staff (per sample)	0.39	0.59	0.84	0.66
Equipment / Supplies (per sample)	5.66	5.66	5.66	5.66
Facilities (per sample)	0.10	0.05	0.17	0.06
Total HPV DNA lab cost (per sample)	6.15	6.30	6.67	6.38

Laboratory Sample Processing Capacity

Based on Bishop's estimation methods for cervical cytology laboratories and our adaptation for HPV DNA laboratories, an estimate of sample-processing capacity was made for a laboratory-equivalent-year for each type of laboratory.⁵

Sample Processing Capability by Laboratory Type

Sample processing capability	Cytology	HPV DNA
Laboratory capacity (samples processed/year)	28,800	21,600

Laboratory Sample Transport

To estimate the costs of transporting cervical samples from the primary screening sites to laboratories for evaluation, either by cervical cytology or HPV DNA testing, we employed the following methodology. Because the screening tests under consideration have not been established on a national level in the study countries, estimates of distances from laboratories to clinical sites could not be based on actual facility locations. Instead, we determined the number of thirty-five-year-old, non-urban females for each country, derived from country-specific data from the U.S. Census Bureau's International Data Base.⁶ Assuming a uniform population distribution, the total land area was employed to determine a density of screen-eligible women.⁷ We combined the eligible population density estimates with our previous sample per year estimates for cervical cytology and HPV DNA laboratories to compute the land area covered by a laboratory (square kilometers per laboratory = samples processed per laboratory divided by eligible women per square kilometers). We approximated the length of a weekly driving route to

collect samples from primary screening sites and bring them to the laboratory, based on the land area covered by a laboratory. By applying World Bank statistics of road network density and percentage paved roads, we assessed the percentage of the route spent on paved roads, versus the percentage traveled on unpaved roads.⁷ Based on International Center for Tropical Agriculture estimates of driving speeds on paved and unpaved roads in developing countries, we calculated an average time for driving.⁸ With these driving distances and times as well as WHO-CHOICE salary and transportation unit cost estimates, we generated component costs for driver pay, vehicle maintenance, gasoline, and vehicle depreciation associated with laboratory transport.⁹ For urban populations, we made similar calculations assuming higher degrees of efficiency due to higher population density and greater proportions of paved roads. We formed a weighted average of the urban and rural laboratory transportation costs based on the percentage of the population living in urban areas.⁷

Per-Sample Transportation Costs for Both Types of Laboratories

Costs (2000 International \$)	India	Kenya	Peru	Thailand
Sample transport (cytology)	0.09	0.35	0.21	0.10
Sample transport (HPV DNA)	0.11	0.40	0.24	0.12

A.4 Quality Assurance / Quality Control for VIA

While VIA does not require laboratory services or specimen transport, it does require supervision to maintain consistent sensitivity and specificity. Estimates of the cost of this activity consisted of one week of a senior nurse's time per 720 screenings, or one senior nurse week per six nurse weeks (720 screenings per week = 15 minutes per screening per nurse for 30 hours per week for 6 nurses). Additionally, the QA/QC cost estimate included one day of doctor time per 720 screenings, or one doctor day per six nurse weeks.

Per-Sample VIA QA/QC Costs

Costs (2000 International \$)	India	Kenya	Peru	Thailand
VIA QA/QC per screen	0.31	0.48	0.61	0.46

A.5 Total Screening Costs

Total screening costs, including laboratory, laboratory transport, and VIA QA/QC, for each country follow:

Total Direct Medical Costs Including Laboratory Costs and QA/QC by Screening Method

Costs (2000 International \$)	India	Kenya	Peru	S. Africa	Thailand
VIA	1.82	2.31	4.13	14.21	2.08
Cervical cytology	4.01	4.92	6.43	19.64	4.15
HPV DNA	10.48	12.30	13.12	21.21	11.21

A.6 Diagnostic Testing

National fee schedules, hospital charge rates from each country, and published literature informed the cost estimates of diagnostic testing in the form of colposcopy and, when appropriate, biopsy.^{4,10}

Costs of Colposcopy and Biopsy

Costs (2000 International \$)	India	Kenya	Peru	S. Africa	Thailand
Colposcopy / biopsy cost	36.14	27.71	10.42	107.87	81.10

A.7 Treatment of Pre-Cancer

Primary data from pilot project experience, hospital charge rates, and published literature for four treatment types (cryosurgery; loop electrosurgical excision procedure (LEEP); cold knife conization; and simple hysterectomy) determined the cost of treatment for cervical intraepithelial neoplasia (CIN).^{4,10} We estimated the costs of hospitalization and follow-up visits as well as the costs of major and minor complications.

Pre-Cancer Procedure Costs by Treatment Type

Costs (2000 International \$)	India	Kenya	Peru	S. Africa	Thailand
Cryosurgery	14.35	24.86	11.75	88.86	40.55
LEEP	95.96	222.33	173.43	378.63	324.39
Cold knife conization	212.58	291.58	394.17	458.48	486.58
Simple hysterectomy	303.68	601.39	533.64	1582.73	973.16

Hospitalization

We assumed cryosurgery and LEEP were performed as outpatient procedures, while cold knife conization and simple hysterectomy were performed as inpatient procedures. For each inpatient procedure, the number of days of hospitalization and costs per hospitalized day were ascertained from primary in-country data.

Hospitalization Days by Treatment Type

Hospitalization (# days)	India	Kenya	Peru	S. Africa	Thailand
Cold knife conization	3	1	1	1	4
Simple hysterectomy	7	5	4	7	7

Cost of Hospital Inpatient Day

Costs (2000 International \$)	India	Kenya	Peru	S. Africa	Thailand
Inpatient day	4.56	17.53	94.00	231.75	24.33

Follow-up Visits

We assumed cryosurgery required one follow-up visit on average within the first year after treatment. All other treatment types necessitated two follow-up visits on average within the first year after treatment. For cryosurgery, the cost of the follow-up visit was assumed to be the same as the cost of a cervical cytology screening visit. For all other treatment types, we assumed the cost of the first follow-up visit was the same as the cost of a colposcopy visit; the cost of the second follow-up visit was the same as the cost of a cervical cytology screening visit.

Complications

The rates of complications from cryosurgery were conservatively assumed to be five percent for minor complications and one percent for major complications. We defined minor complications as any complication requiring a clinic visit. We assumed that at some clinic visits pain medicines would be dispensed and at others antibiotics would be dispensed. We defined major complications as any complication requiring a hospital admission that might include intravenous antibiotics, blood transfusions, or other procedures. Country-specific data collection established costs associated with complications.

Average Cryosurgical Complication Costs

Costs (2000 International \$)	India	Kenya	Peru	S. Africa	Thailand
Minor complication	13.67	6.30	18.47	42.20	41.49
Major complication	151.84	75.56	94.00	514.00	248.94

A.8 Cancer Care

Cancer costs estimates include staging of cancer as well as treatment and management. We applied a standardized set of treatments based both on international recommendations and current in-country practice. Local cancers were treated with a mixture of simple and radical hysterectomy while regional and distant cancers were treated with radiotherapy only.¹¹

Standardized Cancer Care by Cancer Stage

FIGO Cancer Stage	Model Nomenclature	Care Algorithm
1a1	Local	Simple hysterectomy
1a2	Local	Simple hysterectomy
1b1	Local	Radical hysterectomy
1b2	Local	Radical hysterectomy
2a	Local	Radical hysterectomy
2b	Regional	Radiotherapy
3a	Regional	Radiotherapy
3b	Regional	Radiotherapy
4a	Distant	Radiotherapy
4b	Distant	Radiotherapy

Hysterectomy costs included primary treatment, anesthesia, and hospitalization as well as follow-up, which included visits and direct non-medical costs for transport and patient time. Radiotherapy, assumed to be an outpatient procedure, included costs for treatment as well as follow-up, which included visits and direct non-medical costs for transport and patient time.⁴

Cost of Cancer Care by Stage

Costs (2000 International \$)	India	Kenya	Peru	S. Africa	Thailand
Staging	182.21	169.41	144.79	549.98	340.60
Local cancer	1263.18	1383.04	3291.55	4108.53	2209.57
Regional cancer	1922.72	1755.79	2749.49	2493.85	2551.97
Distant cancer	1922.72	1755.79	2749.49	2090.18	2551.97

A.9 Direct Non-medical Costs: Patient Time and Patient Transport

Patient Time Value

Direct non-medical costs incorporate all transportation costs as well as the time the patient spent traveling to and from the site of care, her waiting time, her time receiving care, and hospitalization time post treatment. We employed wage rate estimates as a proxy for the value of patient time.^{7,12-15} In the developing countries of this study, many women eligible for screening are not employed in the formal wage-earning sectors of the economy. Yet time devoted to such activities could otherwise have been used in various forms of productive labor. It is still necessary, therefore, to estimate the value of time dedicated to screening and potentially to treatment for cervical cancer. Our wage rate estimates were based on a weighted average of wages for formal sector jobs and minimum wage rates for informal sector jobs. Data from the U.S. Department of Commerce, the World Bank, and the Economic Research Institute established formal sector average wage rates. Minimum wage rates were derived from U.S. Department of Labor wage rate studies and World Bank estimates, while average yearly hours worked were ascertained from the World Bank. An International Labour Office report provided the percentage employment in the informal sector.¹⁴

Patient Time Value with Value of Informal/Unpaid Labor Included

Costs (2000 International \$)	India	Kenya	Peru	S. Africa	Thailand
Hourly wage rate	0.30	0.76	1.81	4.80	1.82

Formal and Informal Economic Sectors

The International Labour Organization defines the informal economy as being comprised of informal employment (without secure contracts, worker benefits, or social protection) both inside and outside informal enterprises (small unregistered or unincorporated enterprises).¹⁴ The formal economy comprises formal employment (secure contracts, worker benefits, and/or social protection) both inside and outside, though usually inside, formal enterprises (generally larger, registered, and/or incorporated enterprises).¹⁴

Patient Time by Procedure and Facility Type

Consensus meetings with members of each of the five country groups defined the expected time to perform each screening, diagnostic, and treatment procedure in non-study settings based on data and experience from each study setting.

Patient Time Spent Receiving Care by Procedure Type

Procedure time (minutes)	India	Kenya	Peru	S. Africa	Thailand
Screening					
VIA	15	15	15	15	15
Cervical cytology	15	15	15	15	15
HPV DNA	15	15	15	15	15
Diagnosis					
Colposcopy / biopsy	20	20	20	20	20
Pre-cancer treatment					
Cryosurgery	20	20	20	20	20
LEEP	30	30	30	30	30
Cold knife conization	45	45	45	45	45
Simple hysterectomy	130	130	130	130	130

Patient Time Spent Traveling and Waiting by Facility Type

The amount of time spent traveling and waiting to receive a service depended on the type of facility at which the service was provided. To consistently represent the diverse health care systems of the five study countries, we identified three major facility categories: primary facilities, secondary facilities, and tertiary facilities. Clinical services were ultimately mapped to facility type. For example, while screening might occur in a local health clinic (a primary facility), major surgery or other cancer-related therapies would more likely occur at a tertiary hospital. Travel and wait times were estimated for each major facility category. Based on initial data collected in the various country study sites, consensus between representatives of each country was reached as to a reasonable estimate for procedure time under non-study conditions.

Patient Wait and Transport Times by Facility Type

	India	Kenya	Peru	S. Africa	Thailand
Wait time (minutes)					
Primary facility	60	90	25	111	30
Secondary facility	120	180	90	138	35
Tertiary facility	180	360	90	138	50
One-way transport time (minutes)					
Primary facility	30	110	30	48	15
Secondary facility	120	170	120	56	44
Tertiary facility	180	230	60	112	53

Primary data informed the cost of transportation to and from each type of facility.

Patient Transport Costs by Facility Type

Costs (2000 International \$)	India	Kenya	Peru	S. Africa	Thailand
Primary facility	0.03	3.01	6.83	1.42	0.00
Secondary facility	6.07	7.32	9.10	3.74	2.74
Tertiary facility	18.22	15.93	191.2	3.74	10.15

We generated a matrix that matched all screening, diagnostic, pre-cancer treatment, and cancer services to facility categories for each screening strategy considered in our analyses. For example, cryosurgery conducted as part of a one-visit screening strategy is performed in primary facilities, except in the case of women deemed ineligible for immediate treatment. Pre-cancer treatment conducted as part of three-visit strategies, and in any strategy in which the woman was deemed ineligible for immediate cryosurgery, is provided in secondary facilities. All invasive cancer management, including radiotherapy, is performed in tertiary facilities.

Loss to Follow-up

As mentioned in Table 2 of the manuscript, the approximate loss to follow up for a three visit strategy would be 45%. The calculations below highlight why with a 15% loss to follow up between visits, the total for a three visit strategy would not be equal to 45%. The base case, per-visit loss to follow-up was fifteen percent. After attending an initial screening visit, on each subsequent visit (three subsequent visits for a three-visit strategy), fifteen percent of women were lost to follow-up. Thus, in a three-visit strategy for women who truly had cervical abnormalities and tested positive on the screening test, the percent of women who would be lost to follow-up is:

$$\begin{aligned} LossToFollowUp_{3visit} &= p_{LFU} + (p_{LFU} (1 - p_{LFU})) + p_{LFU} [1 - (p_{LFU} (1 - p_{LFU}))] \\ LossToFollowUp_{3visit} &= 0.15 + (0.15(1 - 0.15)) + 0.15 [1 - (0.15(1 - 0.15))] \\ LossToFollowUp_{3visit} &= 0.403875 \end{aligned}$$

Benefits were accrued when women who were not lost to follow-up were treated for pre-cancer or diagnosed with cancer at an earlier stage. Costs, both in terms of clinical services used and in terms of patient time and transport costs, were accrued only for those visits that women attended.

A.10 Program Costs

Program costs are defined as costs incurred at the administrative levels outside the point of delivery of health care to patients; although often omitted from cost-effectiveness analyses, these costs may comprise an important component of total costs.¹⁶ For those programmatic costs that differ by screening strategy, such as laboratory equipment and supplies, specimen transport, and training and supervision, we used the micro-costing methods detailed above. As recommended in several cost-effectiveness guidelines, we assumed capacity utilization of 80% in most settings – i.e., health personnel are fully occupied for 80% of their time. We expected that programmatic costs associated with administering the screening program and recruiting the eligible population were independent of the initial screening test used. Based on a review of the published literature (spanning diverse health programs in multiple developing country regions), we assumed these latter costs were approximately 25% of the direct medical costs, although we varied our estimates from 15% to 75% in sensitivity analyses.¹⁷⁻⁴⁵

B. SUPPLEMENTAL INFORMATION AND RESULTS

Appendix Figure 1. Health states in the model incorporate cervical disease status and HPV infection status. Each month, women can progress or regress in their cervical disease. Probabilities of transitioning between health states are dependent on age. Not shown, women may die from cervical cancer, AIDS, or other causes. Invasive cervical cancer stages 1a1, 1a2, 1b1, 1b2, and 2a are classified as local cancer, stages 2b, 3a, and 3b as regional cancer, and stages 4a and 4b as distant cancer, based on the Federation Internationale de Gynecologie et Obstetriques (FIGO) staging system.⁴⁶

Appendix Figure 2. Age-specific incidence of cervical cancer. The age-specific incidence of invasive cervical cancer is shown for Kenya (red), Peru (blue), India (green), South Africa (orange) and Thailand (black). This graph plots data from the International Agency for Research on Cancer.⁴⁷ Using previously published natural history parameters,⁴ we adjusted the age-specific incidence of HPV and regression of CIN 2,3 in calibration exercises. This method ensured the age-specific cervical cancer incidence predicted by each model approximated the cumulative risk of invasive cancer in women under age 64, the peak age-specific cancer incidence, and the general shape of the age-specific cancer incidence curve (see inset table). The data for peak age-specific cancer incidence is a point provided by Globocan data that represents a single, large age category. Therefore, in some cases (e.g., Kenya and Peru) we placed a higher priority on matching the cumulative risk of cancer, represented by the general area under the curve, rather than a single spiked peak (in the case of Kenya), or a continuously increasing curve after age 65 (in the case of Peru). In other cases (South Africa, India, and Thailand) we utilized available but limited data on the age-related prevalence of CIN in conjunction with information on invasive cancer to calibrate the model.

Appendix Table 1. Discounted lifetime costs, life expectancy and cost-effectiveness ratios of eight strategies performed at different screening intervals in India, Kenya, Peru (Upper Panel), South Africa and Thailand (Lower Panel). In this table, as in the manuscript, all screening tests are assumed to be *equally* available, and therefore the cost-effectiveness ratios shown are calculated by comparing the incremental costs (2000 international dollars) and benefits (life expectancy gains) of each strategy to those of the next best strategy.

Appendix Table 2. Cost-effectiveness ratios of six strategies performed at different screening intervals in India, Kenya, Peru, South Africa and Thailand. In this supplementary analysis (not included in the manuscript), we assumed screening tests may *not be* equally available in low-resource settings, and therefore, the cost-effectiveness ratios shown are calculated by comparing the incremental costs (2000 international dollars) and benefits (life expectancy gains) of each strategy to no screening.

Appendix Figure 3. Impact of varying screening coverage in South Africa. Shown is the relationship between overall screening coverage rates (varied from 70% to 100%), the reduction in lifetime risk of cervical cancer, and the cost-effectiveness ratio (CER) associated with screening using a two-visit HPV testing strategy three times per lifetime. For each value of screening coverage two bars are displayed representing a homogeneous population, in which women are all equally likely to comply with screening (left), and a heterogeneous population (right), in which patients who are at a higher risk of cervical cancer are less likely to be screened. The overall reduction in cervical cancer decreases with lower screening coverage, and this reduction is attenuated further when women at higher risk are less likely to be screened (the heterogeneous population). Different coverage rates only adversely affect the incremental cost-

effectiveness ratio of screening when the population is heterogeneous and screening coverage is less likely in patients at higher risk.

C. SUPPLEMENTAL SENSITIVITY ANALYSES

In addition to a series of one-way sensitivity analyses (**Appendix Table 3**), we conducted several supplemental analyses as outlined below.

Effectiveness of Cryosurgery

The uncertainty around the long-term effectiveness of cryosurgery was explored in the following manner. Using Thailand as an example, as cryosurgery became less effective, the incremental cost-effectiveness of 1-visit VIA (once per lifetime) increased. For example, if cryosurgery is only 50% effective, the cost-effectiveness ratio increased from \$109 per year of life saved to \$188 per year of life saved. Similar results were found in all five countries. Once the effectiveness of cryosurgery is reduced to less than 50%, two-visit strategies that employ loop electrosurgical excision procedure (LEEP) are more effective than one-visit VIA and are cost-effective.

Optimal Screening Age and Screening Interval

In our base case, women are screened beginning at age 35, and more frequent screening is applied at five-year intervals. These target ages and frequencies were chosen on the basis of our prior work,^{4,48} and an extended set of analyses for these five countries (**Appendix Table 4**).

To assess the effect of screening women once, twice and three times in their life using different screening modalities, we examined 1-visit VIA, 2-visit HPV, and 3-visit Pap for Kenya, Peru, South Africa, Thailand, and India. We varied the age at which screening begins: 18, 20, 22, 24,

26, 28, 30, 32, 34, 36, 38, 40, 42, 44, 46, 48, and 50 years of age. For twice and three times per-lifetime screening, we tested five-year interval screenings and ten-year interval screenings. We identified the following three outcomes for each of these analyses: (1) the most *effective* age at which to screen irrespective of the expense; (2) the least *costly* age to screen irrespective of the effectiveness; and (3) the most *cost-effective* age at which to screen. The most cost-effective age at which to screen for each screening modality, frequency, and interval, represents the optimal balance between the resources required to screen and the population benefits obtained. We found that screening in the early 30s produced maximum cancer reduction and life expectancy gains for once-per-lifetime screenings, regardless of screening modality. It was least costly to screen women late in our age range since there are both fewer eligible women to be screened, due to competing mortality, and fewer false positives. For once- per-lifetime screening, the most cost-effective age at which to screen was always mid to late-30s. For twice and three times per lifetime, the most cost-effective age was early to mid-30s. Twice and three times per lifetime screening with ten year intervals tended to have earlier start ages for screening since the later subsequent screenings were less cost-effective. We also assessed which strategies were most cost-effective overall (for each country, we simultaneously compared 256 strategies, representing combinations of modality, screening age, frequency, and interval). The general findings from these combined analyses were consistent with the above results.

Increased Competing Mortality and HPV Infections/CIN in HIV+ Population

For analyses of cervical cancer, populations with higher HIV prevalence have two important characteristics. The first is increased competing mortality due to HIV/AIDS. The second is increased incidence of detectable HPV infection and concomitant CIN. The relative effect of these factors on the actual risk of invasive cancer is uncertain.

Much literature exists on this issue, and it is clear that in both developed and developing countries we have not seen the increase in cervical cancer that was predicted a decade ago. There are at least two possible reasons for this: (1) the competing mortality of HIV kills women before the age at which cervical cancer manifests itself (in developing countries), or current screening is effective enough to prevent cervical cancer cases (in developed countries); (2) increasingly, it appears that immunosuppression is most strongly associated with the early stages of cervical dysplasia, yet may not be as strongly associated with progression to cancer per se. While analyses based on data from the Swiss Cohort show statistically-elevated standardized incidence ratios for cervical cancer,⁴⁹ other analyses utilizing data from the U.S. (including the two largest multicenter prospective cohort studies, the WIHS and the HERS) and Europe have failed to show an increase in cervical cancer.⁵⁰⁻⁵² Even among studies that found increases in cervical cancer, the magnitude of these associations is very small compared with other AIDS-related cancers (standardized incidence ratios of 8.8 versus 258); additionally, there does not appear to be a strong relationship with CD4 cell count.⁵³ Data from the European Non-Aggregate AIDS Data Set, analyzed to assess recent trends in AIDS-defining cancers in Western Europe, suggested that the small increase in AIDS-defining cancers was attributable only to lymphoma, while the incidence of cervical cancer actually decreased.⁵⁴ Data from the Italian National Registry of AIDS and nineteen cancer registries were inconclusive.⁵⁵ Data from select cross-sectional studies in Africa have failed to show a convincing increase in the risk of invasive cancer while a study in Senegal found a positive association with cervical cancer prevalence.^{56,57}

Both the natural history model for Kenya and for South Africa are constructed to be able to (1) incorporate age-related competing mortality secondary to HIV-related disease and AIDS; (2) permit transitions that govern the incidence of HPV and CIN to be conditional on HIV status; and (3) explore the implications of higher rates of invasive cancer in women with HIV if better

data become available to support this. The first of these is included in the base case. The second and third are included in sensitivity analyses, in part because the data we used in the model for natural history were from HIV-uninfected women. In addition, we focused screening in the base case on older women without any symptoms of HIV, and therefore the prevalence of HIV in this age group is much lower than is reported in antenatal clinics. We did explore the effect of higher HPV prevalence rates in younger women and show these results below. Our sensitivity analysis explores the impact of higher HIV prevalence accompanied by higher rates of HPV and CIN.

We have previously documented the methods used to derive the natural history parameters, including those to account for the impact of HIV.⁴ In our previous South Africa analysis, we used primary data from a population with high HIV prevalence. Therefore, we had to estimate the proportion of HPV that was attributable to the HIV-infected and that to the HIV-uninfected segments of the population so as to not overestimate the risk in non-infected women or underestimate the risk in infected women. Since the observed prevalence in our South Africa primary data of HPV and CIN is attributable to both HIV-infected and uninfected women, and the risk of both are greater in HIV-infected women, we estimated these *attributable fractions*. For example, based on the average prevalence of HPV (22% overall) and HIV (8% overall) reported in the South Africa screening study and the probability of HPV in HIV-infected women compared with HIV-uninfected women (i.e., the risk ratio), we estimated that 78% of all detectable HPV was attributable to HIV-uninfected women.⁴ We used a rate ratio of 3.8 for the base case (i.e., the probability of HPV in HIV-infected versus uninfected women), and established a plausible range of 3.5 to 5.6.

We previously validated this approach using data from the Zimbabwe Screening Study.⁵⁸ Using the methods described above, we estimated a prevalence of HPV of 67% in HIV-infected women

and 26% in the HIV-uninfected women in Zimbabwe. Since there were also data on the HIV status of each individual woman, we were able to compare our estimates with the actual prevalence reported. Our estimates came quite close to the observed data: HPV prevalence of 64.3% in HIV-infected women and 27.6% in HIV-uninfected women.

We explored the potential effect of different assumptions about the impact of HIV on the natural history of cervical cancer in two countries with substantial HIV prevalence, Kenya and South Africa. Probabilities governing the incidence of HPV and CIN were converted to rates and then multiplied by a series of factors ranging from one to four and then converted back to probabilities for use in the model. Probabilities governing the clearance of HPV and regression of CIN were converted to rates and then multiplied by a series of incremental factors ranging from 0.25 to 1 and then converted back to probabilities for use in the model. We examined the relative cost-effectiveness of screening in the overall population under scenarios that both simulated higher rates of HIV and higher rates of HPV and CIN. In all analyses, the competing mortality secondary to HIV was included.

We assumed the following conditions: screening was conducted between the ages of 35 and 45 years, and no screening occurred if a woman had any symptoms of AIDS. Interestingly, as the prevalence of HIV increased from twenty-five percent to seventy-five percent, the incremental cost-effectiveness ratios associated with once and twice in a lifetime screening decreased by more than fifty percent. The reason for this observation is as follows: the *cost* of screening declined dramatically as the proportion of the population eligible for screening decreased due to HIV-related mortality. The *benefits* of screening remained stable, and were substantial, as the women who reached age 35 or 40 years did not have AIDS; specifically, they were the women who were not HIV-infected. These women had an entire stream of life, on the order of two

decades, to be saved from premature cancer death, instead of an early AIDS-related death. An important limitation of this exploratory analysis is that we did not incorporate the costs or the benefits associated with HIV-related treatment, including antiretroviral therapy (ART), in the analysis. As antiretroviral therapy is introduced on a widespread scale, our results could change. Key uncertainties that need to be addressed that could clearly impact our results include: (1) the effect of ART on HPV positivity, (2) the effect of ART on CIN and cancer; and (3) the effect of ART on the life expectancy of an HIV-infected woman. For example, if ART increases life expectancy *and* the period of time at which women are asymptomatic with their HIV disease, a greater proportion of the women in the eligible pool for screening will be HIV-infected. If these women have an increased risk of HPV positivity and CIN and a longer life expectancy, their risk of dying from cervical cancer prior to AIDS may be higher. This could cause the cost-effectiveness of screening to be less attractive, especially when coupled with the fact that the number of years of life they gain from averting a case of cervical cancer will likely be lower than an HIV-uninfected woman. An additional important limitation to this exploratory analysis is that we assume the age-related HIV prevalence is skewed towards younger women. If this situation changes, and an increase in HIV prevalence is disproportionately experienced by women over age 35, the clinical benefits and cost-effectiveness of screening would be markedly less attractive.

APPENDIX REFERENCES

1. World Health Organization. World Health Report 2002 - Reducing Risks, Promoting Healthy Life. Geneva, 2002. http://www.who.int/whr/2002/en/whr02_en.pdf (last accessed September 12, 2005)
2. WHO-CHOICE.
<http://www3.who.int/whosis/menu.cfm?path=evidence.cea&language=english> (last accessed September 12, 2005)
3. The Economist, Economic Intelligence Unit: Country Data.
<http://eu.bvdep.com/cgi/template.dll?product=101> (last accessed September 14, 2005)
4. Goldie SJ, Kuhn L, Denny L, Pollack A, Wright TC. Policy analysis of cervical cancer screening strategies in low-resource settings: clinical benefits and cost-effectiveness. JAMA. 2001; 285:3107-15.
5. Bishop, JW. The cost of production in cervical cytology: comparison of conventional and automated primary screening systems. Am J Clin Pathol. 1997; 107:445-50.
6. United States Census Bureau. <http://www.census.gov/ipc/www/idbnew.html> (last accessed April 8, 2005)
7. World Development Indicators.
<http://www.worldbank.org/data/onlinebases/onlinebases.html> (last accessed September 12, 2005)
8. International Center for Tropical Agriculture.
http://gisweb.ciat.cgiar.org/cross_scale/download/2.5_web.pdf (last accessed November 23, 2004)

9. WHO-CHOICE prices for tradable goods.
http://www3.who.int/whosis/cea/prices/capital.cfm?path=evidence,cea,cea_prices,cea_prices_capital&language=english (last accessed November 23, 2004)
10. Mandelblatt JS, Lawrence WF, Gaffikin L, Limpahayom KK, Lumbiganon P, Warakamin S, King J, Yi B, Ringers P, Blumenthal PD. Costs and benefits of different strategies to screen for cervical cancer in less-developed countries. *J Natl Cancer Inst.* 2002; 94:1469-83.
11. Waggoner SE. Cervical cancer. *Lancet.* 2003; 361:2217-25.
12. Nominal interbank exchange rates (year averages):
<http://www.oanda.com/convert/fxhistory> (last accessed on November 23, 2004)
13. Yearly minimum wages: United States Department of Labor, World Development Indicators 2002, Economic Research Institute
<http://www.dol.gov/ilab/media/reports/oiea/wagestudy/FS-India.htm>;
<http://www.salaryexpert.com/seco/careerjournal/hrcodes/KENYA.htm>;
<http://www.gpn.org/data/kenya/kenya-analysis.pdf>;
<http://www.state.gov/g/drl/rls/hrrpt/2000/af/841.htm>;
<http://www.dol.gov/ilab/media/reports/oiea/wagestudy/FS-Peru.htm>;
<http://www.dol.gov/ilab/media/reports/oiea/wagestudy/FS-Thailand.htm> (all last accessed November 23, 2004)
14. International Labour Office Report "Women and Men in the Informal Economy: A Statistical Picture".
<http://www.ilo.org/public/english/employment/gems/download/women.pdf> (last accessed November 23, 2004)

15. United States Department of Commerce International Trade Administration Import Administration 1999 Report on Wages:
<http://ia.ita.doc.gov/wages/99wages/99wages.htm> (last accessed November 23, 2004)
16. Johns B, Baltussen R, Hutubessy R. Programme costs in the economic evaluation of health interventions. *Cost Eff Resour Alloc.* 2003 Feb 26;1(1):1.
17. Soucat A, Levy-Bruhl D, De Bethune X, Gbedonou P, Lamarque JP, Bangoura O, Camara O, Gandaho T, Ortiz C, Kaddar M, Knippenberg R. Affordability, cost-effectiveness and efficiency of primary health care: the Bamako Initiative experience in Benin and Guinea. *Int J Health Plann Manage* 1997; 12 Suppl 1:S81-108.
18. Cowley, P. Preliminary cost-effectiveness analysis of an AIDS vaccine in Abidjan, Ivory Coast. *Health Policy* 1993; 24:145-153.
19. Talaat M, Evans DB. The costs and coverage of a strategy to control schistosomiasis morbidity in non-enrolled school-age children in Egypt. *Trans R Soc Trop Med Hyg* 2000; 94:449-54.
20. Chabot J, Waddington C. Primary health care is not cheap: a case study from Guinea Bissau. *Int J Health Serv* 1987; 17:387-409.
21. Guyatt HL, Kinnear J, Burini M, Snow RW. A comparative cost analysis of insecticide-treated nets and indoor residual spraying in highland Kenya. *Health Policy Plan* 2002; 17:144-53.
22. Sweat M, Gregorich S, Sangiwa G, Furlonge C, Balmer D, Kamenga C, Grinstead O, Coates T. Cost-effectiveness of voluntary HIV-1 counseling and testing in reducing sexual transmission of HIV-1 in Kenya and Tanzania. *Lancet* 2000; 356:113-21.

23. de Jonghe E, Murray CJ, Chum HJ, Nyangulu DS, Salomao A, Styblo K. Cost-effectiveness of chemotherapy for sputum smear-positive pulmonary tuberculosis in Malawi, Mozambique and Tanzania. *Int J Health Plann Manage* 1994; 9:151-181.
24. Over M. The effect of scale on cost projections for a primary health care program in a developing country. *Soc Sci Med* 1986; 22:351-60.
25. Onwujekwe O, Chima R, Shu E, Okonkwo P. Community-directed treatment with ivermectin in two Nigerian communities: an analysis of first year start-up processes, costs and consequences. *Health Policy* 2002; 62: 31-51.
26. Broomberg J, Rees H. What does primary health care cost and can we afford to find out? Rationale and methodology for a cost analysis of the Diepkloof Community Health Centre, Soweto. *S Afr Med J* 1993; 83:275-82.
27. Kocks DJ, Ross MH. The financial components and contribution of occupational health services to the provision of primary health care services in a developing country such as South Africa. *Occup Med (Lond)* 1995; 45:156-8.
28. Wilkinson D, Floyd K, Gilks CF. Antiretroviral drugs as a public health intervention for pregnant HIV-infected women in rural South Africa: an issue of cost-effectiveness and capacity. *AIDS* 1998; 12:1675-82.
29. Wilkinson D, Floyd K, Gilks CF. Costs and cost-effectiveness of alternative tuberculosis management strategies in South Africa--implications for policy. *S Afr Med J* 1997; 87:451-5.
30. Wilkinson D, Floyd K, Gilks CF. National and provincial estimated costs and cost effectiveness of a programme to reduce mother-to-child HIV transmission in South Africa. *S Afr Med J* 2000; 90:794-8.

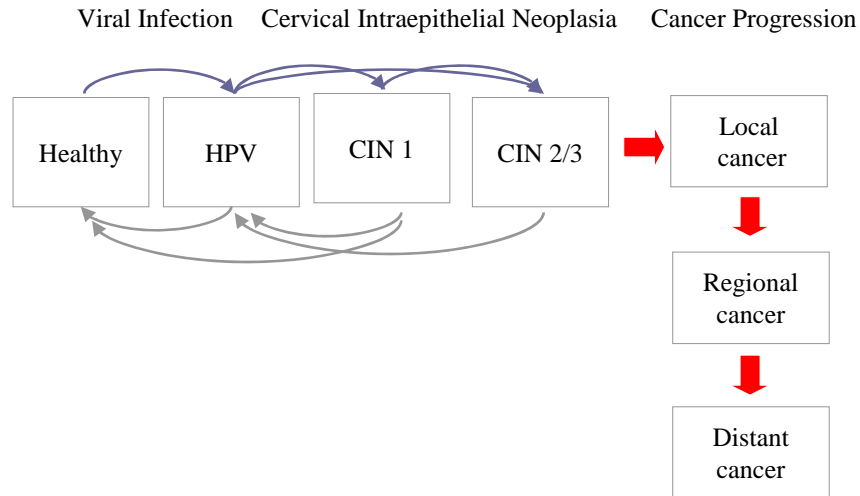
31. Wilkins JJ, Folb PI, Valentine N, Barnes KI. An economic comparison of chloroquine and sulfadoxine-pyrimethamine as first-line treatment for malaria in South Africa: development of a model for estimating recurrent direct costs. *Trans R Soc Trop Med Hyg* 2002; 96:85-90.
32. Guyatt HL, Evans D, Lengeler C, Tanner M. Controlling schistosomiasis: the cost-effectiveness of alternative delivery strategies. *Health Policy Plan* 1994; 9:385-95.
33. Peterson SV, Assey V, Forsberg BC, Greiner T, Kavishe FP, Mduma B, Rosling H, Snaga AB, Gebre-Medhin M. Coverage and cost of iodized oil capsule distribution in Tanzania. *Health Policy Plan* 1999; 14:390-9.
34. Sauderson, PR. An economic evaluation of alternative programme designs for tuberculosis control in rural Uganda. *Soc Sci Med* 1995; 40(9):1203-1212
35. Hansen KG, Woelk G, Jackson H, Kerkhoven R, Manjonjori N, Maramba P, Mutambirwa J, Ndimande E, Vera E. The cost of home-based care for HIV/AIDS patients in Zimbabwe. *AIDS Care* 1998; 10:751-9.
36. Robertson RL, Castro CE, Gomez LC, Gwynne G, Tinajero Baca CL, Zschock DK. Primary health services in Ecuador: comparative costs, quality, and equity of care in Ministry of Health and rural social security facilities. *Soc Sci Med* 1991; 32:1327-36.
37. Phillips M, Sanghvi T, Suarez R, McKigney J, Fiedler J. The costs and effectiveness of three vitamin A interventions in Guatemala. *Soc Sci Med* 1996; 42:1661-8.
38. Suarez PG, Floyd K, Portocarrero J, Alarcon E, Rapiti E, Ramos G, Bonilla C, Sabogal I, Aranda I, Dye C, Raviglione M, Espinal MA. Feasibility and cost-effectiveness of standardised second-line drug treatment for chronic tuberculosis patients: a national cohort study in Peru. *Lancet* 2002; 359:1980-9.

39. Fiedler JL, Day LM. A cost analysis of family planning in Bangladesh. *Int J Health Plann Manage* 1997; 12:251-77.
40. Jackson S, Sleigh AC, Liu XL. Cost of malaria control in China: Henan's consolidation programme from community and government perspectives. *Bull World Health Organ* 2002; 80:653-9.
41. Berman P, Brotowasisto, Nadjib M, Sakai S, Gani A. The costs of public primary health care services in rural Indonesia. *Bull World Health Organ* 1989; 67:685-94.
42. Walker D, McDermott JM, Fox-Rushby J, Tanjung M, Nadjib M, Widiatmoko D, Achadi E. An economic analysis of midwifery training programmes in South Kalimantan, Indonesia. *Bull World Health Organ* 2002; 80(1):47-55.
43. Fiedler JL, Dado DR, Maglalang H, Juban N, Capistrano M, Magpantay MV. Cost analysis as a vitamin A program design and evaluation tool: a case study of the Philippines. *Soc Sci Med* 2000; 51:223-42.
44. Soderlund N, Lavis J, Broomberg J, Mills A. The costs of HIV prevention strategies in developing countries. *Bull World Health Organ* 1993; 71:595-604.
45. Janowitz B, Thompson A. Why it is difficult to determine resource requirements for family planning. *J Biosoc Sci* 2001; 33:551-67.
46. Pecorelli S, Benedet JL, Creasman WT, Shepherd JH. FIGO staging of gynecologic cancer. 1994-1997 FIGO Committee on Gynecologic Oncology. International Federation of Gynecology and Obstetrics *Int J Gynaecol Obstet* 1999; 65:243-9.
47. Ferlay J, Bray F, Pisani P, Parkin DM. *Globocan 2000: Cancer Incidence, Mortality, and Prevalence Worldwide, Version 1.0*, IARC CancerBase No. 5. 2001. Lyon (France): IARC Press, International Agency for Research on Cancer, World Health Organization.

48. Goldhaber-Fiebert JD, Kim JJ, Wright TC, Goldie SJ. Optimization of target age and screening interval for cervical cancer prevention in two developing countries. [Abstract] 25th Annual Meeting of the Society for Medical Decision Making, 18-22 October 2003, Chicago, Illinois. 2003; 23(6):568.
49. Clifford GM, Polesel J, Rickenbach M, Dal Maso L, Keiser O, Kofler A, Rapiti E, Levi F, Jundt G, Fisch T, Bordoni A, De Weck D, Franceschi S; Swiss HIV Cohort. Cancer risk in the Swiss HIV Cohort Study: associations with immunodeficiency, smoking, and highly active antiretroviral therapy. *J Natl Cancer Inst* 2005; 97(6):407-9.
50. Ferenczy A, Coutlee F, Franco E, Hankins C. Human papillomavirus and HIV coinfection and the risk of neoplasias of the lower genital tract: a review of recent developments. *CMAJ* 2003; 169(5):431-4.
51. Mbulaiteye SM, Parkin DM, Rabkin CS. Epidemiology of AIDS-related malignancies an international perspective. *Hematol Oncol Clin North Am* 2003; 17(3):673-96.
52. Palefsky JM, Holly EA. Immunosuppression and co-infection with HIV. Chapter 6. *J Nat Cancer Inst Monographs* 2003
53. Mbulaiteye SM, Biggar RJ, Goedert JJ, Engels EA. Immune deficiency and risk for malignancy among persons with AIDS. *J Acquir Immune Defic Syndr* 2003; 32(5):527-33.
54. Ebrahim SH, Abdullah AS, McKenna M, Hamers FF. AIDS-defining cancers in Western Europe, 1994-2001. *AIDS Patient Care STDS*. 2004; 18(9):501-8
55. Franceschi S, Dal Maso L, Pezzotti P, Polesel J, Braga C, Piselli P, Serraino D, Tagliabue G, Federico M, Ferretti S, De Lisi V, La Rosa F, Conti E, Budroni M, Vicario G, Piffer S, Pannelli F, Giacomini A, Bellu F, Tumino R, Fusco M, Rezza G; Cancer and AIDS Registry Linkage Study. Incidence of AIDS-defining cancers after

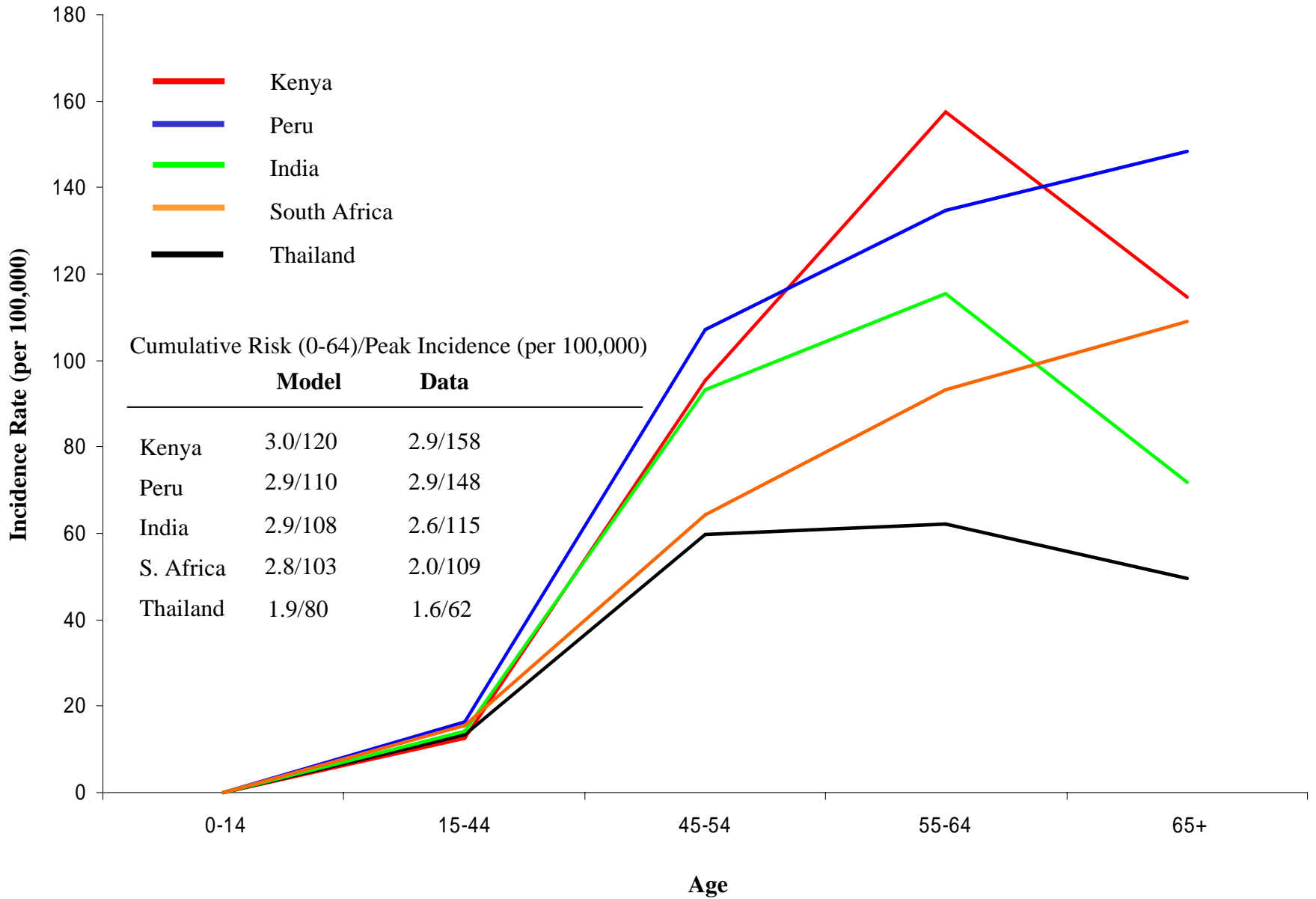
- AIDS diagnosis among people with AIDS in Italy, 1986-1998. *J Acquir Immune Defic Syndr* 2003; 34(1):84-90.
56. Ocheni S, Aken'Ova YA. Association between HIV/AIDS and malignancies in a Nigerian tertiary institution. *West Afr J Med*. 2004; 23(2):151-5
57. Hawes SE, Critchlow CW, Faye Niang MA, Diouf MB, Diop A, Toure P, Aziz Kasse A, Dembele B, Salif Sow P, Coll-Seck AM, Kuypers JM, Kiviat NB. Increased risk of high-grade cervical squamous intraepithelial lesions and invasive cervical cancer among African women with human immunodeficiency virus type 1 and 2 infections. *J Infect Dis* 2003; 188(4):555-63.
58. Womack SD, Chirenje ZM, Gaffikin L, Blumenthal PD, McGrath JA, Chipato T, Ngwalle S, Munjoma M, Shah KV. HPV-based cervical cancer screening in a population at high risk for HIV infection. *Int J Cancer* 2000; 85:206-10.

Appendix Figure 1.



Model Schematic. Health states in the model incorporate cervical disease status and HPV infection status. Each month, women can progress or regress in their cervical disease. Probabilities of transitioning between health states are dependent on age. Not shown, women may die from cervical cancer, AIDS, or other causes. Invasive cervical cancer stages 1a1, 1a2, 1b1, 1b2, and 2a are classified as local cancer, stages 2b, 3a, and 3b as regional cancer, and stages 4a and 4b as distant cancer, based on the Federation Internationale de Gynecologie et Obstetriques (FIGO) staging system.⁴⁶

Appendix Figure 2.



Age-specific incidence of cervical cancer. Age-specific incidence of cervical cancer. The age-specific incidence of invasive cervical cancer is shown for Kenya (red), Peru (blue), India (green), South Africa (orange) and Thailand (black). This graph plots data from the International Agency for Research on Cancer.⁴⁷ Using previously published natural history parameters,⁴ we adjusted the age-specific incidence of HPV and regression of CIN 2,3 in calibration exercises. This method ensured the age-specific cervical cancer incidence predicted by each model approximated the cumulative risk of invasive cancer in women under age 64, the peak age-specific cancer incidence, and the general shape of the age-specific cancer incidence curve (see inset table). The data for peak age-specific cancer incidence is a point provided by Globocan data that represents a single, large age category. Therefore, in some cases (e.g., Kenya and Peru) we placed a higher priority on matching the cumulative risk of cancer, represented by the general area under the curve, rather than a single spiked peak (in the case of Kenya), or a continuously increasing curve after age 65 (in the case of Peru). In other cases (South Africa, India, and Thailand) we utilized available but limited data on the age-related prevalence of CIN in conjunction with information on invasive cancer to calibrate the model.

Appendix Table 1 (Lower Panel) Cost-effectiveness of Cervical Cancer Screening Strategies***[Screening tests considered to be equally available]**

Screening Strategy†	South Africa			Thailand		
	Lifetime	Life	CER	Lifetime	Life	CER
	Costs (I\$)	Expectancy (years)	(I\$/YLS) ‡	Costs (I\$)	Expectancy (years)	(I\$/YLS) ‡
No screening	46.65	26.7610	-----	30.40	27.3002	-----
3-visit Pap - 1X	110.95	26.7938	§	57.54	27.3371	§
2-visit Pap - 1X	80.84	26.7981	§	35.46	27.3418	§
2-visit HPV/VIA - 1X	80.39	26.8004	§	38.18	27.3444	§
3-visit HPV - 1X	124.61	26.8069	§	69.70	27.3517	§
2-visit VIA - 1X	80.93	26.8074	§	38.06	27.3523	§
3-visit Pap - 2X	156.85	26.8120	§	74.78	27.3579	§
2-visit HPV - 1X	82.51	26.8129	§	39.03	27.3583	§
1-visit VIA - 1X	78.86	26.8137	§	36.84	27.3593	109
2-visit Pap - 2X	109.48	26.8174	§	39.80	27.3639	§
2-visit HPV/VIA - 2X	108.30	26.8203	§	44.78	27.3671	§

Appendix Table 1 (Lower Panel) Cost-effectiveness of Cervical Cancer Screening Strategies***[Screening tests considered to be equally available] (cont.)**

Screening Strategy†	South Africa			Thailand		
	Lifetime	Life	CER	Lifetime	Life	CER
	Costs (I\$)	Expectancy (years)	(I\$/YLS) ‡	Costs (I\$)	Expectancy (years)	(I\$/YLS) ‡
3-visit Pap - 3X	191.25	26.8215	§	86.47	27.3690	§
1-visit HPV - 1X	75.14	26.8220	467	38.42	27.3686	170
2-visit Pap - 3X	133.69	26.8269	§	43.65	27.3751	§
3-visit HPV - 2X	175.31	26.8282	§	92.69	27.3761	§
2-visit VIA - 2X	109.38	26.8288	§	44.51	27.3767	§
2-visit HPV/VIA - 3X	131.74	26.8299	§	50.52	27.3784	§
2-visit HPV - 2X	112.52	26.8346	§	46.58	27.3832	§
1-visit VIA - 2X	106.28	26.8355	§	42.75	27.3842	277
3-visit HPV - 3X	211.85	26.8378	§	107.97	27.3875	§
2-visit VIA - 3X	133.36	26.8383	§	50.11	27.3880	§
2-visit HPV - 3X	137.96	26.8437	§	53.24	27.3940	§

Appendix Table 1 (Lower Panel) Cost-effectiveness of Cervical Cancer Screening Strategies*

[Screening tests considered to be equally available] (cont.)

Screening Strategy†	South Africa			Thailand		
	Lifetime	Life	CER	Lifetime	Life	CER
	Costs (I\$)	Expectancy (years)	(I\$/YLS) ‡	Costs (I\$)	Expectancy (years)	(I\$/YLS) ‡
1-visit HPV - 2X	98.93	26.8438	1,093	45.63	27.3935	310
1-visit VIA - 3X	129.71	26.8445	§	48.10	27.3949	§
1-visit HPV - 3X	119.17	26.8520	2,458	52.05	27.4033	658

Costs reported in 2000 international dollars. VIA = Visual inspection with acetic acid; HPV = HPV

* DNA testing using Hybrid Capture II; YLS = years of life saved; I\$= International Dollars; CER = cost-effectiveness ratio.

Appendix Table 1 (Lower Panel) Cost-effectiveness of Cervical Cancer Screening Strategies***[Screening tests considered to be equally available] (cont.)**

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- † Strategies are represented using shorthand notation that indicates the number of visits required (one, two or three visits) and the frequency of screening (once, twice, or three times per lifetime). For example, “3-visit Pap - 2X” indicates a strategy requiring three visits, using cervical cytology occurring twice in woman’s lifetime (e.g., Pap smear screening in the first visit, diagnostic work-up with colposcopy in women with positive test results in the second visit, and treatment of women with confirmed disease in the third visit). Screening women once per lifetime occurs at age 35; twice per lifetime occurs at ages 35 and 40; three times per lifetime occurs at ages 35, 40, and 45.
- ‡ All screening tests are assumed to be equally available, and therefore the cost-effectiveness ratios shown are calculated by comparing the incremental costs (2000 international dollars) and benefits (life expectancy gains) of each strategy to those of the next best strategy.
- § Strategies shown either cost more but are less effective (strongly dominated), or cost more and are less cost-effective (weakly dominated), than an alternative strategy.

Appendix Table 1 (Upper Panel) Cost-effectiveness of Cervical Cancer Screening Strategies* [Screening tests considered to be equally available]

Screening Strategy†	India			Kenya			Peru		
	Lifetime	Life	CER	Lifetime	Life	CER	Lifetime	Life	CER
	Costs (I\$)	Expectancy (years)	(I\$/YLS) ‡	Costs (I\$)	Expectancy (years)	(I\$/YLS) ‡	Costs (I\$)	Expectancy (years)	(I\$/YLS) ‡
No screening	23.67	26.1079	-----	23.31	26.2919	-----	41.29	27.3518	-----
3-visit Pap - 1X	33.56	26.1405	§	48.69	26.3239	§	70.02	27.3881	§
2-visit Pap - 1X	24.17	26.1447	§	34.44	26.3281	§	56.34	27.3929	§
2-visit HPV/VIA - 1X	27.31	26.1470	§	42.64	26.3304	§	59.09	27.3954	§
3-visit HPV - 1X	39.27	26.1534	§	57.45	26.3367	§	77.00	27.4025	§
2-visit VIA - 1X	25.90	26.1540	§	32.81	26.3372	§	51.11	27.4032	§
3-visit Pap - 2X	40.19	26.1584	§	66.63	26.3415	§	91.87	27.4085	§
2-visit HPV - 1X	26.29	26.1593	§	37.62	26.3425	§	57.90	27.4092	§
1-visit VIA - 1X	24.20	26.1601	10	30.20	26.3433	134	48.49	27.4101	124
2-visit Pap - 2X	25.33	26.1637	§	44.15	26.3468	§	70.45	27.4145	§
2-visit HPV/VIA - 2X	31.07	26.1666	§	59.26	26.3496	§	75.61	27.4177	§

Appendix Table 1 (Upper Panel) Cost-effectiveness of Cervical Cancer Screening Strategies* [Screening tests considered to be equally available] (cont.)

Screening Strategy†	India			Kenya			Peru		
	Lifetime	Life	CER	Lifetime	Life	CER	Lifetime	Life	CER
	Costs (I\$)	Expectancy (years)	(I\$/YLS) ‡	Costs (I\$)	Expectancy (years)	(I\$/YLS) ‡	Costs (I\$)	Expectancy (years)	(I\$/YLS) ‡
3-visit Pap - 3X	45.01	26.1676	§	79.99	26.3506	§	109.20	27.4193	§
1-visit HPV - 1X	25.43	26.1684	§	33.23	26.3514	§	49.89	27.4193	152
2-visit Pap - 3X	26.82	26.1730	§	52.60	26.3560	§	83.25	27.4254	§
3-visit HPV - 2X	49.48	26.1744	§	80.08	26.3573	§	102.92	27.4264	§
2-visit VIA - 2X	28.69	26.1750	§	41.11	26.3578	§	61.33	27.4271	§
2-visit HPV/VIA - 3X	34.70	26.1759	§	73.48	26.3588	§	90.49	27.4286	§
2-visit HPV - 2X	30.02	26.1807	§	50.45	26.3636	§	74.68	27.4336	§
1-visit VIA - 2X	26.16	26.1816	91	36.92	26.3644	319	57.51	27.4345	§
3-visit HPV - 3X	56.98	26.1838	§	96.67	26.3665	§	123.24	27.4374	§
2-visit VIA - 3X	31.59	26.1843	§	48.35	26.3670	§	71.01	27.4380	§
2-visit HPV - 3X	33.90	26.1897	§	61.66	26.3723	§	90.17	27.4440	§

Appendix Table 1 (Upper Panel) Cost-effectiveness of Cervical Cancer Screening Strategies* [Screening tests considered to be equally available] (cont.)

Screening Strategy [†]	India			Kenya			Peru		
	Lifetime	Life	CER	Lifetime	Life	CER	Lifetime	Life	CER
	Costs (I\$)	Expectancy (years)	(I\$/YLS) ‡	Costs (I\$)	Expectancy (years)	(I\$/YLS) ‡	Costs (I\$)	Expectancy (years)	(I\$/YLS) ‡
1-visit HPV - 2X	29.05	26.1898	§	42.71	26.3725	705	60.95	27.4437	453
1-visit VIA - 3X	28.53	26.1905	268	43.06	26.3731	§	66.49	27.4449	§
1-visit HPV - 3X	32.92	26.1979	591	51.18	26.3804	1,109	71.76	27.4531	1,145

* Costs reported in 2000 international dollars. VIA = Visual inspection with acetic acid; HPV = HPV DNA testing using Hybrid Capture II; YLS = years of life saved; I\$= International Dollars; CER = cost-effectiveness ratio.

† Strategies are represented using shorthand notation that indicates the number of visits required (one, two or three visits) and the frequency of screening (once, twice, or three times per lifetime). For example, “3-visit Pap - 2X” indicates a strategy requiring three visits, using cervical cytology occurring twice in woman’s lifetime (e.g., Pap smear screening in the first visit, diagnostic work-up with colposcopy in women with positive test results in the second visit, and treatment of women with confirmed disease in the third visit). Screening women once per lifetime occurs at age 35; twice per lifetime occurs at ages 35 and 40; three times per lifetime occurs at ages 35, 40, and 45.

Appendix Table 1 (Upper Panel) Cost-effectiveness of Cervical Cancer Screening Strategies* [Screening tests considered to be equally available] (cont.)

- ‡ All screening tests are assumed to be equally available, and therefore the cost-effectiveness ratios shown are calculated by comparing the incremental costs (2000 international dollars) and benefits (life expectancy gains) of each strategy to those of the next best strategy.
- § Strategies shown either cost more but are less effective (strongly dominated), or cost more and are less cost-effective (weakly dominated), than an alternative strategy.

Appendix Table 2: Cost-Effectiveness Ratios (International Dollars (I\$)/Year of Life Saved)* [Screening tests considered independently]

	India	Kenya	Peru	South Africa	Thailand
Strategy	CER (I\$/YLS)†	CER (I\$/YLS)†	CER (I\$/YLS)†	CER (I\$/YLS)†	CER (I\$/YLS)†
VIA (1-visit): Women are screened, receive results, and are treated in a single visit					
1x per lifetime	10	134	124	611	109
2x per lifetime	91	319	369	1258	237
3x per lifetime	268	705	866	2590	500
VIA (2-visit): Women are screened and receive results in a first visit, return for treatment in a second visit					
1x per lifetime	48	210	192	738	147
2x per lifetime	133	402	427	1334	264
3x per lifetime	311	791	888	2514	499
HPV (1-visit): Women are screened with an HPV DNA test in the morning and are treated in the afternoon (same visit)					
1x per lifetime	29	166	128	467	117
2x per lifetime	169	450	453	1093	289
3x per lifetime	481	1069	1145	2458	658



Appendix Table 2: Cost-Effectiveness Ratios (International Dollars (I\$)/Year of Life Saved)* [Screening tests considered independently]

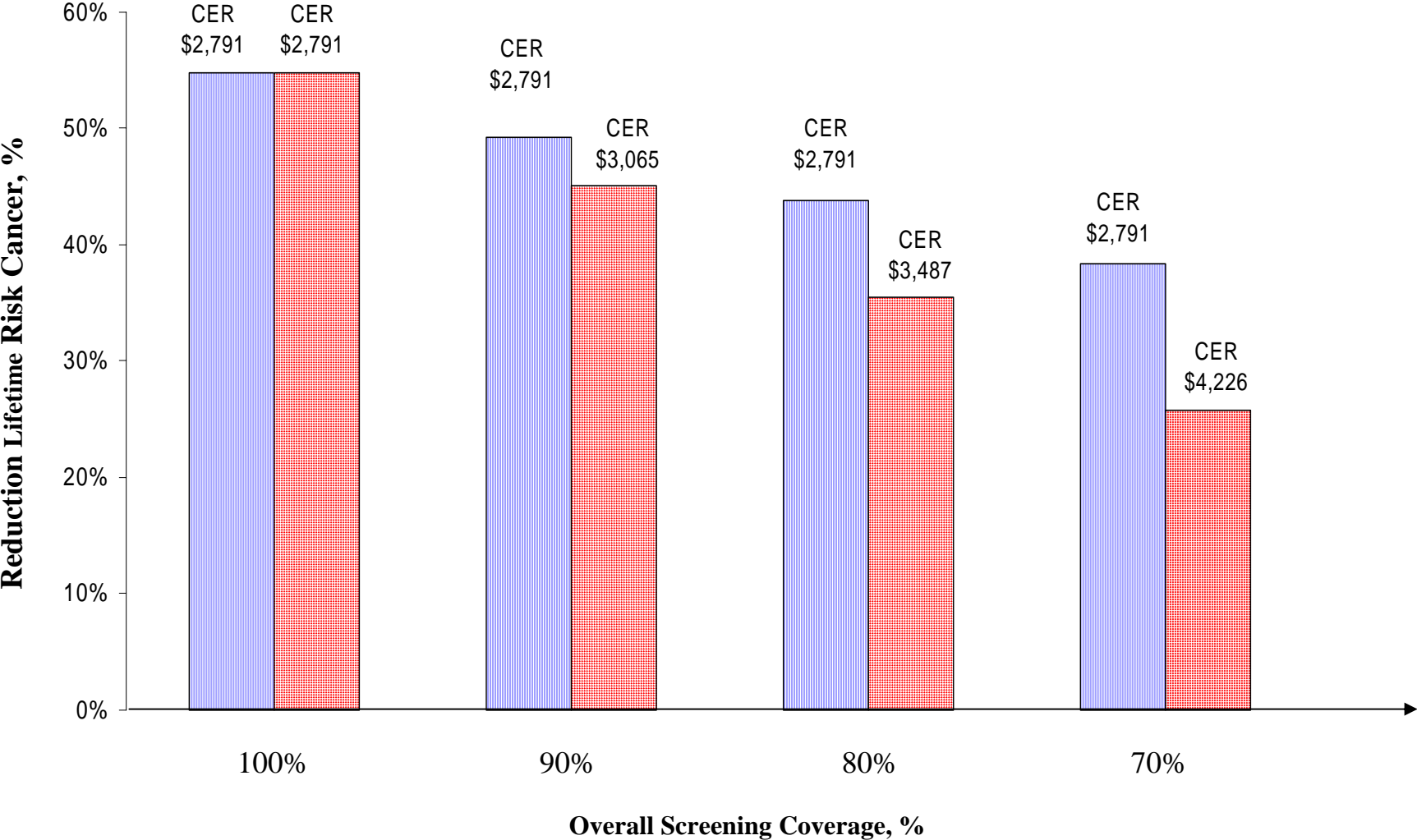
	India	Kenya	Peru	South Africa	Thailand
Strategy	CER (I\$/YLS)†	CER (I\$/YLS)†	CER (I\$/YLS)†	CER (I\$/YLS)†	CER (I\$/YLS)†
HPV (2-visit): Women are screened in a first visit, return to receive results and treatment in a second visit					
1x per lifetime	51	283	290	691	148
2x per lifetime	174	609	688	1380	303
3x per lifetime	435	1279	1484	2791	620
Cytology (2-visit): Women are screened in a first visit, return to receive results and treatment in a second visit					
1x per lifetime	13	307	367	920	122
2x per lifetime	61	520	652	1483	197
3x per lifetime	159	924	1176	2543	344
Cytology (3-visit): Women are screened in a first visit, receive colposcopy/biopsy in a second visit, and are treated in a third visit					
1x per lifetime	303	792	792	1956	736
2x per lifetime	370	1019	1,072	2523	828
3x per lifetime	522	1477	1,608	3645	1054

Appendix Table 2: Cost-Effectiveness Ratios (International Dollars (I\$)/Year of Life Saved)* [Screening tests considered independently]

- * VIA = Visual inspection with acetic acid; HPV = HPV DNA testing using Hybrid Capture II. The 1-visit HPV testing strategy assumes a performance and cost that is the same as the Hybrid Capture II test. Screening women once per lifetime occurs at age 35; twice per lifetime occurs at ages 35 and 40; three times per lifetime occurs at ages 35, 40, and 45.
- † CER = cost-effectiveness ratio. In this analysis, we assumed screening tests may not be equally available in low-resource settings, and therefore, the cost-effectiveness ratios shown are calculated by comparing the incremental costs (2000 international dollars) and benefits (life expectancy gains) of each strategy to no screening.

Appendix Figure 3.

 Homogeneous population
 Heterogeneous population



Impact of varying screening coverage in South Africa. Shown is the relationship between overall screening coverage rates (varied from 70% to 100%), the reduction in lifetime risk of cervical cancer, and the cost-effectiveness ratio (CER) associated with screening using a two-visit HPV testing strategy three times per lifetime. For each value of screening coverage two bars are displayed representing a homogeneous population, in which women are all equally likely to comply with screening (left), and a heterogeneous population (right), in which patients who are at a higher risk of cervical cancer are less likely to be screened. The overall reduction in cervical cancer decreases with lower screening coverage, and this reduction is attenuated further when women at higher risk are less likely to be screened (the heterogeneous population). Different coverage rates only adversely affect the incremental cost-effectiveness ratio of screening when the population is heterogeneous and screening coverage is less likely in patients at higher risk.

Appendix Table 3. One-Way Sensitivity Analyses - Cost Effectiveness Ratios expressed in \$International/YLS*

VIA Sensitivity	Low 60%	Base Case 76%	High 90%
India			
1 visit VIA 1 X lifetime	†	\$10	CS
1 visit VIA 2 X lifetime	†	\$91	\$95
1 visit VIA 3 X lifetime	†	\$268	\$317
2 visit VIA 1 X lifetime	†	†	†
2 visit VIA 2 X lifetime	†	†	†
2 visit VIA 3 X lifetime	†	†	†
1 visit HPV 1 X lifetime	\$29	†	†
1 visit HPV 2 X lifetime	\$169	†	†
1 visit HPV 3 X lifetime	\$481	\$591	†
2 visit HPV 1 X lifetime	†	†	†
2 visit HPV 2 X lifetime	†	†	†
2 visit HPV 3 X lifetime	†	†	†
2 visit HPV/VIA 1 X lifetime	†	†	†
2 visit HPV/VIA 2 X lifetime	†	†	†
2 visit HPV/VIA 3 X lifetime	†	†	†
3 visit HPV 1 X lifetime	†	†	†
3 visit HPV 2 X lifetime	†	†	†
3 visit HPV 3 X lifetime	†	†	†
2 visit cytology 1 X lifetime	†	†	†
2 visit cytology 2 X lifetime	†	†	†
2 visit cytology 3 X lifetime	†	†	†
3 visit cytology 1 X lifetime	†	†	†
3 visit cytology 2 X lifetime	†	†	†
3 visit cytology 3 X lifetime	†	†	†
Kenya			
1 visit VIA 1 X lifetime	†	\$134	\$107
1 visit VIA 2 X lifetime	†	\$319	\$324
1 visit VIA 3 X lifetime	†	†	\$805
2 visit VIA 1 X lifetime	†	†	†
2 visit VIA 2 X lifetime	†	†	†
2 visit VIA 3 X lifetime	†	†	†

Appendix Table 3. One-Way Sensitivity Analyses (cont.)

VIA Sensitivity	Low 60%	Base Case 76%	High 90%
Kenya (cont.)			
1 visit HPV 1 X lifetime	\$166	†	†
1 visit HPV 2 X lifetime	\$450	\$705	†
1 visit HPV 3 X lifetime	\$1,069	\$1,109	†
2 visit HPV 1 X lifetime	†	†	†
2 visit HPV 2 X lifetime	†	†	†
2 visit HPV 3 X lifetime	†	†	†
2 visit HPV/VIA 1 X lifetime	†	†	†
2 visit HPV/VIA 2 X lifetime	†	†	†
2 visit HPV/VIA 3 X lifetime	†	†	†
3 visit HPV 1 X lifetime	†	†	†
3 visit HPV 2 X lifetime	†	†	†
3 visit HPV 3 X lifetime	†	†	†
2 visit cytology 1 X lifetime	†	†	†
2 visit cytology 2 X lifetime	†	†	†
2 visit cytology 3 X lifetime	†	†	†
3 visit cytology 1 X lifetime	†	†	†
3 visit cytology 2 X lifetime	†	†	†
3 visit cytology 3 X lifetime	†	†	†
Peru			
1 visit VIA 1 X lifetime	†	\$124	\$86
1 visit VIA 2 X lifetime	†	†	\$374
1 visit VIA 3 X lifetime	†	†	\$994
2 visit VIA 1 X lifetime	†	†	†
2 visit VIA 2 X lifetime	†	†	†
2 visit VIA 3 X lifetime	†	†	†
1 visit HPV 1 X lifetime	\$128	\$152	†
1 visit HPV 2 X lifetime	\$453	\$453	†
1 visit HPV 3 X lifetime	\$1,145	\$1,145	†
2 visit HPV 1 X lifetime	†	†	†
2 visit HPV 2 X lifetime	†	†	†
2 visit HPV 3 X lifetime	†	†	†

Appendix Table 3. One-Way Sensitivity Analyses (cont.)

VIA Sensitivity	Low 60%	Base Case 76%	High 90%
Peru (cont.)			
2 visit HPV/VIA 1 X lifetime	†	†	†
2 visit HPV/VIA 2 X lifetime	†	†	†
2 visit HPV/VIA 3 X lifetime	†	†	†
3 visit HPV 1 X lifetime	†	†	†
3 visit HPV 2 X lifetime	†	†	†
3 visit HPV 3 X lifetime	†	†	†
2 visit cytology 1 X lifetime	†	†	†
2 visit cytology 2 X lifetime	†	†	†
2 visit cytology 3 X lifetime	†	†	†
3 visit cytology 1 X lifetime	†	†	†
3 visit cytology 2 X lifetime	†	†	†
3 visit cytology 3 X lifetime	†	†	†
South Africa			
1 visit VIA 1 X lifetime	†	†	†
1 visit VIA 2 X lifetime	†	†	†
1 visit VIA 3 X lifetime	†	†	\$9,946
2 visit VIA 1 X lifetime	†	†	†
2 visit VIA 2 X lifetime	†	†	†
2 visit VIA 3 X lifetime	†	†	†
1 visit HPV 1 X lifetime	\$467	\$467	\$467
1 visit HPV 2 X lifetime	\$1,093	\$1,093	\$1,093
1 visit HPV 3 X lifetime	\$2,458	\$2,458	\$2,458
2 visit HPV 1 X lifetime	†	†	†
2 visit HPV 2 X lifetime	†	†	†
2 visit HPV 3 X lifetime	†	†	†
2 visit HPV/VIA 1 X lifetime	†	†	†
2 visit HPV/VIA 2 X lifetime	†	†	†
2 visit HPV/VIA 3 X lifetime	†	†	†
3 visit HPV 1 X lifetime	†	†	†
3 visit HPV 2 X lifetime	†	†	†
3 visit HPV 3 X lifetime	†	†	†

Appendix Table 3. One-Way Sensitivity Analyses (cont.)

VIA Sensitivity	Low 60%	Base Case 76%	High 90%
South Africa (cont.)			
2visit cytology 1 X lifetime	†	†	†
2visit cytology 2 X lifetime	†	†	†
2visit cytology 3 X lifetime	†	†	†
3 visit cytology 1 X lifetime	†	†	†
3 visit cytology 2 X lifetime	†	†	†
3 visit cytology 3 X lifetime	†	†	†
Thailand			
1 visit VIA 1 X lifetime	†	\$109	\$91
1 visit VIA 2 X lifetime	†	\$277	\$242
1 visit VIA 3 X lifetime	†	†	\$571
2 visit VIA 1 X lifetime	†	†	†
2 visit VIA 2 X lifetime	†	†	†
2 visit VIA 3 X lifetime	†	†	†
1 visit HPV 1 X lifetime	\$117	\$170	†
1 visit HPV 2 X lifetime	\$289	\$310	†
1 visit HPV 3 X lifetime	\$658	\$658	†
2 visit HPV 1 X lifetime	†	†	†
2 visit HPV 2 X lifetime	†	†	†
2 visit HPV 3 X lifetime	†	†	†
2 visit HPV/VIA 1 X lifetime	†	†	†
2 visit HPV/VIA 2 X lifetime	†	†	†
2 visit HPV/VIA 3 X lifetime	†	†	†
3 visit HPV 1 X lifetime	†	†	†
3 visit HPV 2 X lifetime	†	†	†
3 visit HPV 3 X lifetime	†	†	†
2 visit cytology 1 X lifetime	†	†	†
2 visit cytology 2 X lifetime	†	†	†
2 visit cytology 3 X lifetime	†	†	†
3 visit cytology 1 X lifetime	†	†	†
3 visit cytology 2 X lifetime	†	†	†
3 visit cytology 3 X lifetime	†	†	†

Appendix Table 3. One-Way Sensitivity Analyses (cont.)

VIA Specificity	Low 66%	Base Case 81%	High 96%
India			
1 visit VIA 1 X lifetime	†	\$10	CS
1 visit VIA 2 X lifetime	†	\$91	\$23
1 visit VIA 3 X lifetime	†	\$268	\$317
2 visit VIA 1 X lifetime	†	†	†
2 visit VIA 2 X lifetime	†	†	†
2 visit VIA 3 X lifetime	†	†	†
1 visit HPV 1 X lifetime	\$29	†	†
1 visit HPV 2 X lifetime	\$169	†	†
1 visit HPV 3 X lifetime	\$481	\$591	†
2 visit HPV 1 X lifetime	†	†	†
2 visit HPV 2 X lifetime	†	†	†
2 visit HPV 3 X lifetime	†	†	†
2 visit HPV/VIA 1 X lifetime	†	†	†
2 visit HPV/VIA 2 X lifetime	†	†	†
2 visit HPV/VIA 3 X lifetime	†	†	†
3 visit HPV 1 X lifetime	†	†	†
3 visit HPV 2 X lifetime	†	†	†
3 visit HPV 3 X lifetime	†	†	†
2 visit cytology 1 X lifetime	†	†	†
2 visit cytology 2 X lifetime	†	†	†
2 visit cytology 3 X lifetime	†	†	†
3 visit cytology 1 X lifetime	†	†	†
3 visit cytology 2 X lifetime	†	†	†
3 visit cytology 3 X lifetime	†	†	†
Kenya			
1 visit VIA 1 X lifetime	†	\$134	\$96
1 visit VIA 2 X lifetime	†	\$319	\$234
1 visit VIA 3 X lifetime	†	†	\$527
2 visit VIA 1 X lifetime	†	†	†
2 visit VIA 2 X lifetime	†	†	†
2 visit VIA 3 X lifetime	†	†	†

Appendix Table 3. One-Way Sensitivity Analyses (cont.)

VIA Specificity	Low 66%	Base Case 81%	High 96%
Kenya (cont.)			
1 visit HPV 1 X lifetime	\$166	†	†
1 visit HPV 2 X lifetime	\$450	\$705	†
1 visit HPV 3 X lifetime	\$1,069	\$1,109	\$1,836
2 visit HPV 1 X lifetime	†	†	†
2 visit HPV 2 X lifetime	†	†	†
2 visit HPV 3 X lifetime	†	†	†
2 visit HPV/VIA 1 X lifetime	†	†	†
2 visit HPV/VIA 2 X lifetime	†	†	†
2 visit HPV/VIA 3 X lifetime	†	†	†
3 visit HPV 1 X lifetime	†	†	†
3 visit HPV 2 X lifetime	†	†	†
3 visit HPV 3 X lifetime	†	†	†
2 visit cytology 1 X lifetime	†	†	†
2 visit cytology 2 X lifetime	†	†	†
2 visit cytology 3 X lifetime	†	†	†
3 visit cytology 1 X lifetime	†	†	†
3 visit cytology 2 X lifetime	†	†	†
3 visit cytology 3 X lifetime	†	†	†
Peru			
1 visit VIA 1 X lifetime	†	\$124	\$80
1 visit VIA 2 X lifetime	†	†	\$274
1 visit VIA 3 X lifetime	†	†	\$672
2 visit VIA 1 X lifetime	†	†	†
2 visit VIA 2 X lifetime	†	†	†
2 visit VIA 3 X lifetime	†	†	†
1 visit HPV 1 X lifetime	\$128	\$152	†
1 visit HPV 2 X lifetime	\$453	\$453	†
1 visit HPV 3 X lifetime	\$1,145	\$1,145	\$1,473
2 visit HPV 1 X lifetime	†	†	†
2 visit HPV 2 X lifetime	†	†	†
2 visit HPV 3 X lifetime	†	†	†

Appendix Table 3. One-Way Sensitivity Analyses (cont.)

VIA Specificity	Low 66%	Base Case 81%	High 96%
Peru (cont.)			
2 visit HPV/VIA 1 X lifetime	†	†	†
2 visit HPV/VIA 2 X lifetime	†	†	†
2 visit HPV/VIA 3 X lifetime	†	†	†
3 visit HPV 1 X lifetime	†	†	†
3 visit HPV 2 X lifetime	†	†	†
3 visit HPV 3 X lifetime	†	†	†
2 visit cytology 1 X lifetime	†	†	†
2 visit cytology 2 X lifetime	†	†	†
2 visit cytology 3 X lifetime	†	†	†
3 visit cytology 1 X lifetime	†	†	†
3 visit cytology 2 X lifetime	†	†	†
3 visit cytology 3 X lifetime	†	†	†
South Africa			
1 visit VIA 1 X lifetime	†	†	\$435
1 visit VIA 2 X lifetime	†	†	\$997
1 visit VIA 3 X lifetime	†	†	†
2 visit VIA 1 X lifetime	†	†	†
2 visit VIA 2 X lifetime	†	†	†
2 visit VIA 3 X lifetime	†	†	†
1 visit HPV 1 X lifetime	\$467	\$467	\$668
1 visit HPV 2 X lifetime	\$1,093	\$1,093	\$1,248
1 visit HPV 3 X lifetime	\$2,458	\$2,458	\$2,458
2 visit HPV 1 X lifetime	†	†	†
2 visit HPV 2 X lifetime	†	†	†
2 visit HPV 3 X lifetime	†	†	†
2 visit HPV/VIA 1 X lifetime	†	†	†
2 visit HPV/VIA 2 X lifetime	†	†	†
2 visit HPV/VIA 3 X lifetime	†	†	†
3 visit HPV 1 X lifetime	†	†	†
3 visit HPV 2 X lifetime	†	†	†
3 visit HPV 3 X lifetime	†	†	†

Appendix Table 3. One-Way Sensitivity Analyses (cont.)

VIA Specificity	Low 66%	Base Case 81%	High 96%
South Africa (cont.)			
2 visit cytology 1 X lifetime	†	†	†
2 visit cytology 2 X lifetime	†	†	†
2 visit cytology 3 X lifetime	†	†	†
3 visit cytology 1 X lifetime	†	†	†
3 visit cytology 2 X lifetime	†	†	†
3 visit cytology 3 X lifetime	†	†	†
Thailand			
1 visit VIA 1 X lifetime	†	\$109	\$48
1 visit VIA 2 X lifetime	†	\$277	\$105
1 visit VIA 3 X lifetime	†	†	\$232
2 visit VIA 1 X lifetime	†	†	†
2 visit VIA 2 X lifetime	†	†	†
2 visit VIA 3 X lifetime	†	†	†
1 visit HPV 1 X lifetime	\$117	\$170	†
1 visit HPV 2 X lifetime	\$289	\$310	†
1 visit HPV 3 X lifetime	\$658	\$658	\$1,635
2 visit HPV 1 X lifetime	†	†	†
2 visit HPV 2 X lifetime	†	†	†
2 visit HPV 3 X lifetime	†	†	†
2 visit HPV/VIA 1 X lifetime	†	†	†
2 visit HPV/VIA 2 X lifetime	†	†	†
2 visit HPV/VIA 3 X lifetime	†	†	†
3 visit HPV 1 X lifetime	†	†	†
3 visit HPV 2 X lifetime	†	†	†
3 visit HPV 3 X lifetime	†	†	†
2 visit cytology 1 X lifetime	†	†	†
2 visit cytology 2 X lifetime	†	†	†
2 visit cytology 3 X lifetime	†	†	†
3 visit cytology 1 X lifetime	†	†	†
3 visit cytology 2 X lifetime	†	†	†
3 visit cytology 3 X lifetime	†	†	†

Appendix Table 3. One-Way Sensitivity Analyses (cont.)

	Low	Base Case	High
HPV Sensitivity	65%	88%	95%
India			
1 visit VIA 1 X lifetime	\$10	\$10	\$10
1 visit VIA 2 X lifetime	\$91	\$91	\$131
1 visit VIA 3 X lifetime	\$268	\$268	†
2 visit VIA 1 X lifetime	†	†	†
2 visit VIA 2 X lifetime	†	†	†
2 visit VIA 3 X lifetime	†	†	†
1 visit HPV 1 X lifetime	†	†	†
1 visit HPV 2 X lifetime	†	†	†
1 visit HPV 3 X lifetime	†	\$591	†
2 visit HPV 1 X lifetime	†	†	\$66
2 visit HPV 2 X lifetime	†	†	\$205
2 visit HPV 3 X lifetime	†	†	\$527
2 visit HPV/VIA 1 X lifetime	†	†	†
2 visit HPV/VIA 2 X lifetime	†	†	†
2 visit HPV/VIA 3 X lifetime	†	†	†
3 visit HPV 1 X lifetime	†	†	†
3 visit HPV 2 X lifetime	†	†	†
3 visit HPV 3 X lifetime	†	†	†
2 visit cytology 1 X lifetime	†	†	†
2 visit cytology 2 X lifetime	†	†	†
2 visit cytology 3 X lifetime	†	†	†
3 visit cytology 1 X lifetime	†	†	†
3 visit cytology 2 X lifetime	†	†	†
3 visit cytology 3 X lifetime	†	†	†
Kenya			
1 visit VIA 1 X lifetime	\$134	\$134	\$134
1 visit VIA 2 X lifetime	\$319	\$319	\$319
1 visit VIA 3 X lifetime	\$705	†	†
2 visit VIA 1 X lifetime	†	†	†
2 visit VIA 2 X lifetime	†	†	†
2 visit VIA 3 X lifetime	†	†	†

Appendix Table 3. One-Way Sensitivity Analyses (cont.)

HPV Sensitivity	Low 65%	Base Case 88%	High 95%
Kenya (cont.)			
1 visit HPV 1 X lifetime	†	†	†
1 visit HPV 2 X lifetime	†	\$705	\$621
1 visit HPV 3 X lifetime	\$2,230	\$1,109	\$1,030
2 visit HPV 1 X lifetime	†	†	†
2 visit HPV 2 X lifetime	†	†	†
2 visit HPV 3 X lifetime	†	†	†
2 visit HPV/VIA 1 X lifetime	†	†	†
2 visit HPV/VIA 2 X lifetime	†	†	†
2 visit HPV/VIA 3 X lifetime	†	†	†
3 visit HPV 1 X lifetime	†	†	†
3 visit HPV 2 X lifetime	†	†	†
3 visit HPV 3 X lifetime	†	†	†
2 visit cytology 1 X lifetime	†	†	†
2 visit cytology 2 X lifetime	†	†	†
2 visit cytology 3 X lifetime	†	†	†
3 visit cytology 1 X lifetime	†	†	†
3 visit cytology 2 X lifetime	†	†	†
3 visit cytology 3 X lifetime	†	†	†
Peru			
1 visit VIA 1 X lifetime	\$124	\$124	†
1 visit VIA 2 X lifetime	\$369	†	†
1 visit VIA 3 X lifetime	\$866	†	†
2 visit VIA 1 X lifetime	†	†	†
2 visit VIA 2 X lifetime	†	†	†
2 visit VIA 3 X lifetime	†	†	†
1 visit HPV 1 X lifetime	†	\$152	\$110
1 visit HPV 2 X lifetime	†	\$453	\$466
1 visit HPV 3 X lifetime	†	\$1,145	\$1,245
2 visit HPV 1 X lifetime	†	†	†
2 visit HPV 2 X lifetime	†	†	†
2 visit HPV 3 X lifetime	†	†	†

Appendix Table 3. One-Way Sensitivity Analyses (cont.)

HPV Sensitivity	Low 65%	Base Case 88%	High 95%
Peru (cont.)			
2 visit HPV/VIA 1 X lifetime	†	†	†
2 visit HPV/VIA 2 X lifetime	†	†	†
2 visit HPV/VIA 3 X lifetime	†	†	†
3 visit HPV 1 X lifetime	†	†	†
3 visit HPV 2 X lifetime	†	†	†
3 visit HPV 3 X lifetime	†	†	†
2 visit cytology 1 X lifetime	†	†	†
2 visit cytology 2 X lifetime	†	†	†
2 visit cytology 3 X lifetime	†	†	†
3 visit cytology 1 X lifetime	†	†	†
3 visit cytology 2 X lifetime	†	†	†
3 visit cytology 3 X lifetime	†	†	†
South Africa			
1 visit VIA 1 X lifetime	\$611	†	†
1 visit VIA 2 X lifetime	\$1,258	†	†
1 visit VIA 3 X lifetime	\$2,590	†	†
2 visit VIA 1 X lifetime	†	†	†
2 visit VIA 2 X lifetime	†	†	†
2 visit VIA 3 X lifetime	†	†	†
1 visit HPV 1 X lifetime	†	\$467	\$434
1 visit HPV 2 X lifetime	†	\$1,093	\$1,120
1 visit HPV 3 X lifetime	†	\$2,458	\$2,654
2 visit HPV 1 X lifetime	†	†	†
2 visit HPV 2 X lifetime	†	†	†
2 visit HPV 3 X lifetime	†	†	†
2 visit HPV/VIA 1 X lifetime	†	†	†
2 visit HPV/VIA 2 X lifetime	†	†	†
2 visit HPV/VIA 3 X lifetime	†	†	†
3 visit HPV 1 X lifetime	†	†	†
3 visit HPV 2 X lifetime	†	†	†
3 visit HPV 3 X lifetime	†	†	†

Appendix Table 3. One-Way Sensitivity Analyses (cont.)

HPV Sensitivity	Low 65%	Base Case 88%	High 95%
South Africa (cont.)			
2 visit cytology 1 X lifetime	†	†	†
2 visit cytology 2 X lifetime	†	†	†
2 visit cytology 3 X lifetime	†	†	†
3 visit cytology 1 X lifetime	†	†	†
3 visit cytology 2 X lifetime	†	†	†
3 visit cytology 3 X lifetime	†	†	†
Thailand			
1 visit VIA 1 X lifetime	\$109	\$109	†
1 visit VIA 2 X lifetime	\$237	\$277	†
1 visit VIA 3 X lifetime	\$500	†	†
2 visit VIA 1 X lifetime	†	†	†
2 visit VIA 2 X lifetime	†	†	†
2 visit VIA 3 X lifetime	†	†	†
1 visit HPV 1 X lifetime	†	\$170	\$108
1 visit HPV 2 X lifetime	†	\$310	\$297
1 visit HPV 3 X lifetime	†	\$658	\$712
2 visit HPV 1 X lifetime	†	†	†
2 visit HPV 2 X lifetime	†	†	†
2 visit HPV 3 X lifetime	†	†	†
2 visit HPV/VIA 1 X lifetime	†	†	†
2 visit HPV/VIA 2 X lifetime	†	†	†
2 visit HPV/VIA 3 X lifetime	†	†	†
3 visit HPV 1 X lifetime	†	†	†
3 visit HPV 2 X lifetime	†	†	†
3 visit HPV 3 X lifetime	†	†	†
2 visit cytology 1 X lifetime	†	†	†
2 visit cytology 2 X lifetime	†	†	†
2 visit cytology 3 X lifetime	†	†	†
3 visit cytology 1 X lifetime	†	†	†
3 visit cytology 2 X lifetime	†	†	†
3 visit cytology 3 X lifetime	†	†	†

Appendix Table 3. One-Way Sensitivity Analyses (cont.)

	Low	Base Case	High
HPV Specificity	70%	93%	96%
India			
1 visit VIA 1 X lifetime	\$10	\$10	\$10
1 visit VIA 2 X lifetime	\$91	\$91	\$91
1 visit VIA 3 X lifetime	\$268	\$268	\$268
2 visit VIA 1 X lifetime	†	†	†
2 visit VIA 2 X lifetime	†	†	†
2 visit VIA 3 X lifetime	†	†	†
1 visit HPV 1 X lifetime	†	†	†
1 visit HPV 2 X lifetime	†	†	†
1 visit HPV 3 X lifetime	\$1,414	\$591	\$484
2 visit HPV 1 X lifetime	†	†	†
2 visit HPV 2 X lifetime	†	†	†
2 visit HPV 3 X lifetime	†	†	†
2 visit HPV/VIA 1 X lifetime	†	†	†
2 visit HPV/VIA 2 X lifetime	†	†	†
2 visit HPV/VIA 3 X lifetime	†	†	†
3 visit HPV 1 X lifetime	†	†	†
3 visit HPV 2 X lifetime	†	†	†
3 visit HPV 3 X lifetime	†	†	†
2 visit cytology 1 X lifetime	†	†	†
2 visit cytology 2 X lifetime	†	†	†
2 visit cytology 3 X lifetime	†	†	†
3 visit cytology 1 X lifetime	†	†	†
3 visit cytology 2 X lifetime	†	†	†
3 visit cytology 3 X lifetime	†	†	†
Kenya			
1 visit VIA 1 X lifetime	\$134	\$134	\$134
1 visit VIA 2 X lifetime	\$319	\$319	†
1 visit VIA 3 X lifetime	\$705	†	†
2 visit VIA 1 X lifetime	†	†	†
2 visit VIA 2 X lifetime	†	†	†
2 visit VIA 3 X lifetime	†	†	†

Appendix Table 3. One-Way Sensitivity Analyses (cont.)

HPV Specificity	Low 70%	Base Case 93%	High 96%
Kenya (cont.)			
1 visit HPV 1 X lifetime	†	†	\$221
1 visit HPV 2 X lifetime	†	\$705	\$462
1 visit HPV 3 X lifetime	†	\$1,109	\$1,157
2 visit HPV 1 X lifetime	†	†	†
2 visit HPV 2 X lifetime	†	†	†
2 visit HPV 3 X lifetime	†	†	†
2 visit HPV/VIA 1 X lifetime	†	†	†
2 visit HPV/VIA 2 X lifetime	†	†	†
2 visit HPV/VIA 3 X lifetime	†	†	†
3 visit HPV 1 X lifetime	†	†	†
3 visit HPV 2 X lifetime	†	†	†
3 visit HPV 3 X lifetime	†	†	†
2 visit cytology 1 X lifetime	†	†	†
2 visit cytology 2 X lifetime	†	†	†
2 visit cytology 3 X lifetime	†	†	†
3 visit cytology 1 X lifetime	†	†	†
3 visit cytology 2 X lifetime	†	†	†
3 visit cytology 3 X lifetime	†	†	†
Peru			
1 visit VIA 1 X lifetime	\$124	\$124	†
1 visit VIA 2 X lifetime	\$369	†	†
1 visit VIA 3 X lifetime	\$866	†	†
2 visit VIA 1 X lifetime	†	†	†
2 visit VIA 2 X lifetime	†	†	†
2 visit VIA 3 X lifetime	†	†	†
1 visit HPV 1 X lifetime	†	\$152	\$120
1 visit HPV 2 X lifetime	†	\$453	\$433
1 visit HPV 3 X lifetime	\$1,924	\$1,145	\$1,102
2 visit HPV 1 X lifetime	†	†	†
2 visit HPV 2 X lifetime	†	†	†
2 visit HPV 3 X lifetime	†	†	†

Appendix Table 3. One-Way Sensitivity Analyses (cont.)

HPV Specificity	Low 70%	Base Case 93%	High 96%
Peru (cont.)			
2 visit HPV/VIA 1 X lifetime	†	†	†
2 visit HPV/VIA 2 X lifetime	†	†	†
2 visit HPV/VIA 3 X lifetime	†	†	†
3 visit HPV 1 X lifetime	†	†	†
3 visit HPV 2 X lifetime	†	†	†
3 visit HPV 3 X lifetime	†	†	†
2 visit cytology 1 X lifetime	†	†	†
2 visit cytology 2 X lifetime	†	†	†
2 visit cytology 3 X lifetime	†	†	†
3 visit cytology 1 X lifetime	†	†	†
3 visit cytology 2 X lifetime	†	†	†
3 visit cytology 3 X lifetime	†	†	†
South Africa			
1 visit VIA 1 X lifetime	\$611	†	†
1 visit VIA 2 X lifetime	\$1,258	†	†
1 visit VIA 3 X lifetime	†	†	†
2 visit VIA 1 X lifetime	†	†	†
2 visit VIA 2 X lifetime	†	†	†
2 visit VIA 3 X lifetime	†	†	†
1 visit HPV 1 X lifetime	†	\$467	\$436
1 visit HPV 2 X lifetime	\$2,400	\$1,093	\$1,015
1 visit HPV 3 X lifetime	\$3,829	\$2,458	\$2,279
2 visit HPV 1 X lifetime	†	†	†
2 visit HPV 2 X lifetime	†	†	†
2 visit HPV 3 X lifetime	†	†	†
2 visit HPV/VIA 1 X lifetime	†	†	†
2 visit HPV/VIA 2 X lifetime	†	†	†
2 visit HPV/VIA 3 X lifetime	†	†	†
3 visit HPV 1 X lifetime	†	†	†
3 visit HPV 2 X lifetime	†	†	†
3 visit HPV 3 X lifetime	†	†	†

Appendix Table 3. One-Way Sensitivity Analyses (cont.)

HPV Specificity	Low 70%	Base Case 93%	High 96%
South Africa (cont.)			
2 visit cytology 1 X lifetime	†	†	†
2 visit cytology 2 X lifetime	†	†	†
2 visit cytology 3 X lifetime	†	†	†
3 visit cytology 1 X lifetime	†	†	†
3 visit cytology 2 X lifetime	†	†	†
3 visit cytology 3 X lifetime	†	†	†
Thailand			
1 visit VIA 1 X lifetime	\$109	\$109	†
1 visit VIA 2 X lifetime	\$237	\$277	†
1 visit VIA 3 X lifetime	\$500	†	†
2 visit VIA 1 X lifetime	†	†	†
2 visit VIA 2 X lifetime	†	†	†
2 visit VIA 3 X lifetime	†	†	†
1 visit HPV 1 X lifetime	\$2,265	\$170	\$107
1 visit HPV 2 X lifetime	†	\$310	\$262
1 visit HPV 3 X lifetime	†	\$658	\$599
2 visit HPV 1 X lifetime	†	†	†
2 visit HPV 2 X lifetime	†	†	†
2 visit HPV 3 X lifetime	†	†	†
2 visit HPV/VIA 1 X lifetime	†	†	†
2 visit HPV/VIA 2 X lifetime	†	†	†
2 visit HPV/VIA 3 X lifetime	†	†	†
3 visit HPV 1 X lifetime	†	†	†
3 visit HPV 2 X lifetime	†	†	†
3 visit HPV 3 X lifetime	†	†	†
2 visit cytology 1 X lifetime	†	†	†
2 visit cytology 2 X lifetime	†	†	†
2 visit cytology 3 X lifetime	†	†	†
3 visit cytology 1 X lifetime	†	†	†
3 visit cytology 2 X lifetime	†	†	†
3 visit cytology 3 X lifetime	†	†	†

Appendix Table 3. One-Way Sensitivity Analyses (cont.)

Cancer Costs	Low .5x	Base Case 1x	High 2x
India			
1 visit VIA 1 X lifetime	\$80	\$10	CS
1 visit VIA 2 X lifetime	\$169	\$91	CS
1 visit VIA 3 X lifetime	\$357	\$268	CS
2 visit VIA 1 X lifetime	†	†	CS
2 visit VIA 2 X lifetime	†	†	CS
2 visit VIA 3 X lifetime	†	†	CS
1 visit HPV 1 X lifetime	†	†	CS
1 visit HPV 2 X lifetime	†	†	CS
1 visit HPV 3 X lifetime	\$661	\$591	CS
2 visit HPV 1 X lifetime	†	†	CS
2 visit HPV 2 X lifetime	†	†	CS
2 visit HPV 3 X lifetime	†	†	CS
2 visit HPV/VIA 1 X lifetime	†	†	CS
2 visit HPV/VIA 2 X lifetime	†	†	CS
2 visit HPV/VIA 3 X lifetime	†	†	\$13
3 visit HPV 1 X lifetime	†	†	†
3 visit HPV 2 X lifetime	†	†	†
3 visit HPV 3 X lifetime	†	†	\$2,681
2 visit cytology 1 X lifetime	†	†	CS
2 visit cytology 2 X lifetime	†	†	CS
2 visit cytology 3 X lifetime	†	†	CS
3 visit cytology 1 X lifetime	†	†	†
3 visit cytology 2 X lifetime	†	†	†
3 visit cytology 3 X lifetime	†	†	†
Kenya			
1 visit VIA 1 X lifetime	\$203	\$134	CS
1 visit VIA 2 X lifetime	\$395	\$319	\$121
1 visit VIA 3 X lifetime	\$784	†	\$528
2 visit VIA 1 X lifetime	†	†	†
2 visit VIA 2 X lifetime	†	†	†
2 visit VIA 3 X lifetime	†	†	†

Appendix Table 3. One-Way Sensitivity Analyses (cont.)

Cancer Costs	Low .5x	Base Case 1x	High 2x
Kenya (cont.)			
1 visit HPV 1 X lifetime	†	†	\$29
1 visit HPV 2 X lifetime	\$926	\$705	†
1 visit HPV 3 X lifetime	\$1,178	\$1,109	\$972
2 visit HPV 1 X lifetime	†	†	†
2 visit HPV 2 X lifetime	†	†	†
2 visit HPV 3 X lifetime	†	†	†
2 visit HPV/VIA 1 X lifetime	†	†	†
2 visit HPV/VIA 2 X lifetime	†	†	†
2 visit HPV/VIA 3 X lifetime	†	†	†
3 visit HPV 1 X lifetime	†	†	†
3 visit HPV 2 X lifetime	†	†	†
3 visit HPV 3 X lifetime	†	†	†
2 visit cytology 1 X lifetime	†	†	†
2 visit cytology 2 X lifetime	†	†	†
2 visit cytology 3 X lifetime	†	†	†
3 visit cytology 1 X lifetime	†	†	†
3 visit cytology 2 X lifetime	†	†	†
3 visit cytology 3 X lifetime	†	†	†
Peru			
1 visit VIA 1 X lifetime	\$229	\$124	CS
1 visit VIA 2 X lifetime	†	†	CS
1 visit VIA 3 X lifetime	†	†	\$49
2 visit VIA 1 X lifetime	†	†	CS
2 visit VIA 2 X lifetime	†	†	†
2 visit VIA 3 X lifetime	†	†	†
1 visit HPV 1 X lifetime	\$257	\$152	CS
1 visit HPV 2 X lifetime	\$569	\$453	CS
1 visit HPV 3 X lifetime	\$1,279	\$1,145	\$427
2 visit HPV 1 X lifetime	†	†	†
2 visit HPV 2 X lifetime	†	†	†
2 visit HPV 3 X lifetime	†	†	†

Appendix Table 3. One-Way Sensitivity Analyses (cont.)

Cancer Costs	Low .5x	Base Case 1x	High 2x
Peru (cont.)			
2 visit HPV/VIA 1 X lifetime	†	†	†
2 visit HPV/VIA 2 X lifetime	†	†	†
2 visit HPV/VIA 3 X lifetime	†	†	†
3 visit HPV 1 X lifetime	†	†	†
3 visit HPV 2 X lifetime	†	†	†
3 visit HPV 3 X lifetime	†	†	†
2 visit cytology 1 X lifetime	†	†	†
2 visit cytology 2 X lifetime	†	†	†
2 visit cytology 3 X lifetime	†	†	†
3 visit cytology 1 X lifetime	†	†	†
3 visit cytology 2 X lifetime	†	†	†
3 visit cytology 3 X lifetime	†	†	†
South Africa			
1 visit VIA 1 X lifetime	†	†	†
1 visit VIA 2 X lifetime	†	†	†
1 visit VIA 3 X lifetime	†	†	†
2 visit VIA 1 X lifetime	†	†	†
2 visit VIA 2 X lifetime	†	†	†
2 visit VIA 3 X lifetime	†	†	†
1 visit HPV 1 X lifetime	\$596	\$467	\$209
1 visit HPV 2 X lifetime	\$1,236	\$1,093	\$807
1 visit HPV 3 X lifetime	\$2,624	\$2,458	\$2,126
2 visit HPV 1 X lifetime	†	†	†
2 visit HPV 2 X lifetime	†	†	†
2 visit HPV 3 X lifetime	†	†	†
2 visit HPV/VIA 1 X lifetime	†	†	†
2 visit HPV/VIA 2 X lifetime	†	†	†
2 visit HPV/VIA 3 X lifetime	†	†	†
3 visit HPV 1 X lifetime	†	†	†
3 visit HPV 2 X lifetime	†	†	†
3 visit HPV 3 X lifetime	†	†	†

Appendix Table 3. One-Way Sensitivity Analyses (cont.)

Cancer Costs	Low .5x	Base Case 1x	High 2x
South Africa (cont.)			
2 visit cytology 1 X lifetime	†	†	†
2 visit cytology 2 X lifetime	†	†	†
2 visit cytology 3 X lifetime	†	†	†
3 visit cytology 1 X lifetime	†	†	†
3 visit cytology 2 X lifetime	†	†	†
3 visit cytology 3 X lifetime	†	†	†
Thailand			
1 visit VIA 1 X lifetime	\$184	\$109	CS
1 visit VIA 2 X lifetime	\$362	\$277	CS
1 visit VIA 3 X lifetime	†	†	†
2 visit VIA 1 X lifetime	†	†	CS
2 visit VIA 2 X lifetime	†	†	†
2 visit VIA 3 X lifetime	†	†	†
1 visit HPV 1 X lifetime	\$244	\$170	CS
1 visit HPV 2 X lifetime	\$385	\$310	\$11
1 visit HPV 3 X lifetime	\$751	\$658	\$471
2 visit HPV 1 X lifetime	†	†	CS
2 visit HPV 2 X lifetime	†	†	†
2 visit HPV 3 X lifetime	†	†	†
2 visit HPV/VIA 1 X lifetime	†	†	†
2 visit HPV/VIA 2 X lifetime	†	†	†
2 visit HPV/VIA 3 X lifetime	†	†	†
3 visit HPV 1 X lifetime	†	†	†
3 visit HPV 2 X lifetime	†	†	†
3 visit HPV 3 X lifetime	†	†	†
2 visit cytology 1 X lifetime	†	†	CS
2 visit cytology 2 X lifetime	†	†	CS
2 visit cytology 3 X lifetime	†	†	†
3 visit cytology 1 X lifetime	†	†	†
3 visit cytology 2 X lifetime	†	†	†
3 visit cytology 3 X lifetime	†	†	†

Appendix Table 3. One-Way Sensitivity Analyses (cont.)

	Low	Base Case	High
Loss to follow up	0%	15%	50%
India			
1 visit VIA 1 X lifetime	\$14	\$10	CS
1 visit VIA 2 X lifetime	\$98	\$91	\$24
1 visit VIA 3 X lifetime	\$284	\$268	\$233
2 visit VIA 1 X lifetime	†	†	†
2 visit VIA 2 X lifetime	†	†	†
2 visit VIA 3 X lifetime	†	†	†
1 visit HPV 1 X lifetime	†	†	†
1 visit HPV 2 X lifetime	†	†	\$22
1 visit HPV 3 X lifetime	\$590	\$591	\$598
2 visit HPV 1 X lifetime	†	†	†
2 visit HPV 2 X lifetime	†	†	†
2 visit HPV 3 X lifetime	†	†	†
2 visit HPV/VIA 1 X lifetime	†	†	†
2 visit HPV/VIA 2 X lifetime	†	†	†
2 visit HPV/VIA 3 X lifetime	†	†	†
3 visit HPV 1 X lifetime	†	†	†
3 visit HPV 2 X lifetime	†	†	†
3 visit HPV 3 X lifetime	†	†	†
2 visit cytology 1 X lifetime	†	†	†
2 visit cytology 2 X lifetime	†	†	†
2 visit cytology 3 X lifetime	†	†	†
3 visit cytology 1 X lifetime	†	†	†
3 visit cytology 2 X lifetime	†	†	†
3 visit cytology 3 X lifetime	†	†	†
Kenya			
1 visit VIA 1 X lifetime	\$139	\$134	\$122
1 visit VIA 2 X lifetime	\$328	\$319	\$296
1 visit VIA 3 X lifetime	\$1,089	†	\$652
2 visit VIA 1 X lifetime	†	†	†
2 visit VIA 2 X lifetime	†	†	†
2 visit VIA 3 X lifetime	†	†	†

Appendix Table 3. One-Way Sensitivity Analyses (cont.)

Loss to follow up	Low 0%	Base Case 15%	High 50%
Kenya (cont.)			
1 visit HPV 1 X lifetime	†	†	†
1 visit HPV 2 X lifetime	\$711	\$705	†
1 visit HPV 3 X lifetime	\$1,111	\$1,109	\$1,112
2 visit HPV 1 X lifetime	†	†	†
2 visit HPV 2 X lifetime	†	†	†
2 visit HPV 3 X lifetime	†	†	†
2 visit HPV/VIA 1 X lifetime	†	†	†
2 visit HPV/VIA 2 X lifetime	†	†	†
2 visit HPV/VIA 3 X lifetime	†	†	†
3 visit HPV 1 X lifetime	†	†	†
3 visit HPV 2 X lifetime	†	†	†
3 visit HPV 3 X lifetime	†	†	†
2 visit cytology 1 X lifetime	†	†	†
2 visit cytology 2 X lifetime	†	†	†
2 visit cytology 3 X lifetime	†	†	†
3 visit cytology 1 X lifetime	†	†	†
3 visit cytology 2 X lifetime	†	†	†
3 visit cytology 3 X lifetime	†	†	†
Peru			
1 visit VIA 1 X lifetime	\$126	\$124	\$120
1 visit VIA 2 X lifetime	†	†	†
1 visit VIA 3 X lifetime	†	†	†
2 visit VIA 1 X lifetime	†	†	†
2 visit VIA 2 X lifetime	†	†	†
2 visit VIA 3 X lifetime	†	†	†
1 visit HPV 1 X lifetime	\$149	\$152	\$161
1 visit HPV 2 X lifetime	\$464	\$453	\$430
1 visit HPV 3 X lifetime	\$1,187	\$1,145	\$1,061
2 visit HPV 1 X lifetime	†	†	†
2 visit HPV 2 X lifetime	†	†	†
2 visit HPV 3 X lifetime	†	†	†

Appendix Table 3. One-Way Sensitivity Analyses (cont.)

	Low	Base Case	High
Loss to follow up	0%	15%	50%
Peru (cont.)			
2 visit HPV/VIA 1 X lifetime	†	†	†
2 visit HPV/VIA 2 X lifetime	†	†	†
2 visit HPV/VIA 3 X lifetime	†	†	†
3 visit HPV 1 X lifetime	†	†	†
3 visit HPV 2 X lifetime	†	†	†
3 visit HPV 3 X lifetime	†	†	†
2 visit cytology 1 X lifetime	†	†	†
2 visit cytology 2 X lifetime	†	†	†
2 visit cytology 3 X lifetime	†	†	†
3 visit cytology 1 X lifetime	†	†	†
3 visit cytology 2 X lifetime	†	†	†
3 visit cytology 3 X lifetime	†	†	†
South Africa			
1 visit VIA 1 X lifetime	†	†	†
1 visit VIA 2 X lifetime	†	†	†
1 visit VIA 3 X lifetime	†	†	†
2 visit VIA 1 X lifetime	†	†	†
2 visit VIA 2 X lifetime	†	†	†
2 visit VIA 3 X lifetime	†	†	†
1 visit HPV 1 X lifetime	\$475	\$467	\$446
1 visit HPV 2 X lifetime	\$1,123	\$1,093	\$1,029
1 visit HPV 3 X lifetime	\$2,551	\$2,458	\$2,267
2 visit HPV 1 X lifetime	†	†	†
2 visit HPV 2 X lifetime	†	†	†
2 visit HPV 3 X lifetime	†	†	†
2 visit HPV/VIA 1 X lifetime	†	†	†
2 visit HPV/VIA 2 X lifetime	†	†	†
2 visit HPV/VIA 3 X lifetime	†	†	†
3 visit HPV 1 X lifetime	†	†	†
3 visit HPV 2 X lifetime	†	†	†
3 visit HPV 3 X lifetime	†	†	†

Appendix Table 3. One-Way Sensitivity Analyses (cont.)

	Low	Base Case	High
Loss to follow up	0%	15%	50%
South Africa (cont.)			
2 visit cytology 1 X lifetime	†	†	†
2 visit cytology 2 X lifetime	†	†	†
2 visit cytology 3 X lifetime	†	†	†
3 visit cytology 1 X lifetime	†	†	†
3 visit cytology 2 X lifetime	†	†	†
3 visit cytology 3 X lifetime	†	†	†
Thailand			
1 visit VIA 1 X lifetime	\$121	\$109	\$79
1 visit VIA 2 X lifetime	\$304	\$277	\$213
1 visit VIA 3 X lifetime	†	†	†
2 visit VIA 1 X lifetime	†	†	†
2 visit VIA 2 X lifetime	†	†	†
2 visit VIA 3 X lifetime	†	†	†
1 visit HPV 1 X lifetime	\$172	\$170	\$164
1 visit HPV 2 X lifetime	\$310	\$310	\$308
1 visit HPV 3 X lifetime	\$695	\$658	\$577
2 visit HPV 1 X lifetime	†	†	†
2 visit HPV 2 X lifetime	†	†	†
2 visit HPV 3 X lifetime	†	†	†
2 visit HPV/VIA 1 X lifetime	†	†	†
2 visit HPV/VIA 2 X lifetime	†	†	†
2 visit HPV/VIA 3 X lifetime	†	†	†
3 visit HPV 1 X lifetime	†	†	†
3 visit HPV 2 X lifetime	†	†	†
3 visit HPV 3 X lifetime	†	†	†
2 visit cytology 1 X lifetime	†	†	†
2 visit cytology 2 X lifetime	†	†	†
2 visit cytology 3 X lifetime	†	†	†
3 visit cytology 1 X lifetime	†	†	†
3 visit cytology 2 X lifetime	†	†	†
3 visit cytology 3 X lifetime	†	†	†

* Costs reported in 2000 international dollars. VIA = Visual inspection with acetic acid; HPV = HPV DNA testing using Hybrid Capture II; YLS = years of life saved; I\$= International Dollars; CS = Cost Saving. Strategies are represented using shorthand notation that indicates the number of visits required (one, two or three visits) and the frequency of screening (once, twice, or three times per lifetime). For example, “3-visit Pap - 2X” indicated a strategy requiring three visits, using cervical cytology occurring twice in woman’s lifetime (e.g., Pap smear screening in the first visit, diagnostic work-up with colposcopy in women with positive test results in the second visit, and treatment of women with confirmed disease in the third visit). Screening women once per lifetime occurs at age 35; twice per lifetime occurs at ages 35 and 40; three times per lifetime occurs at ages 35, 40, and 45.

† Strategies shown either cost more but are less effective (strongly dominated), or cost more and are less cost-effective (weakly dominated), than an alternative strategy.

Appendix Table 4: Sensitivity Analysis on Optimal Age of Screening by Frequency and Interval (1 visit – VIA)*

Frequency	Interval	Metric	Kenya	Peru	South Africa	Thailand
1 X		Min Cost	50	50	50	50
		Max Effect	30	32	30	32
		Most Cost Effective	36	36	36	38
2 X	5 years	Min Cost	50	50	50	50
		Max Effect	26	26	26	26
		Most Cost Effective	34	34	34	36
2 X	10 years	Min Cost	50	50	50	50
		Max Effect	28	28	28	28
		Most Cost Effective	34	34	32	34
3 X	5 years	Min Cost	50	50	50	50
		Max Effect	26	26	26	26
		Most Cost Effective	32	32	32	34
3 X	10 years	Min Cost	50	50	50	50
		Max Effect	26	26	26	26
		Most Cost Effective	32	32	32	32

* VIA = Visual inspection with acetic acid

Appendix Table 4: Sensitivity Analysis on Optimal Age of Screening by Frequency and Interval (2 visit – HPV)*

Frequency	Interval	Metric	Kenya	Peru	South Africa	Thailand
1 X		Min Cost	50	50	50	50
		Max Effect	30	30	32	30
		Most Cost Effective	36	36	36	36
2 X	5 years	Min Cost	50	50	50	50
		Max Effect	26	26	26	26
		Most Cost Effective	34	34	34	34
2 X	10 years	Min Cost	50	50	50	50
		Max Effect	28	28	28	28
		Most Cost Effective	34	32	34	32
3 X	5 years	Min Cost	50	50	50	50
		Max Effect	26	26	26	26
		Most Cost Effective	32	32	32	32
3 X	10 years	Min Cost	50	50	50	50
		Max Effect	26	26	26	26
		Most Cost Effective	32	32	32	32

* HPV = HPV DNA testing using Hybrid Capture II

Appendix Table 4: Sensitivity Analysis on Optimal Age of Screening by Frequency and Interval (3 visit – cytology)

Frequency	Interval	Metric	Kenya	Peru	South Africa	Thailand
1 X lifetime		Min Cost	50	50	50	18
		Max Effect	30	30	32	30
		Most Cost Effective	36	36	36	36
2 X lifetime	5 years	Min Cost	50	50	50	50
		Max Effect	26	26	26	26
		Most Cost Effective	34	34	34	34
2 X lifetime	10 years	Min Cost	50	50	50	50
		Max Effect	28	28	28	28
		Most Cost Effective	34	32	34	32
3 X lifetime	5 years	Min Cost	50	50	50	50
		Max Effect	26	26	28	26
		Most Cost Effective	32	32	32	32
3 X lifetime	10 years	Min Cost	50	50	50	50
		Max Effect	26	26	26	26
		Most Cost Effective	32	32	32	32