**Technical Appendix**

**Appendix A: Resource Allocation Model**

The resource allocation model, also known as HIV-RAMP, consists of two components: (i) a Bernoulli process model to estimate the annual risk of HIV transmission or acquisition with and without an intervention and (ii) a linear programming model to optimally allocate a fixed budget among interventions and risk populations based on the cost-effectiveness of interventions and target population size.

A.1 Bernoulli Process Model:

In HIV-RAMP, we used the Bernoulli process model to estimate the annual risk of HIV transmission or acquisition. The inputs required for this estimation include sexual and drug-related behavioral data for men who have sex with men (MSM), injection drug users (IDU) and heterosexuals on the annual number of partners (sex and needle sharing), number of sex acts by type of act, number of needles shared, condom use, partnership overlap, and HIV prevalence among partners (Table A.1). The model also considers the behavioral change after diagnosis, treatment, and other interventions [1](#_ENREF_1).

First, we calculated per-partnership transmission probabilities for each risk population using per-act HIV transmission probabilities for each type of sex act (vaginal insertive, vaginal receptive, anal insertive and anal receptive) and needle sharing. For IDUs, we also included transmissions based on needle sharing in the calculations. We estimated per-partnership transmission probabilities by risk populations

 for MSM and heterosexuals

 for IDUs

where

 : per-act transmission probability for type of sex act

: annual number of sexual contacts of type per partnership for risk population

: condom effectiveness in reducing HIV transmission

: proportion of sex acts of type protected by condom use

: reduction in sexual transmission due to interventions (e.g. awareness of sero-status, viral load suppression, risky behavior reduction following behavioral interventions)

: reduction in needle sharing transmission due to interventions

: per-act transmission probability for needle-sharing injection drug use

: annual number of injections

: proportion of needle sharing acts per partnership

Then, the annual risk of transmitting HIV, , is estimated by

and the annual risk of acquiring HIV, , is estimated by

where

: proportion of uninfected partners who have more than 1 concurrent positive partner (partner overlapping rate) for risk population

: HIV prevalence rate for risk population (proportion of the population that is HIV-infected)

: annual number of partners for risk population

Using the parameters and we included the effects of HIV prevention interventions in the Bernoulli process model as the reductions in per-act or per-partnership transmission probabilities and reductions in the number of sex acts not protected by condoms or number of injections from shared needles. Then, we estimated an intervention’s effect on annual HIV transmission or acquisition risk as the difference in the Bernoulli process model’s calculation of annual transmission risk with and without the intervention’s effect (difference in and following an intervention compared with baseline/status quo).

Table A.1 Key input parameters for Bernoulli process model for all pilot sites

|  |  |  |
| --- | --- | --- |
| Parameter  | Value | Source |
| Per-act HIV transmission probability, %  |  |  |
|  Vaginal insertive | 0.04 | [2](#_ENREF_2) |
|  Vaginal receptive | 0.08 | [2](#_ENREF_2) |
|  Anal insertive | 0.18 | [3](#_ENREF_3),[4](#_ENREF_4) |
|  Anal receptive | 0.82 | [3](#_ENREF_3),[4](#_ENREF_4) |
|  Needle-sharing injection drug use | 0.40 | [5](#_ENREF_5) |
| Annual number of sex acts, all partners | 70 | [6-8](#_ENREF_6) |
| Annual number of injections, all partners | 250 | [9](#_ENREF_9),[10](#_ENREF_10) |
| Annual number of partners  |  |  |
|  Heterosexuals | 1.1 | [11](#_ENREF_11) |
|  IDU | 3 | [12](#_ENREF_12) |
|  MSM | 3.5 | [13](#_ENREF_13) |
| Proportion with more than 1 concurrent positive partner, % |  |  |
|  Heterosexuals | 12 | [14-16](#_ENREF_14) |
|  IDU | 25 | [17](#_ENREF_17),[18](#_ENREF_18) |
|  MSM | 25 | [17](#_ENREF_17),[18](#_ENREF_18) |
| Proportion of sex acts protected by condoms, % | 50 | [19](#_ENREF_19) |
| Proportion of injections in which needles are shared among users,% | 15 | [9](#_ENREF_9),[10](#_ENREF_10) |
| Intervention efficacy, % |  |  |
|  Reduction in HIV transmission because of viral load suppression | 96 | [20](#_ENREF_20) |
|  Condom effectiveness in reducing HIV transmission | 80 | [21](#_ENREF_21) |
|  Reduction in needle sharing transmission because of viral load suppression | 50 | [22](#_ENREF_22) |
|  Reduction in unprotected sex prevalence among positive aware persons because of testing | 53 | [23](#_ENREF_23) |
|  Reduction in needle sharing because of testing | 27.5 | Assumed to be half of the reduction in unprotected sexual intercourse |
|  Reduction in unprotected sex acts among HIV-positive persons because of behavioral interventions  | 27 | [24-26](#_ENREF_24) |
| Reduction in unprotected sex acts among HIV-negative persons because of behavioral interventions | 12 | [27](#_ENREF_27),[28](#_ENREF_28) |

A.2 Linear Programming Model (Optimization Model)

The linear programming model determines the optimal allocation among interventions and risk populations that maximizes the number of new infections prevented subject to budget and reachability constraints. This is a one-period static model where the allocation is annual and the effect of allocation is considered for a short duration. The model allocation is significantly driven by the cost-effectiveness of HIV prevention interventions. The linear programming model is summarized as follows:

Subject to

where

Indices

 HIV interventions where

 Risk populations where

Decision variable

 Funding to allocate intervention targeted at population where and

Parameters

 Amount of available funding to be allocated

 Average cost per effective outcome to implement one intervention in population

 Number of individuals in population that are eligible for intervention

 Expected annual number of potential infections averted per person served by intervention in population

 Discounted duration of intervention effect

 Maximum percent of population reachable by intervention in population

The objective function of the model maximizes the number of new infections prevented, subject to constraints that (i) the number of people served by an intervention cannot exceed the maximum target population reachable by that intervention, (ii) total amount of funds allocated to the interventions cannot exceed the budget and (iii) the amount of funds allocated to an intervention cannot be negative. The linear programming model requires budget, cost of interventions, efficacy of interventions (from Bernoulli model), duration of the intervention effect, size of target populations, and maximum percent of population reachable by each intervention (Table 1 in the main paper, Table A.2 and A.3).

Table A.2. Site-specific input parameters of the linear programming model

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Parameter  | Chicago-Nebraska-Alabama | Source | Philadelphia | Source |
| Intervention Cost, 2009$  |  |  |  |  |
|  Cost per test in clinical settings | 28 | [29-31](#_ENREF_29) | 61 | [32](#_ENREF_32) |
|  Cost per test in nonclinical settings | 105 | [30](#_ENREF_30),[31](#_ENREF_31),[33](#_ENREF_33) | 203 | [32](#_ENREF_32) |
|  Cost per partner tested and notified of a new positive diagnosis | 16,997 | [31](#_ENREF_31),[34](#_ENREF_34) | 19,227 | [32](#_ENREF_32) |
|  Cost per additional patient linked to care | 4,377 | [35](#_ENREF_35) | 4,377 | [35](#_ENREF_35) |
|  Cost per additional client retained in care  | 5,253 | Calculated based on [35](#_ENREF_35) | 4,377 | Assumed to be same as [35](#_ENREF_35) |
|  Cost per additional patient put on an intervention to improve the adherence to ART | 3,247 | [36-38](#_ENREF_36) | 3,650 | [36-39](#_ENREF_36) |
|  Cost per client served in the behavioral intervention for positives | 1,470 | [31](#_ENREF_31) | 1,029 | [32](#_ENREF_32) |
|  Cost per client served in the behavioral intervention for negatives | 513 | [31](#_ENREF_31) | 694 | [32](#_ENREF_32) |
| Sero-prevalence, % |  |  |  |  |
|  Sero-prevalence of HIV testing in clinical settings | 0.60 | [30](#_ENREF_30),[31](#_ENREF_31),[40](#_ENREF_40),[41](#_ENREF_41) | 0.61 | [32](#_ENREF_32) |
|  Sero-prevalence of HIV testing in non-clinical settings |  |  |  |  |
|  HRH | 0.51 | [31](#_ENREF_31) | 0.44 | [32](#_ENREF_32) |
|  IDU | 1.50 | [31](#_ENREF_31) | 1.80 | [32](#_ENREF_32) |
|  MSM | 3.00 | [31](#_ENREF_31) | 3.48 | [32](#_ENREF_32) |

Table A.3. Input parameters of the linear programming model that are same across the pilot sites

|  |  |  |
| --- | --- | --- |
| Parameter | Value | Source |
| Duration of intervention effect (years) |  |  |
|  HIV testing (clinical, non-clinical) and partner services | 5 | Assumption |
|  Linkage to care, retention in care, and adherence to ART | 2 | Assumption |
|  Behavioral interventions  | 1 | Assumption |
| Maximum reach, % |  |  |
|  HIV testing (clinical and non-clinical) | 10 | Assumption |
|  Partner services | 5 | Assumption |
|  Linkage to care, retention in care, and adherence to ART | 20 | Assumption |
|  Behavioral interventions for HIV-infected persons | 20 | Assumption |
|  Behavioral interventions for HIV-uninfected persons | 10 | Assumption |

A.3 General Model Characteristics

The HIV-RAMP model, including the Bernoulli process model and the linear programming model is a static, one-year model. As a result, only first-generation annual transmissions prevented were measured. We also assumed a linear relationship between investment and the outcome. Therefore, the number of new HIV cases prevented increased proportionally with funding allocated to the interventions up to the maximum reach. Fixed setup costs for implementing programs and scaling programs for individuals who are difficult to reach were not considered in this model. Structural interventions such as condom distribution, syringe exchange, and social media campaigns were not included in the HIV-RAMP because these interventions’ direct effect on per-partnership HIV transmission or acquisition probability was difficult to observe or quantify.

A.4 Intervention Duration

Because the benefit of a one-time funding could be longer than the time horizon of the model (1 year), we included the duration of the intervention’s effect in the optimization model. Duration was varied based on the intervention type. We assumed 2 years for continuum-of-care interventions, 5 years for testing and partner services and 1 year for behavioral interventions.

We used the following 3 studies in the estimation of duration for behavioral interventions for people living with HIV: Healthy Relationships[24](#_ENREF_24), CLEAR[25](#_ENREF_25) and WiLLOW[26](#_ENREF_26" \o "Wingood, 2004 #40). For persons at risk of infection, studies used to examine duration were POL[27](#_ENREF_27) and 3MV[28](#_ENREF_28). Inclusion criteria for these studies were (i) they were identified as evidence-based behavioral intervention (EBI) through CDC’s Diffusion of Effective Behavioral Interventions (DEBI) project; (ii) they were prioritized for federal funding support through CDC’s High Impact Prevention approach; (iii) they had a randomized control design; and (iv) they reported at least one outcome that can be used to calculate HIV transmission (or acquisition) risk. Those outcomes included the number of sex acts without a condom, the number of condom-protected sex acts, and the number of partners. The longest follow-up period in studies of interventions for people living with HIV were 6 months (Healthy Relationships), 15 months (CLEAR) and 12 months (WiLLOW). The longest follow-up period in studies of interventions for people without HIV was 6 months (POL and 3MV). Three studies reported results for 2 periods. In Healthy Relationships, the effect of intervention appeared to wane from the 3-month follow-up to the 6-month follow-up as the percentage of sex acts unprotected by condoms increased over the same period. Similarly, 3MV reported a reduction in proportion of sex acts protected by condoms at the 6-month follow-up compared to the 3-month follow-up. WiLLOW reported better results for 12-month follow-up than 6-month follow-up in the number of unprotected sex acts with all partners. In summary, behavioral studies with stronger scientific designs frequently did not measure efficacy past 1 year, and in several cases, efficacy declined over the course of that year. Therefore, we believe a 1-year duration was reasonable.

In our model, we assumed reductions in risky behavior associated with a new HIV diagnosis, including one delivered through partner services, lasted for 5 years. In a meta-analysis by Marks et al (2005), of high-risk sexual behavior in persons aware and unaware of their HIV infections in the United States, the prevalence of unprotected anal or vaginal intercourse (UAV) was similar among HIV+ aware men regardless of the length of time between when they were surveyed and when they became aware of their infection.[23](#_ENREF_23) The authors showed that the prevalence of UAV was 17% in men who had been aware of their infection for 2 years or less, and 13% in men who had been aware of their disease for more than 8 years, compared with 39% among PLWH who were unaware of their infection. McGowan et al (2004)[42](#_ENREF_42) reported that the prevalence of unprotected sex was lower among those who had known about their HIV infection for up to 4 years, but higher among those who had been aware for more than 5 years. The study was conducted among HIV+ patients from all risk populations who attended an HIV clinic in New York City. Given these findings, we felt an assumption of a 5-year duration of behavior change following a new diagnosis was reasonable.

Being newly diagnosed with HIV also conferred in our model probabilities of linkage to care, retention in care and adherence to ART. Those probabilities, multiplied together, provided a likelihood of viral load suppression, associated with a 96% reduction in HIV transmission.

 Few data indicate the duration of effect for interventions associated with linkage to care, retention in care and adherence to ART. We believe 2 years was a reasonable assumption. Duration values were tested in sensitivity analysis, and the results are reported at the end of this appendix.

A.5 Target Populations

The model includes a variety of interventions that could be targeted to populations that vary in care and risk level. The size of the target population for an intervention consists of two components: the number of eligible individuals for an intervention and maximum reach.

1. Number of Eligible Individuals

We based the number of eligible individuals for an intervention on the number of HIV-infected persons, the composition of risk populations and the distribution of population among continuum-of-care stages. For the single intervention that targeted the HIV-negative population, behavioral interventions for HIV-negative persons, the number of eligible individuals is the at-risk HIV-uninfected population.

The site-specific number of eligible individuals, in population for an intervention is calculated by

 for testing in clinical settings and partner services

 for testing in non-clinical settings for population HRH, IDU and MSM

 for linkage to care

 for retention in care

 for adherence to HAART

 for behavioral interventions for HIV-positive population HRH, IDU and MSM

 for behavioral interventions for HIV-negative population HRH, IDU and MSM

where

 : the number of persons diagnosed with HIV by year-end (X)

: proportion of undiagnosed HIV-infected persons among all PLWH

: proportion of diagnosed HIV-infected persons who are linked to care

proportion of diagnosed HIV-infected persons who are retained in care

: proportion of diagnosed HIV-infected persons who are prescribed ART

: proportion of diagnosed HIV-infected persons who achieve viral load suppression

HIV prevalence rate for risk population (proportion of the population that is HIV-infected)

1. Maximum Reach

We assumed that only a percentage of a target population could be reached by an intervention. Maximum reach is the maximum proportion of the eligible population that could be reached by an intervention within a year considering the existing budget and intervention scalability.

We set the maximum reach at 20% for continuum-of-care interventions and behavioral interventions for HIV-infected persons, 10% for testing and behavioral interventions for HIV-uninfected persons, and 5% for partner services based on an analysis of Philadelphia’s CDC prevention budget and HIV prevention programs and the consensus of the modelers and public health practitioners of Philadelphia. We assumed these values were the same for the other 3 pilot sites. Maximum reach values were tested in sensitivity analysis, and the results are reported at the end of this appendix.

A.6 Continuum Interventions

For testing and all other interventions along the test-and-treat continuum, including linkage to care, retention in care and adherence to treatment, the efficacy of each intervention is determined by the proportions of PLWH who, based on the jurisdiction’s current surveillance data, are able to achieve subsequent steps along the continuum. Each of those steps moves PLWH toward a probability of achieving viral load suppression, which reduces transmission risk. In that sense, each intervention along the continuum is dependent on subsequent interventions in the continuum and the funding already spent on those interventions. This is not true for behavioral interventions because those effects are considered to be independent of viral load suppression.

We modeled the interventions as discretely implemented programs rather than combined interventions. In particular, continuum-of-care interventions could be delivered as a combined intervention, and they have the potential to be less expensive and more effective than the separately delivered interventions. However, data are lacking on the efficacy of the combined intervention on achieving viral load suppression, and, as a result, we excluded the combined continuum-of-care intervention from our model.

A.7 Cost per case prevented by intervention

The inverse of the coefficients in the objective function of the linear programming are equivalent to the cost per case prevented by intervention. This is formulated as follows:

 for intervention for risk population

For each pilot site, we applied 3% discount rate if the duration of intervention effect is greater than 1 year and we calculated the cost per case prevented of all interventions (Table A.4; for rankings, see Table 2).

Table A.4 Site-specific cost per case prevented by interventions

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Interventions | Chicago  | Nebraska | Alabama | Philadelphia |
| Testing in clinical setting | $15,851  | $18,570 | $19,972 | $51,293 |
| Testing in non-clinical setting: HET | $386,168  | $377,656 | $429,456 | $866,271 |
| Testing in non-clinical setting: IDU | $29,188 | $32,528 | $33,167 | $53,934 |
| Testing in non-clinical setting: MSM | $9,368 | $10,627 | $10,880 | $17,965 |
| Partner services | $58,253 | $68,246 | $73,399 | $99,104 |
| Linkage to care | $55,216 | $58,237 | $87,688 | $114,644 |
| Retention in care | $61,946 | $45,233 | $53,402 | $75,665 |
| Adherence to HAART | $27,215 | $27,960 | $29,415 | $42,753 |
| Behavioral intervention for positives: HET | $975,088 | $841,665 | $935,192 | $594,796 |
| Behavioral intervention for positives: IDU | $1,052,567 | $1,048,150 | $1,044,395 | $700,004 |
| Behavioral intervention for positives: MSM | $139,157 | $139,157 | $139,157 | $97,410 |
| Behavioral intervention for negatives: HET | $13,250,674 | $11,451,288 | $12,713,080 | $15,642,126 |
| Behavioral intervention for negatives: IDU | $2,282,618 | $2,273,077 | $2,264,967 | $2,931,405 |
| Behavioral intervention for negatives: MSM | $241,815 | $241,815 | $241,815 | $327,210 |

The model only considers the prevention activities of the local health departments. We assumed that appropriate care and treatment would be available to those who received continuum-of-care interventions. Because of the model’s health department perspective, we did not include treatment costs in addition to the intervention costs.

A.8 Other model outcomes

Besides optimal allocation for pilot sites, we estimated total number of persons served by interventions and the total number of cases prevented as a result of the optimal allocation (Table 2 in the main paper). We measured the average cost per case of HIV prevented as the budget divided by total number of cases prevented by pilot site. That is

 for each pilot site

where is the total number of cases prevented in a site

Then, we calculated the total HIV lifetime treatment cost prevented for each pilot site by

 for each pilot site

where T is HIV lifetime treatment cost, which was assumed to be $367,134 for 2009 US dollars[43](#_ENREF_43).

**Appendix B: Sensitivity Analysis**

We conducted one-way sensitivity analyses on duration, maximum reach and the reduction in the number of sex acts unprotected by condoms following a new HIV diagnosis. We applied 1 year of duration to all interventions in one analysis, compared with our base case assumption of durations ranging from 1 year to 5 years, depending on the intervention. For the maximum reach analysis, we applied 20% across all interventions, compared with our base case assumption of reaches ranging from 5% to 20%. For proportion of sex acts protected by condoms after a new diagnosis, we applied a 0% increase and a 75% increase, compared with our base case assumption of a 53% increase.

We applied the sensitivity analysis to the Chicago health department, but the results would be similar for other health departments. We reported the optimal allocation, percent of funding received by intervention in the optimal allocation, cost per case prevented by intervention, total persons served, total cases prevented, average cost per case of HIV prevented and total HIV lifetime treatment costs prevented (Table B.1 and B.2).

In the base case, the model funded 6 of 14 possible interventions (18% of total funding to testing in clinical settings, 5% for testing in non-clinical settings for IDUs, 9% for testing in non-clinical settings for MSM, 7% for partner services, 50% for linkage to care and 12% for adherence to ART). When the duration of all interventions was set to 1 year, the model also funded 6 of 14 possible interventions. However, the 2 interventions that received the least funding in the base case, partner services (7% of total funding), and, the testing in non-clinical settings of people who inject drugs (3% of total funding), were not funded in the sensitivity analysis. Two interventions not funded in the base case received modest funding in the sensitivity analysis, retention in care (8% of total funding) and behavior change among MSM living with HIV (3% of total funding). Funding amounts for the other 4 interventions were unchanged.

We found that when we assumed 20% maximum reach across all interventions, the model allocated funds to 5 of the 14 interventions, rather than 6. It dropped funding for partner services. It shifted the proportion of total funds to the remaining interventions as follows: testing in clinical settings, from 18% to 37%; testing in non-clinical settings of people who inject drugs, from 5% to 9%; testing in non-clinical settings of MSM, from 9% to 18%; linkage to care, from 50% to 25%. The allocation to adherence-related interventions remained constant at 12%.

When the effect of behavior change after a new diagnosis varied (0% and 75% from its base case value 53%), the model funded 6 of 14 possible interventions as in the base case. However, when there was no change in behavior following an HIV diagnosis, the model no longer allocated 7% of total funding to partner services, but instead allocated 7% to retention in care. When we assumed a 75% increase in the number of sex acts protected by condoms, the model allocated funding to the same interventions as in the base case. However, funding for partner services rose from 7% of total funding to 33%, while funding for linkage to care fell from 50% to 23%.

Table B.1 Sensitivity analysis results for duration and maximum reach

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Base Case** | **Duration: 1 year for all interventions** | **Maximum reach: 20% for all interventions** |
| **Intervention** | **Cost per case prevented** | **Optimal Allocation** | **% allocated** | **Cost per case prevented** | **Optimal Allocation** | **% allocated** | **Cost per case prevented** | **Optimal Allocation** | **% allocated** |
| Testing in clinical setting | 16,492  | 2,218,522  | 18% | 77,658  | 2,218,522  | 18% | 16,492  | 4,437,044  | 37% |
| Testing in non-clinical setting: HET | 397,280  | 0  | 0% | 1,870,738  | 0  | 0% | 397,280  | 0  | 0% |
| Testing in non-clinical setting: IDU | 30,437  | 552,577  | 5% | 143,324  | 0  | 0% | 30,437  | 1,105,154  | 9% |
| Testing in non-clinical setting: MSM | 9,643  | 1,078,469  | 9% | 45,409  | 1,078,469  | 9% | 9,643  | 2,156,937  | 18% |
| Partner services | 60,067  | 809,201  | 7% | 282,848  | 0  | 0% | 60,067  | 0  | 0% |
| Linkage to care | 58,384  | 6,050,597  | 50% | 115,017  | 6,050,597  | 50% | 58,384  | 3,010,230  | 25% |
| Retention in care | 65,503  | 0  | 0% | 129,041  | 1,009,499  | 8% | 65,503  | 0  | 0% |
| Adherence to ART | 28,781  | 1,394,660  | 12% | 56,699  | 1,394,660  | 12% | 28,781  | 1,394,660  | 12% |
| Behavioral intervention for positives: HET | 975,088  | 0  | 0% | 975,088  | 0  | 0% | 975,088  | 0  | 0% |
| Behavioral intervention for positives: IDU | 1,053,887  | 0  | 0% | 1,053,887  | 0  | 0% | 1,053,887  | 0  | 0% |
| Behavioral intervention for positives: MSM | 139,158  | 0  | 0% | 139,158  | 352,278  | 3% | 139,158  | 0  | 0% |
| Behavioral intervention for negatives: HET | 13,250,674  | 0  | 0% | 13,250,674  | 0  | 0% | 13,250,674  | 0  | 0% |
| Behavioral intervention for negatives: IDU | 2,282,619  | 0  | 0% | 2,282,619  | 0  | 0% | 2,282,619  | 0  | 0% |
| Behavioral intervention for negatives: MSM | 241,816  | 0  | 0% | 241,816  | 0  | 0% | 241,816  | 0  | 0% |
| **Total budget** |  | **$ 12,104,026** |  |  | **$ 12,104,026** |  |  | **$ 12,104,026** |  |
| **Total persons served** |  | **2723** |  |  | **3028** |  |  | **2844** |  |
| **Total cases prevented** |  | **430** |  |  | **140** |  |  | **629** |  |
| **Average cost per case of HIV prevented** |  | **$ 28,143.92** |  |  | **$ 86,533.86** |  |  | **$ 19,241.98** |  |
| **Total HIV lifetime treatment cost averted** |  | **$157,895,524** |  |  | **$ 51,353,300** |  |  | **$ 230,942,980** |  |

Table B.2 Sensitivity analysis results for behavior change after testing

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Base Case** | **0% reduction in unprotected sex prevalence after diagnosis** | **75% reduction in unprotected sex prevalence after diagnosis** |
| **Intervention** | **Cost per case prevented** | **Optimal Allocation** | **% allocated** | **Cost per case prevented** | **Optimal Allocation** | **% allocated** | **Cost per case prevented** | **Optimal Allocation** | **% allocated** |
| Testing in clinical setting | 16,492  | 2,218,522  | 18% | 23,587  | 2,218,522  | 18% | 14,640  | 2,218,522  | 18% |
| Testing in non-clinical setting: HET | 397,280  | 0  | 0% | 600,679  | 0  | 0% | 348,107  | 0  | 0% |
| Testing in non-clinical setting: IDU | 30,437  | 552,577  | 5% | 32,757  | 552,577  | 5% | 29,566  | 552,577  | 5% |
| Testing in non-clinical setting: MSM | 9,643  | 1,078,469  | 9% | 14,536  | 1,078,469  | 9% | 8,446  | 1,078,469  | 9% |
| Partner services | 60,067  | 809,201  | 7% | 85,909  | 0  | 0% | 53,321  | 4,040,166  | 33% |
| Linkage to care | 58,384  | 6,050,597  | 50% | 39,568  | 6,050,597  | 50% | 73,029  | 2,819,632  | 23% |
| Retention in care | 65,503  | 0  | 0% | 44,392  | 809,201  | 7% | 81,934  | 0  | 0% |
| Adherence to ART | 28,781  | 1,394,660  | 12% | 19,505  | 1,394,660  | 12% | 36,001  | 1,394,660  | 12% |
| Behavioral intervention for positives: HET | 975,088  | 0  | 0% | 461,302  | 0  | 0% | 1,828,186  | 0  | 0% |
| Behavioral intervention for positives: IDU | 1,053,887  | 0  | 0% | 496,816  | 0  | 0% | 1,978,840  | 0  | 0% |
| Behavioral intervention for positives: MSM | 139,158  | 0  | 0% | 66,619  | 0  | 0% | 259,626  | 0  | 0% |
| Behavioral intervention for negatives: HET | 13,250,674  | 0  | 0% | 13,250,674  | 0  | 0% | 13,250,674  | 0  | 0% |
| Behavioral intervention for negatives: IDU | 2,282,619  | 0  | 0% | 2,282,619  | 0  | 0% | 2,282,619  | 0  | 0% |
| Behavioral intervention for negatives: MSM | 241,816  | 0  | 0% | 241,816  | 0  | 0% | 241,816  | 0  | 0% |
| **Total budget** |  | **$ 12,104,026** |  |  | **$ 12,104,026** |  |  | **$ 12,104,026** |  |
| **Total persons served** |  | **2723** |  |  | **2829** |  |  | **2175** |  |
| **Total cases prevented** |  | **430** |  |  | **428** |  |  | **451** |  |
| **Average cost per case of HIV prevented** |  | **$ 28,143.92** |  |  | **$ 28,295.89** |  |  | **$ 26,836** |  |
| **Total HIV lifetime treatment cost averted** |  | **$157,895,524** |  |  | **$ 157,047,551** |  |  | **$ 165,590,494** |  |

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