Resource optimization to maximize the HIV response in Kyrgyzstan

Executive summary

In order to maintain the HIV response in Eastern Europe and Central Asia it is imperative to ensure that national HIV programs continue to be sustainably financed. Continued commitment by national governments to finance the HIV the response is critical. Moreover, with planned transition away from donor support, there will be increased demand on domestic fiscal investment. As such it is vital to make cost-effective funding allocations decisions to maximize impact. An allocative efficiency modeling analysis was conducted through partnership with the Kyrgyz Government, the Global Fund, UNAIDS, and the Burnet Institute. The Optima HIV model was applied to estimate the optimized resource allocation across a mix of HIV programs. It is anticipated that recommendations from this analysis, as summarized below, will inform subsequent National Strategic Plans and Global Fund funding applications.

Key recommendations for HIV resource optimization include:

- **Scaling up antiretroviral therapy (ART)**, which could lead to increased treatment coverage of people diagnosed with HIV from 56% (status quo) to 93% (optimized) in 2019, with high coverage levels maintained to 2030.
- **Scaling up investment for needle-syringe programs (NSP) for people who inject drugs (PWID) once additional funds become available.** It is estimated that almost 40% of new HIV infections occurred among PWID in 2018 in Kyrgyzstan. Under optimized allocation of 100% budget some investment in HIV testing and prevention programs targeting PWID programs and NSP should be maintained. As additional resources become available more funds should be invested in these programs.
- **Scaling up investment for HIV testing and prevention programs targeting men who have sex with men (MSM) once additional funds become available**. Given over 20% of new HIV infections were estimated to have occurred among MSM in 2018, a portion of investment in HIV testing and prevention programs targeting this group should be maintained at the 100% budget level, with scale-up once additional funds become available.

Given relatively low new HIV infections among the general population, it is **not recommended to prioritize HIV investments towards the general population at the latest reported budget level**, but rather to target limited funds towards key populations at higher risk of acquiring and transmitting HIV.

Background

Since 2010 new HIV infections increased by over 20%, whereas HIV-related deaths decreased by almost 10% in Kyrgyzstan.[1] The HIV epidemic in Kyrgyzstan is concentrated among key populations, with a HIV prevalence of 12.4% among PWID,[2] 6.3% among MSM,[3] and 2% among FSW in 2017.[4]

The Kyrgyz Republic Government has adopted a 2017-2021 State Program for responding the HIV epidemic in the Kyrgyz Republic.[5] This strategic plan focuses on strengthening the role of the state in the face of declining funding from international donors, with the adoption of greater responsibility for implementation of prevention programs targeting key populations.[6]

Over the 2014-2015 period, an HIV allocative efficiency analysis was conducted using the Optima HIV model with support from the World Bank, UNAIDS, the Global Fund, and other partners. Since then, following on recommendations from the 2014-2015 analysis, there have been significant improvements in the adoption of updated HIV testing and treatment protocols, reductions in treatment costs, updated epidemiological values, and improvements in service delivery leading to cost savings. Following on from this initial study, an updated allocative efficacy modeling analysis was conducted to estimate the optimal allocation of HIV resources based on latest reported values with findings described below.

Objectives

1. Given 2015-2017 resource allocation, how many new HIV infections, HIV-related deaths, and HIV-related disability-adjusted life years (DALYs) (comparable to QALYs saved) are estimated to have been averted through HIV program implementation?
2. What is the optimized resource allocation to minimize HIV infections and HIV-related deaths by 2030 under optimized varying budget levels?
3. What is the optimized HIV resource allocation for best achieving the 90-90-90 and 95-95-95 targets by 2020 and by 2030, respectively, and what are the minimum levels of resources required for best achieving these targets?

Methodology

An allocative efficacy modeling analysis was undertaken in collaboration with the HIV program of Kyrgyzstan. Epidemiological and program data was provided by the Kyrgyzstan country team and validated during a regional workshop that was held July 2019 in Kiev, Ukraine. Country teams were consulted before and after the workshop on data collation and validation, objective and scenario building, and results validation. Demographic, epidemiological, behavioural, programmatic, and expenditure data from various sources including UNAIDS Global AIDS Monitoring and National AIDS Spending Assessment reports, Integrated bio-behavioural surveillance surveys, national reports and systems, as well as from other sources were collated. This allocative efficacy analysis was conducted using Optima HIV, an epidemiological model of HIV transmission overlayed with a programmatic component and a resource optimization algorithm. A more detailed description of the Optima HIV model has been published by Kerr et al.[7]

Populations and HIV programs modeled

Populations considered in this analysis were:

- Key populations
    - Female sex workers (FSW)
    - Clients of female sex workers (Clients)
    - Men who have sex with men and women (MSM)
    - Males who inject drugs (MWID)
    - Females who inject drugs (FWID)
    - Prisoner population (Prisoners)
- General populations
    - Males 0-14 (M0-14)
    - Females 0-14 (F0-14)
    - Males 15-49 (M15-49)
    - Females 15-49 (F14-49)
    - Males 50+ (M50+)
    - Females 50+ (F50+)

HIV programs considered in this analysis:

- Antiretroviral therapy (ART)
- Condoms and social and behaviour change communication (SBCC)
- HIV testing and prevention targeting PWID
- HIV testing and prevention targeting MSM
- HIV testing and prevention targeting FSW
- HIV testing services (HTS) for the general population
- Needle-syringe programs (NSP)
- Prevention of mother-to-child transmission (PMTCT)
- Opiate substitution therapy (OST)

Model constraints

Within the optimization analyses, no one on treatment, including ART, PMTCT, and OST, can be removed from treatment, unless by natural attrition.

Model weightings

To minimize new HIV infections and HIV-related deaths by 2030 objectives functions were weighted 1 to 1 for infections to deaths.

Findings

Objective 1. Given 2015-2017 resource allocation, how many new HIV infections, HIV-related deaths, and HIV-related DALYs are estimated to have been averted through HIV program implementation?

To estimate the impact of past spending on the status of HIV in Kyrgyzstan, all spending on targeted HIV programs was removed from 2015 to 2017, representing the previous Global Fund funding cycle period. This was compared with actual program spending over the same period, referred to as the baseline scenario.

Results suggest that past investments have had an important impact on the HIV response. Had the HIV program not been implemented from 2015 to 2017, by 2018 it is estimated that there could have been almost 120% more new HIV infections (almost 1,800 more infections) and over 140% more HIV-related deaths (approximately 700 more deaths) over this period (figure 1). HIV spending in 2018 amounted to US$10M, of which the estimated share of Global Fund contribution is 34%.

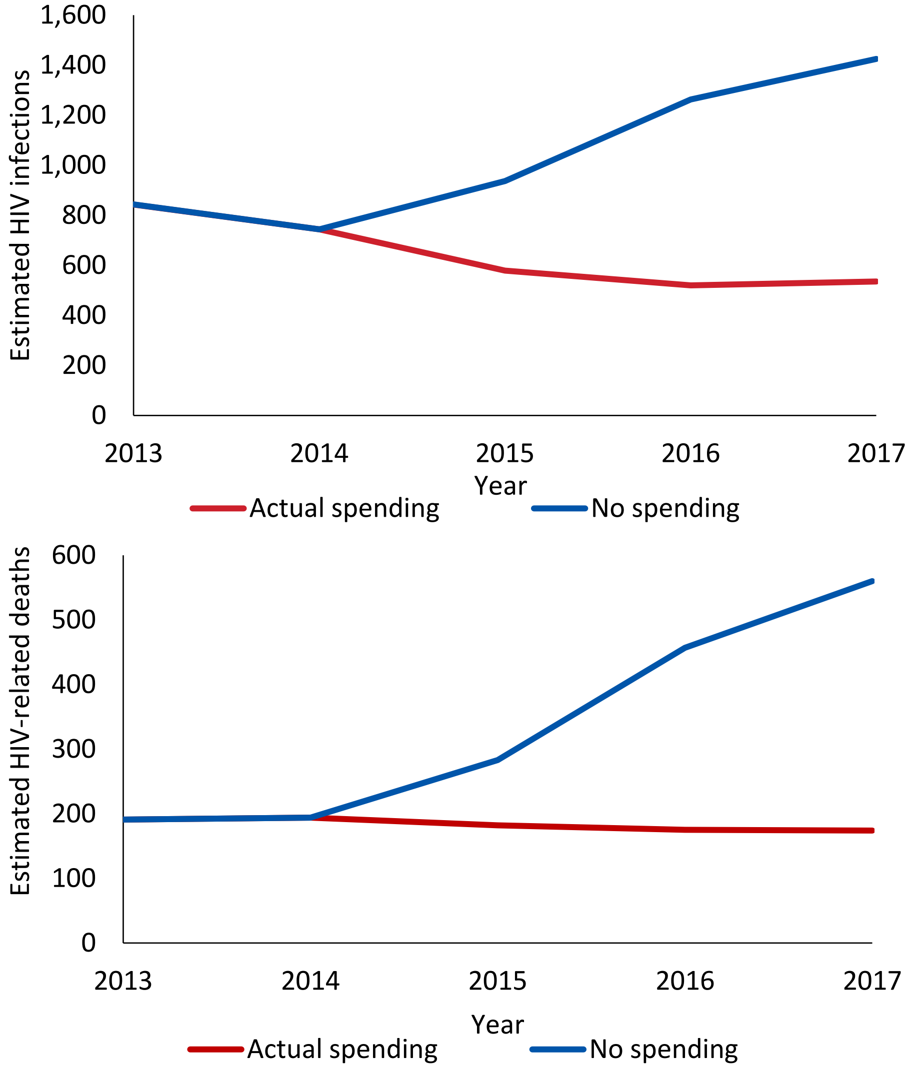


Figure 1. Estimated new HIV infections and HIV-related deaths in the absence of HIV program spending from 2015 to 2017

Objective 2. What is the optimized resource allocation to minimize HIV infections and HIV-related deaths by 2030 under varying budget levels?

Optimization results suggest scaling up ART, which could lead to increased treatment of those diagnosed with HIV from 56% (status quo) to 93% (optimized) in 2019, with high coverage levels maintained to 2030 (figures 2 and 3; table A5).

Given that almost 40% of new HIV infections in 2018 in Kyrgyzstan are estimated to have occurred among PWID, at 100% optimized budget, results suggest maintaining investment for needle-syringe programs and some investment in HIV prevention and testing programs targeting people who inject drugs (figures 2 and 3; table A5). Should additional resources become available, investment in these programs should be maintained, along with that for opiate substitution therapy (OST) (figure 2; table A5). Some investment for HIV testing and prevention programs targeting MSM should be maintained and continued to be scaled up as additional funding becomes available. It is estimated that over 20% of new HIV infections occurred among MSM in 2018. In addition, some investment in HIV testing and prevention programs targeting FSW should be maintained with some proportional increase should additional resources become available. This follows given the relatively low number of new HIV infections were estimated to have occurred among FSW, 7%, in 2018.

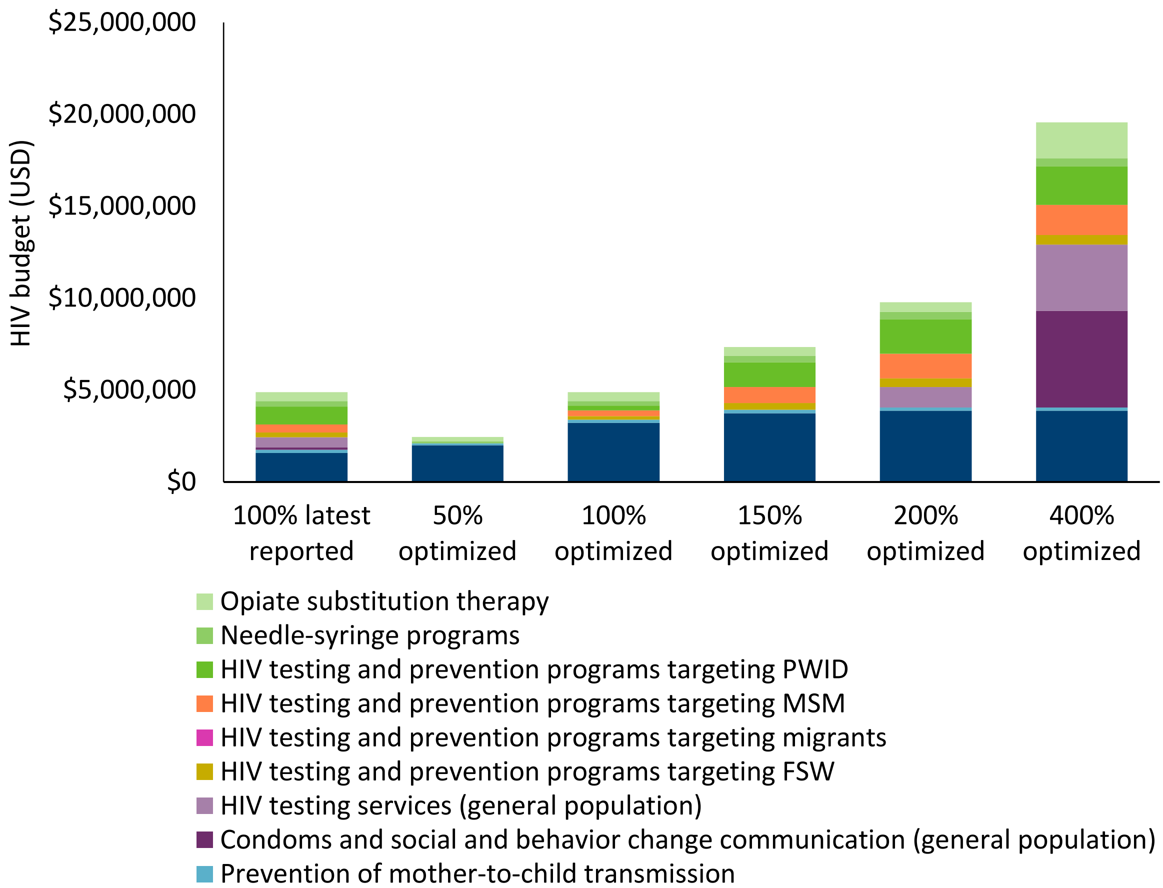


Figure 2. Optimized allocations under varying levels of annual HIV budgets for 2019 to 2030 to minimize new HIV infections and HIV-related deaths by 2030

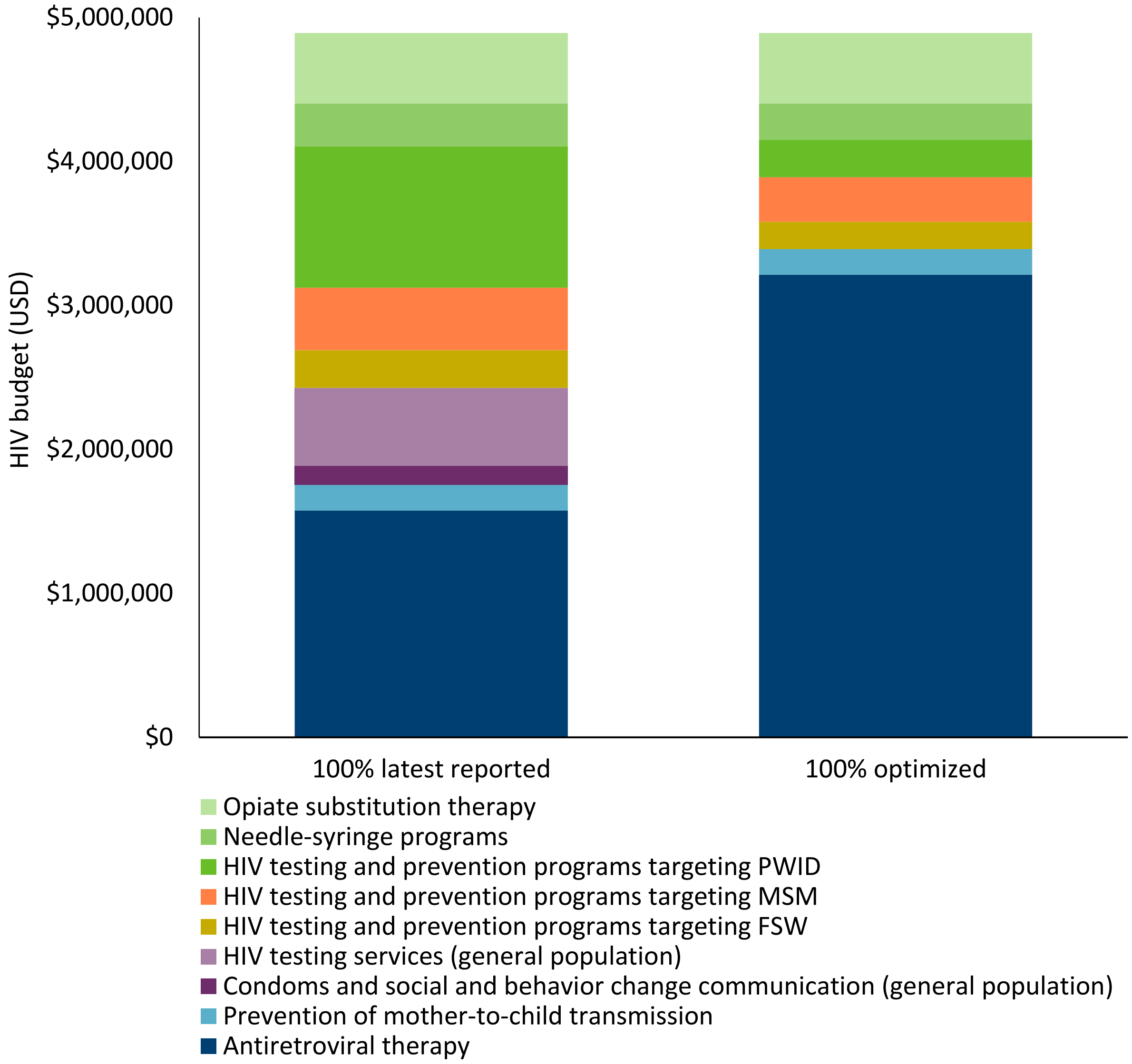


Figure 3. Optimized HIV annual resource allocation for 2019 to 2030 to minimize new infections and HIV-related deaths by 2030.

Under 100% optimized annual budget from 2019 to 2030 to minimize new HIV infections and HIV-related deaths by 2030, it is estimated that an additional 40% of new HIV infections could be averted (3,700 more infections averted) and 45% more HIV-related deaths (1,700 more deaths averted) by 2030 compared with the latest reported allocation being maintained over the same period (figure 4). By 2030, an additional 44,000 DALYs could also be averted under 100% optimized budget allocation.

If the budget were doubled to 200% and the allocation optimized, it is estimated that by 2030 new HIV infections could be reduced by an additional 60% (5,000 more infections averted), HIV-related deaths by 60% (2,000 more deaths averted), and HIV-related disability-adjusted life years (DALYs) by 60% (59,000 more DALYs averted) compared with the latest reported budget level and allocation over this period (figure 4). It is estimated that investment beyond 800% will have only very marginal impact on reducing HIV infections and deaths given the current mix of programs, as programs will reach set saturation levels (calculated as 95% of the maximum achievable reduction in infections and deaths in 2030 compared to 2018 levels).

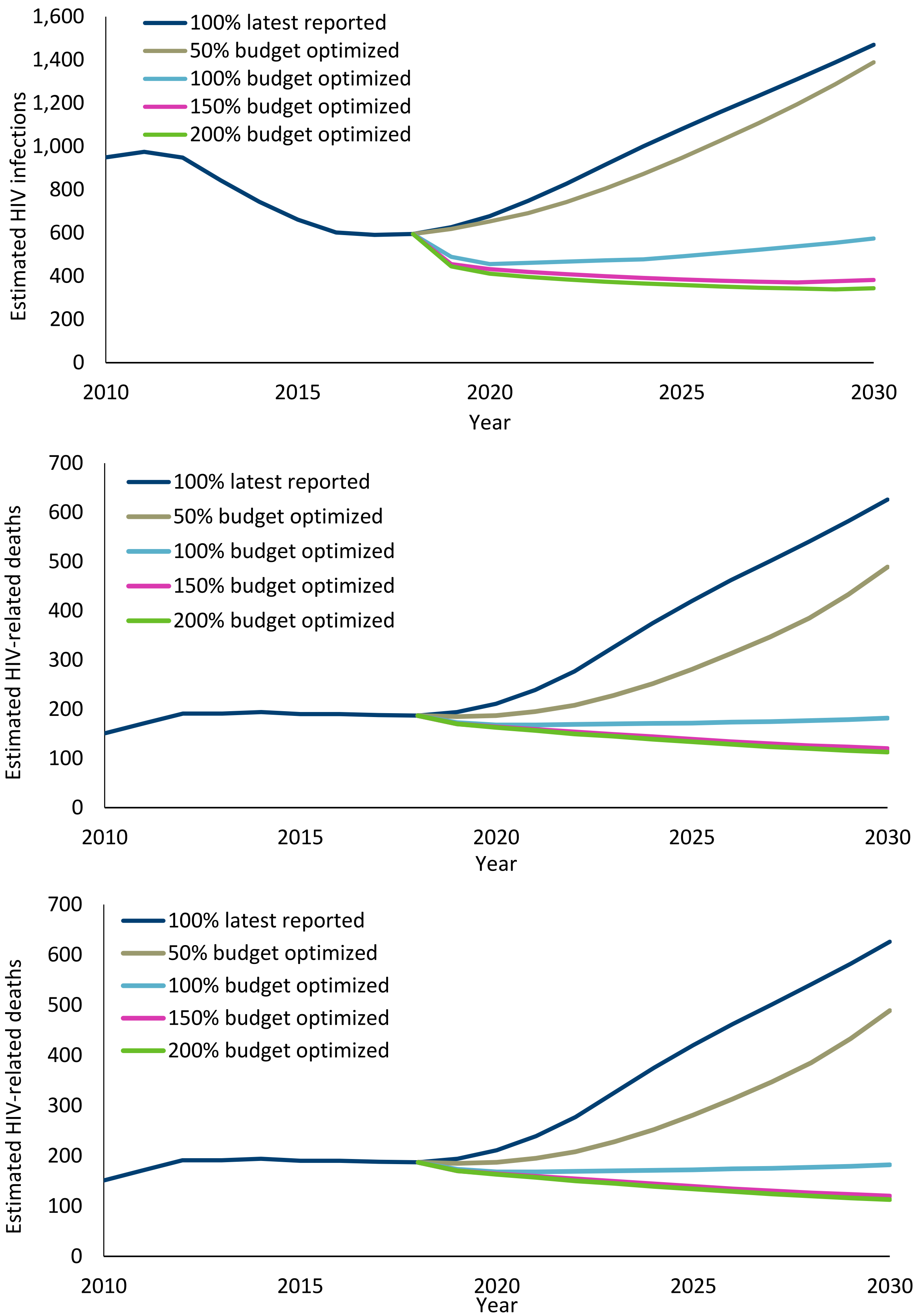


Figure 4. Estimated new HIV infections, HIV-related deaths, and HIV-related DALYs under optimized varying annual budget levels for 2019 to 2030 to minimize infections and deaths by 2030

Objective 3. What is the optimized HIV resource allocation for best achieving the 90-90-90 and 95-95-95 targets by 2020 and 2030, respectively, and what are the minimum levels of resources required for best achieving these targets?

Under latest reported budget, it is estimated that by 2020, 75% of people living with HIV will be diagnosed, 53% of those diagnosed will receive treatment, and 72% of those on treatment will achieve viral suppression. With increased budget, optimization results suggest that 90-90-90 targets could come close to being reached by 2020, with progress to 80-94-90.

Towards best achieving 95-95-95 targets, it is estimated that the annual HIV program budget from 2019 to 2030 should be increased to 240% of the latest reported level (an additional US$13M annually) and optimized with prioritization of antiretroviral therapy (ART), HIV testing, and HIV testing and prevention programs targeting MSM (figure 6). By 2030, this could allow Kyrgyzstan to have 94% of people living with HIV be aware of their status, 96% of those diagnosed on treatment, and 95% of those on treatment to have achieved viral suppression (figure 5).

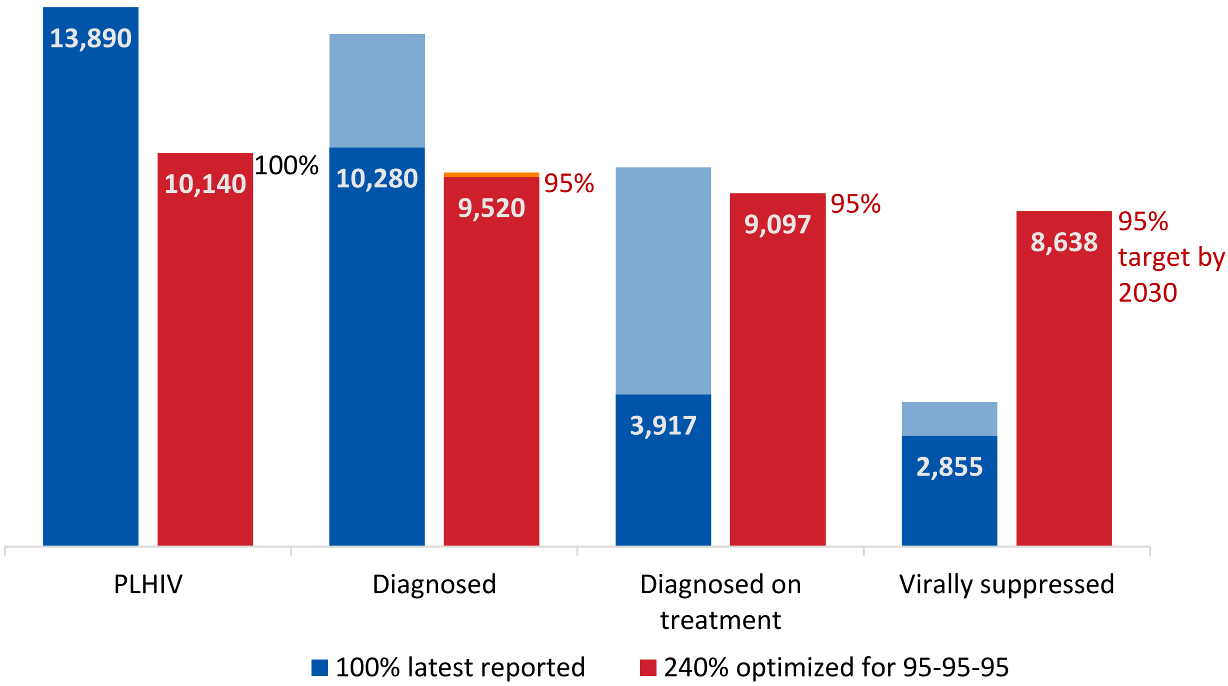


Figure 5. HIV cascade under optimized resource allocation to best achieve 95-95-95 targets by 2030. Dark blue bars represent progress towards 95-95-95 targets under 100% latest reported budget, with light blue bars showing the gap to achieving targets. Red bars represent progress towards 95-95-95 targets under 240% optimized resource allocation to best achieve 95-95-95 targets, with light red bars showing the gap to achieving targets.

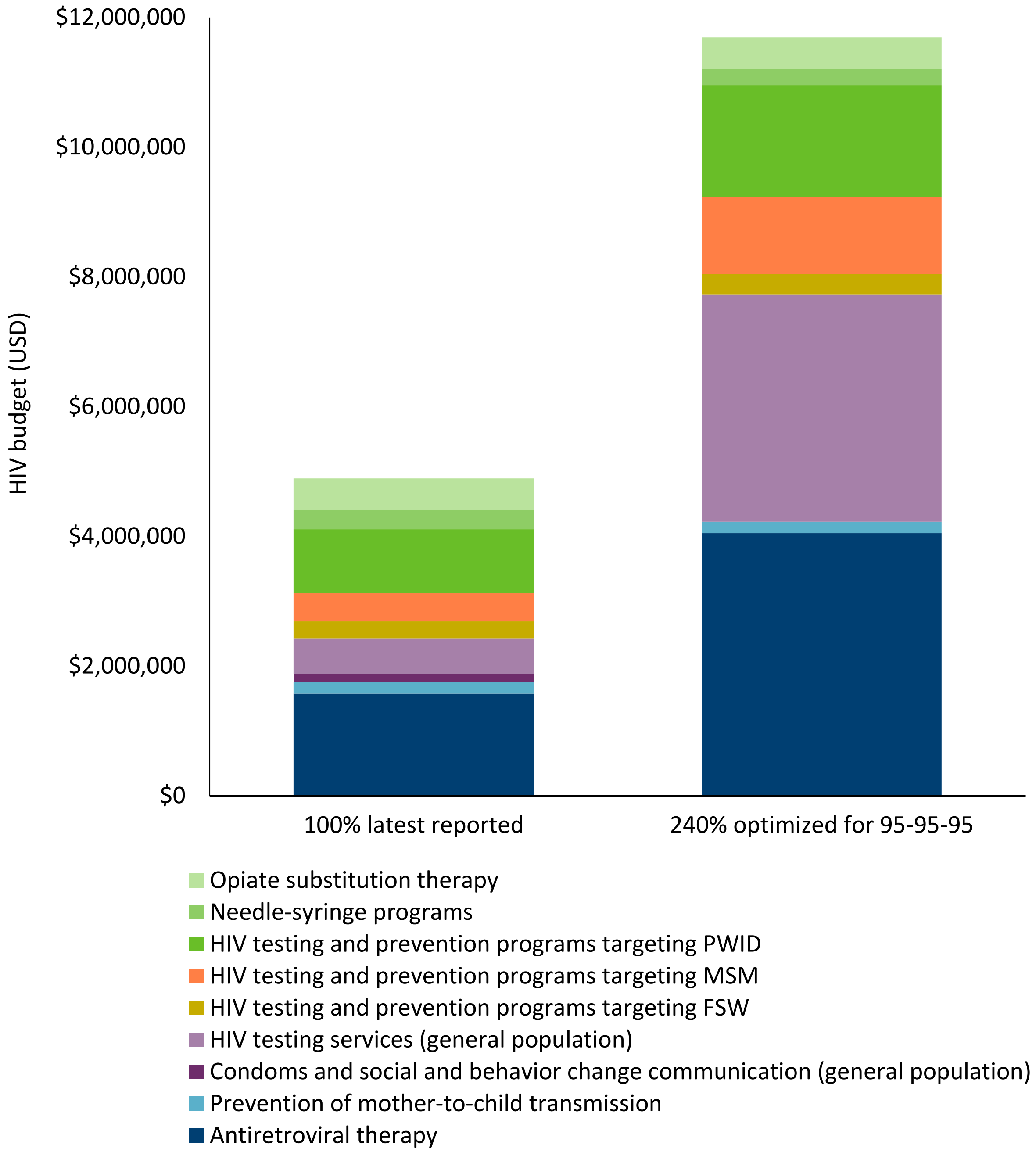
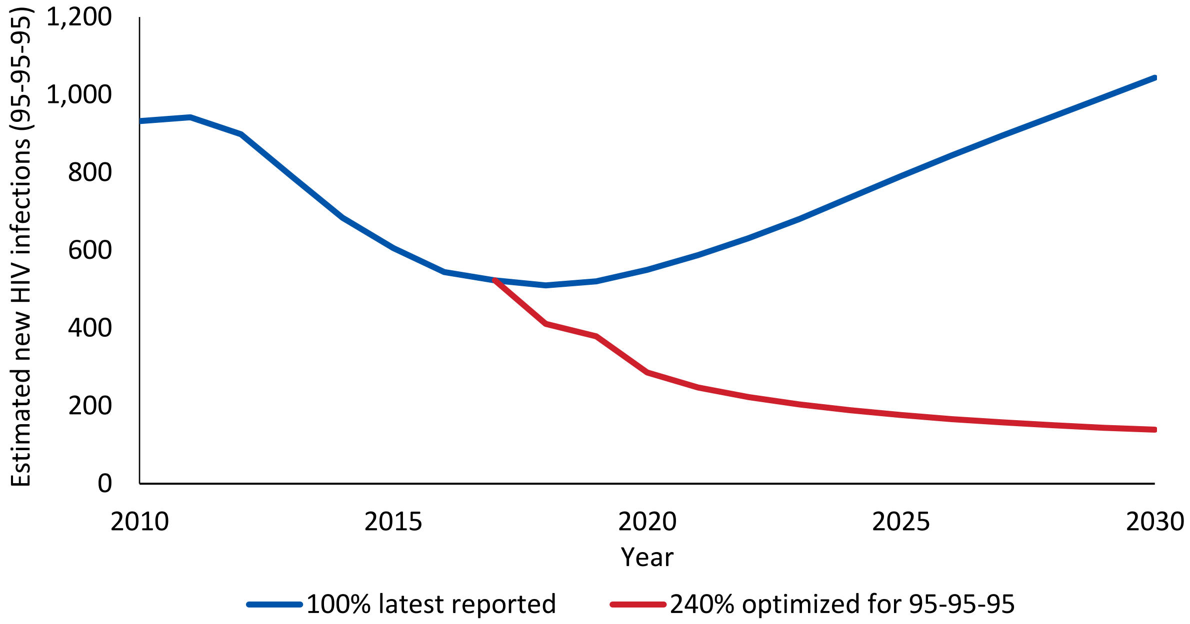


Figure 6. Optimized HIV budget level and allocation to best achieve 95-95-95 targets by 2030

Compared with latest reported 100% budget allocation, by 2030 under optimized allocation of 240% budget towards achieving 95-95-95 targets it is estimated that an additional 70% of new HIV infections could be averted (approximately 6,700 more infections averted) and 70% of HIV-related deaths could be averted (approximately 2,700 more deaths averted) (figure 8).



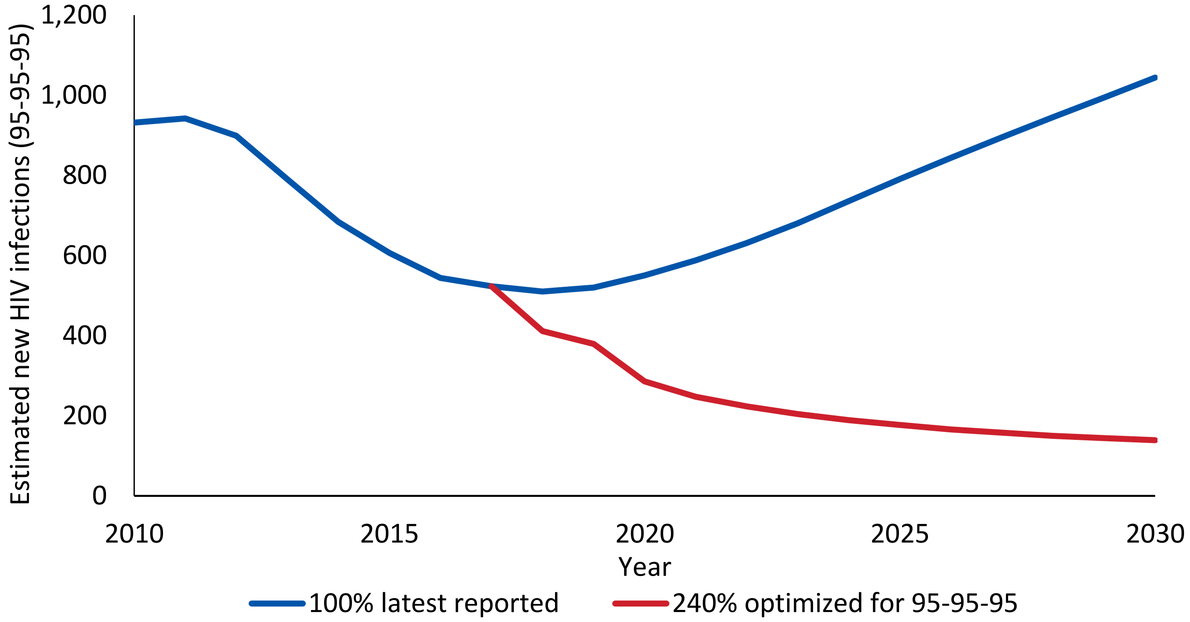


Figure 8. Estimated new HIV infections and HIV-related deaths under optimized allocation towards best achieving 95-95-95 targets by 2030

Study limitations

As with any modelling study, there are limitations that should be considered when interpreting results and recommendations from this analysis. First, limitations in data availability and reliability can lead to uncertainty surrounding projected results. Although the model optimization algorithm accounts for inherent uncertainty, it might not be possible to account for all aspects of uncertainty because of poor quality or insufficient data, particularly for cost and coverage values informing cost functions. Coupled with epidemic trends, cost functions are a primary factor in modeling optimized resource allocations. Second, we used contextual values and expert opinion where available, otherwise evidence from systematic reviews of clinical and research studies were used to inform model assumptions. Lastly, we did not capture the effects of migration of on the HIV epidemic.

Conclusions

The results of this allocative efficiency modeling analysis demonstrate the impact that an optimized resource allocation across a mix of HIV programs can have on reducing infections and deaths. The purpose of this modelling analysis was to evaluate the allocative efficiency of core HIV programs. However, additional gains could be achieved through improving technical or implementation efficiency. In addition, policy makers and funders are encouraged to consider resources required to improve equity, such as through investment in social enablers to remove human rights-based barriers to health. These elements have not been explicitly dealt with in this analysis.

References

1. Kyrgyzstan country overview, UNAIDS, accessed December 2019. https://www.unaids.org/en/regionscountries/countries/kyrgyzstan

2. Integrated bio-behavioral surveillance and population size estimation survey among people who inject drugs in Kyrgyzstan, 2017.

3. Integrated bio-behavioral surveillance and population size estimation survey among men who have sex with men in Kyrgyzstan, 2017.

4. Integrated bio-behavioral surveillance and population size estimation survey among Female sex workers in Kyrgyzstan, 2017.

5. Country progress report – Kyrgyzstan, Global AIDS Monitoring 2017. UNAIDS, 2018.

6. Kyrgyzstan HIV/AIDS national strategic plan 2017-2021.

7. Kerr CC, Stuart RM, Gray RT, Shattock AJ, Fraser-Hurt N, Benedikt C, et al. Optima: A model for HIV epidemic analysis, program prioritization, and resource optimization. JAIDS, 2015;69(3):365-76.

Appendices

Appendix 1. Model parameters

Table A1. Model parameters: transmissibility, disease progression, and disutility weights

Interaction-related transmissibility (% per act)		
	Insertive penile-vaginal intercourse	0.04%
	Receptive penile-vaginal intercourse	0.08%
	Insertive penile-anal intercourse	0.09%
	Receptive penile-anal intercourse	1.38%
	Intravenous injection	0.80%
	Mother-to-child (breastfeeding)	36.70%
	Mother-to-child (non-breastfeeding)	20.50%
Relative disease-related transmissibility		
	Acute infection	5.60
	CD4 (>500)	1.00
	CD4 (500) to CD4 (350-500)	1.00
	CD4 (200-350)	1.00
	CD4 (50-200)	3.49
	CD4 (<50)	7.17
Disease progression (average years to move)		
	Acute to CD4 (>500)	0.30
	CD4 (500) to CD4 (350-500)	1.11
	CD4 (350-500) to CD4 (200-350)	3.10
	CD4 (200-350) to CD4 (50-200)	3.90
	CD4 (50-200) to CD4 (<50)	1.90
Changes in transmissibility (%)		
	Condom use	95%
	Circumcision	58%
	Diagnosis behavior change	0%
	STI cofactor increase	265%
	Opiate substitution therapy	54%
	PMTCT	90%
	Pre-exposure prophylaxis	73%
	Unsuppressive ART	50%
	Suppressive ART	92%
Disutility weights		
	Untreated HIV, acute	0.15
	Untreated HIV, CD4 (>500)	0.01
	Untreated HIV, CD4 (350-500)	0.02
	Untreated HIV, CD4 (200-350)	0.07
	Untreated HIV, CD4 (50-200)	0.27
	Untreated HIV, CD4 (<50)	0.55
	Treated HIV	0.05

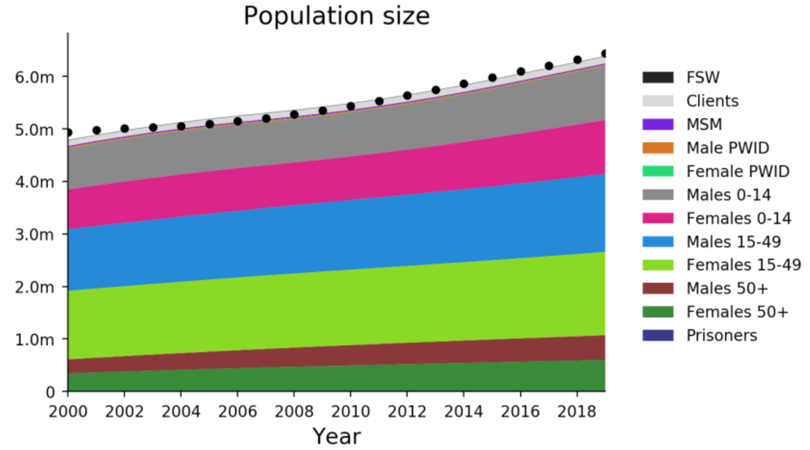
Source: Optima HIV User Guide Volume VI Parameter Data Sources

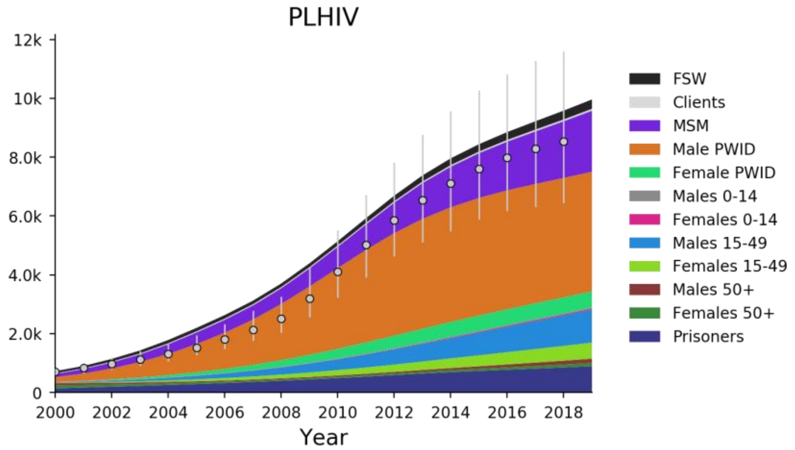
Table A2. Model parameters: treatment recovery and CD4 changes due to ART, and death rates

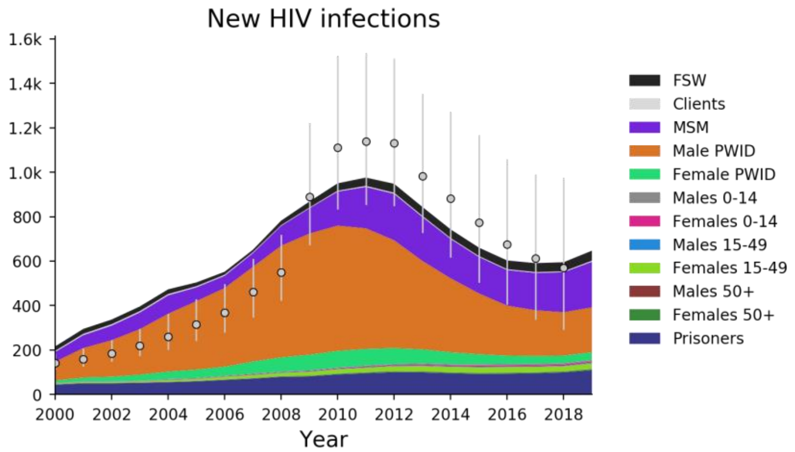
Treatment recovery due to suppressive ART (average years to move)		
	CD4 (350-500) to CD4 (>500)	2.20
	CD4 (200-350) to CD4 (350-500)	1.42
	CD4 (50-200) to CD4 (200-350)	2.14
	CD4 (<50) to CD4 (50-200)	0.66
	Time after initiating ART to achieve viral suppression (years)	0.20
	Number of VL tests recommended per person per year	2.00
CD4 change due to non-suppressive ART (%/year)		
	CD4 (500) to CD4 (350-500)	3%
	CD4 (350-500) to CD4 (>500)	15%
	CD4 (350-500) to CD4 (200-350)	10%
	CD4 (200-350) to CD4 (350-500)	5%
	CD4 (200-350) to CD4 (50-200)	16%
	CD4 (50-200) to CD4 (200-350)	12%
	CD4 (50-200) to CD4 (<50)	9%
	CD4 (<50) to CD4 (50-200)	11%
Death rate (% mortality per year)		
	Acute infection	0%
	CD4 (>500)	0%
	CD4 (350-500)	1%
	CD4 (200-350)	1%
	CD4 (50-200)	8%
	CD4 (<50)	43%
	Relative death rate on suppressive ART	30%
	Relative death rate on non-suppressive ART	70%
	Tuberculosis cofactor	217%

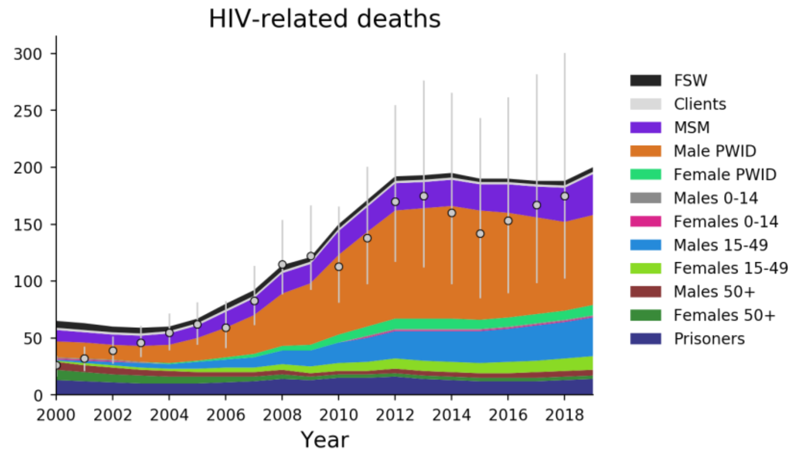
Source: Optima HIV User Guide Volume VI Parameter Data Sources

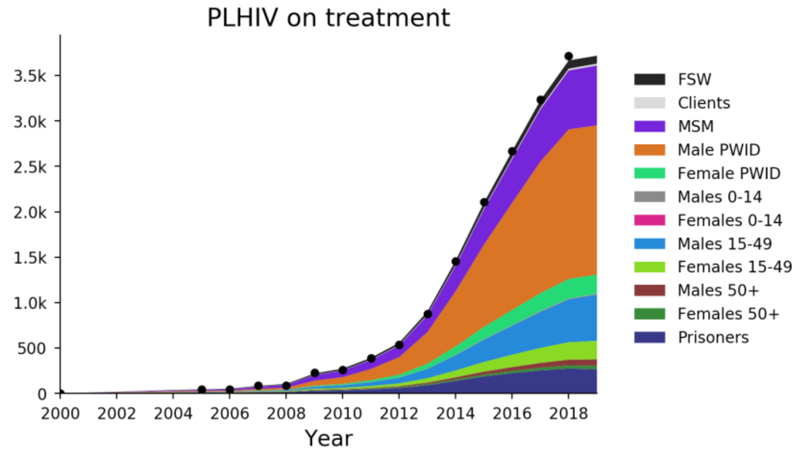
Appendix 2. Model calibration

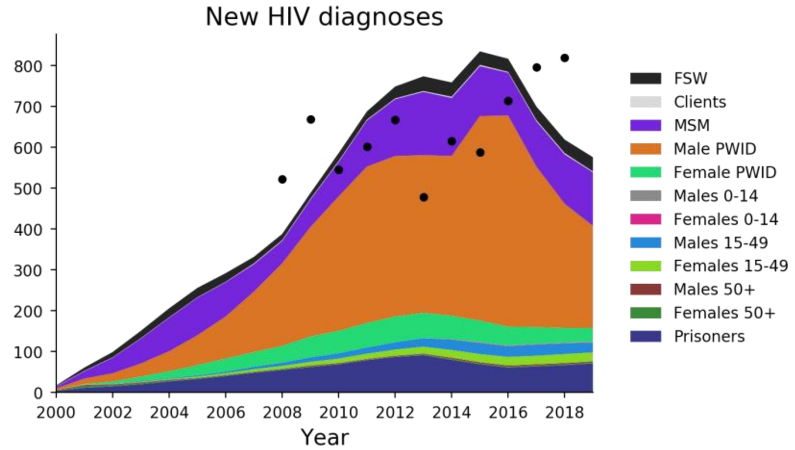


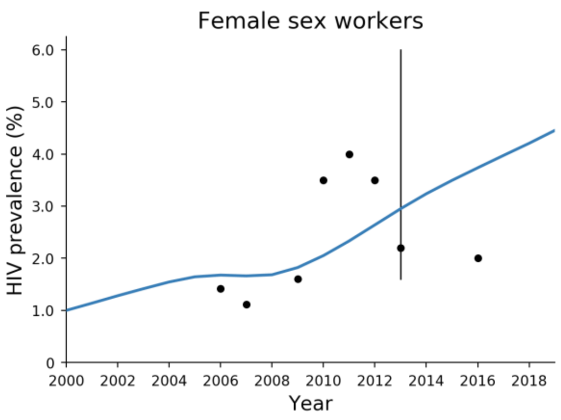


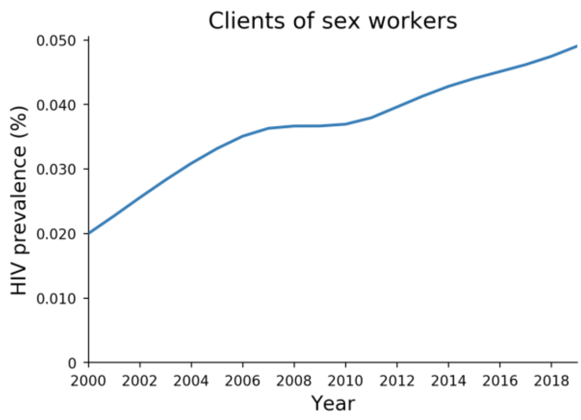


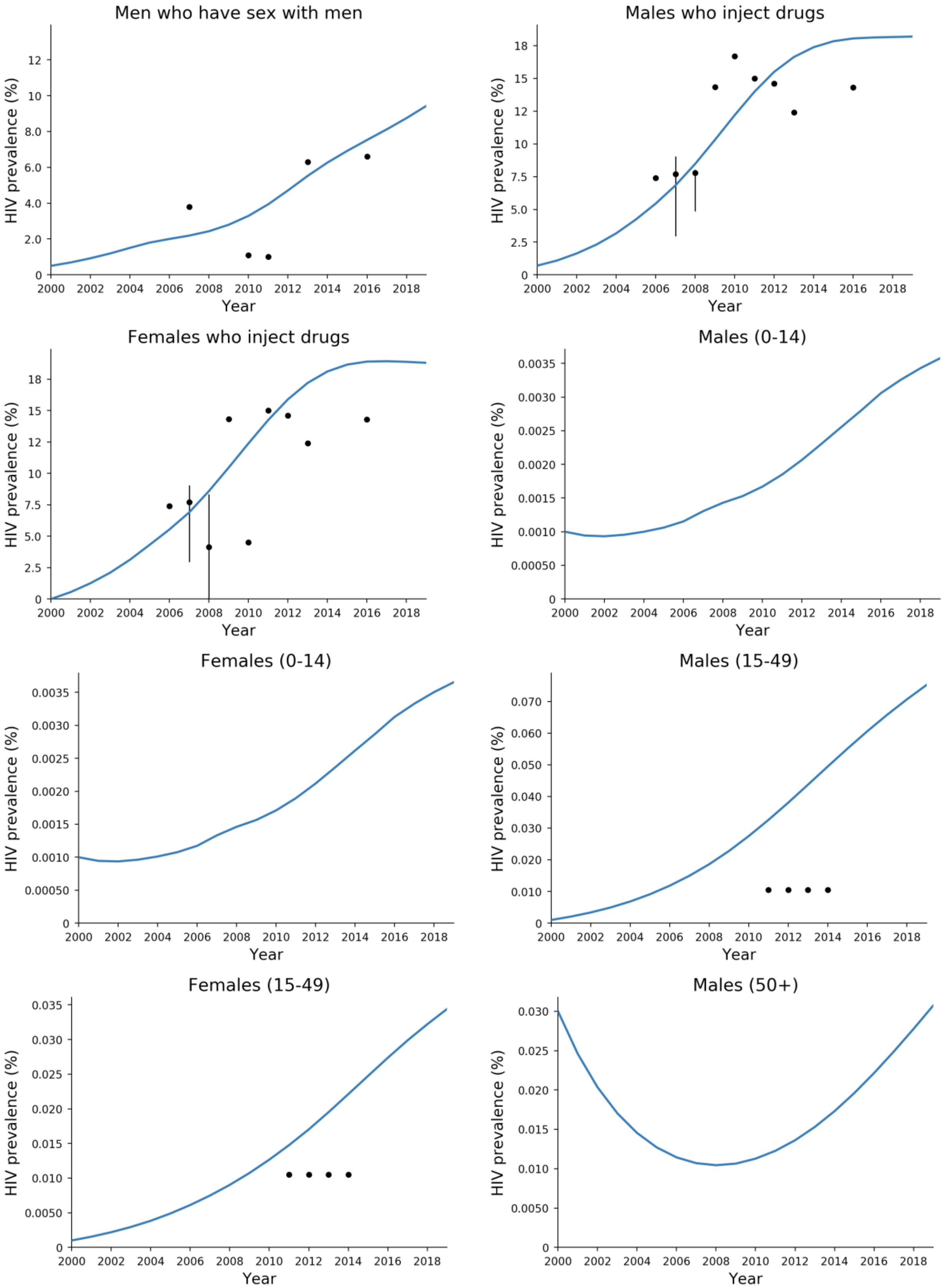

HIV-related deaths
300
250
200
150
100
50
0
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
Year
FSW
Clients
MSM
Male PWID
Female PWID
Males 0-14
Females 0-14
Males 15-49
Females 15-49
Males 50+
Females 50+
Prisoners

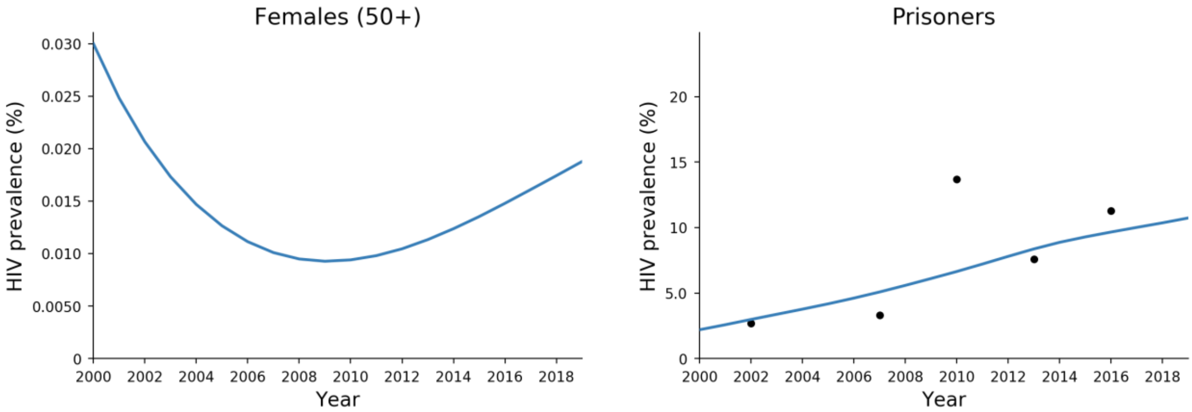

PLHIV on treatment
3.5k
3.0k
2.5k
2.0k
1.5k
1.0k
500
0
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
Year
FSW
Clients
MSM
Male PWID
Female PWID
Males 0-14
Females 0-14
Males 15-49
Females 15-49
Males 50+
Females 50+
Prisoners


New HIV diagnoses
800
700
600
500
400
300
200
100
0
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
Year
FSW
Clients
MSM
Male PWID
Female PWID
Males 0-14
Females 0-14
Males 15-49
Females 15-49
Males 50+
Females 50+
Prisoners


Female sex workers
HIV prevalence (%)
6.0
5.0
4.0
3.0
2.0
1.0
0
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
Year


Clients of sex workers
HIV prevalence (%)
0.050
0.040
0.030
0.020
0.010
0
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
Year


Men who have sex with men
Males who inject drugs
Females who inject drugs
Males (0-14)
Females (0-14)
Males (15-49)
Females (15-49)
Males (50+)
HIV prevalence (%)
Year



Appendix 3. HIV program costing

Table A3. HIV program unit costs and saturation values

HIV programs	Unit cost (USD)	Saturation (low)	Saturation (high)
Antiretroviral therapy (ART)	$423.88	85%	95%
HIV testing services (HTS) (general population)	$1.15	90%	90%
HIV testing and prevention targeting FSW	$50.79	90%	90%
HIV testing and prevention targeting MSM	$44.21	90%	90%
HIV testing and prevention targeting PWID	$55.74	90%	90%
Needle-syringe program (NSP)	$11.73	40%	40%
Opiate substitution therapy (OST)	$447.88	10%	20%
Prevention of mother-to-child transmission (PMTCT)	$894.83	90%	100%
Condoms and social and behaviour change communication (SBCC)	$3.96	85%	95%

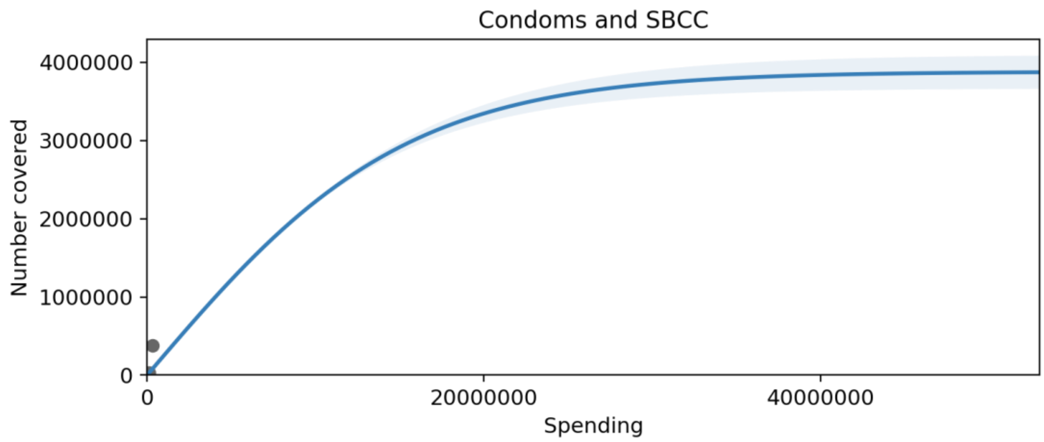
Table A4. Values used to inform HIV program cost functions

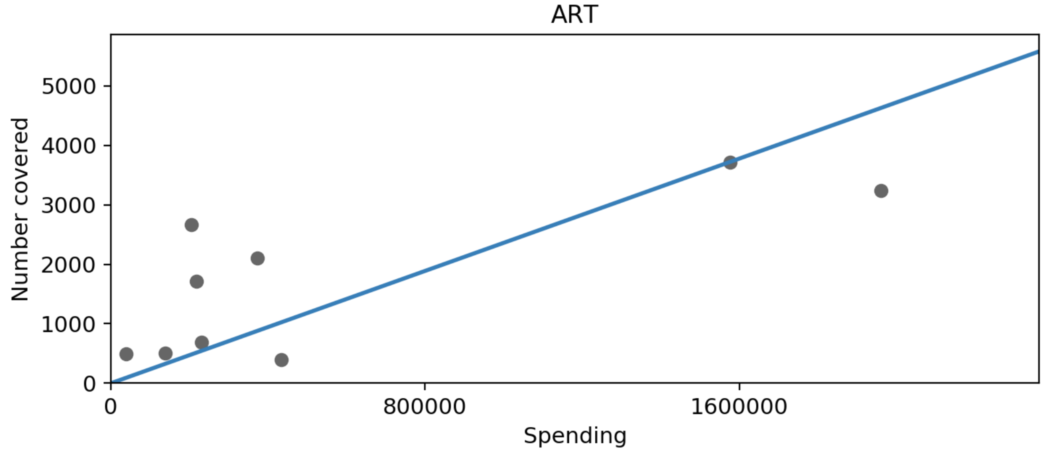
HIV programs	Parameters	Population interactions or populations	In absence of any programs		At max attainable coverage	
			low	high	low	high
HTS	HIV testing rate	FSW	5%	5%	50%	50%
FSW programs	HIV testing rate	FSW	5%	5%	73%	73%
HTS	HIV testing rate	Clients	3%	3%	10%	10%

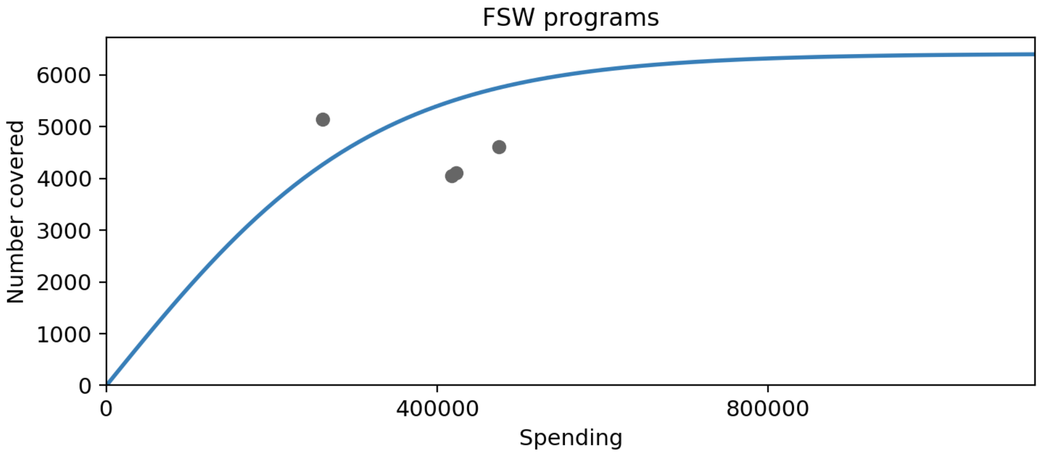
HIV programs	Parameters	Population interactions or populations	In absence of any programs		At max attainable coverage	
			low	high	low	high
MSM programs	HIV testing rate	MSM	3%	3%	38%	43%
HTS	HIV testing rate	MSM	3%	3%	6%	6%
PWID programs	HIV testing rate	Male PWID	7%	7%	70%	70%
HTS	HIV testing rate	Male PWID	7%	7%	26%	27%
PWID programs	HIV testing rate	Female PWID	8%	8%	68%	68%
HTS	HIV testing rate	Female PWID	8%	8%	28%	29%
HTS	HIV testing rate	Males 15-49	2%	2%	8%	8%
HTS	HIV testing rate	Females 15-49	4%	4%	63%	65%
HTS	HIV testing rate	Males 50+	0%	0%	1%	1%
HTS	HIV testing rate	Females 50+	0%	0%	1%	1%
Condoms and SBCC	condom use (casual acts)	('Clients', 'Females 15-49')	71%	71%	81%	81%
MSM programs	condom use (casual acts)	('MSM', 'MSM')	85%	85%	92%	92%
Condoms and SBCC	condom use (casual acts)	('MSM', 'MSM')	85%	85%	85%	85%
Condoms and SBCC	condom use (casual acts)	('Male PWID', 'Female PWID')	9%	9%	44%	44%
PWID programs	condom use (casual acts)	('Male PWID', 'Female PWID')	9%	9%	15%	15%
Condoms and SBCC	condom use (casual acts)	('Male PWID', 'Females 15-49')	23%	23%	68%	68%
PWID programs	condom use (casual acts)	('Male PWID', 'Females 15-49')	23%	23%	55%	55%
Condoms and SBCC	condom use (casual acts)	('Males 15-49', 'Females 15-49')	66%	76%	86%	86%
Condoms and SBCC	condom use (casual acts)	('Males 50+', 'Females 15-49')	48%	48%	87%	87%
Condoms and SBCC	condom use (casual acts)	('Males 50+', 'Females 50+')	30%	30%	60%	60%
Condoms and SBCC	condom use (casual acts)	('Prisoners', 'Prisoners')	30%	30%	61%	61%

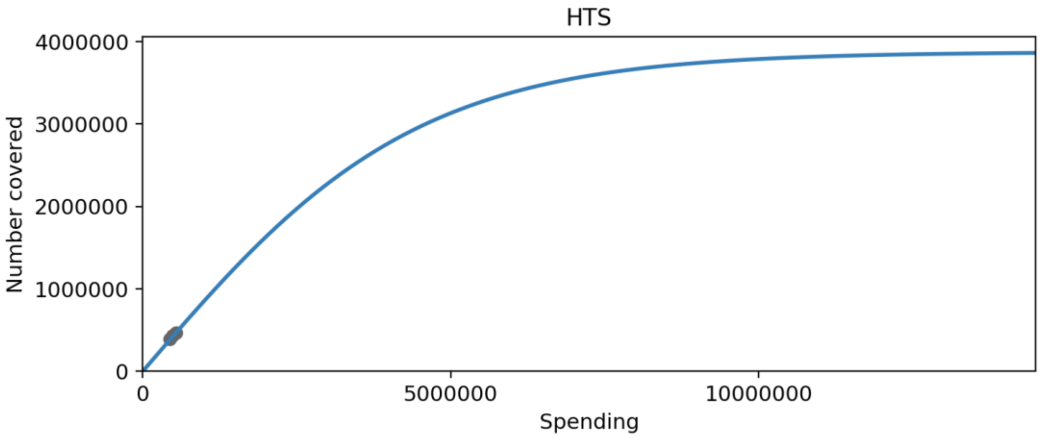
HIV programs	Parameters	Population interactions or populations	In absence of any programs		At max attainable coverage	
			low	high	low	high
FSW programs	condom use (commercial acts)	('Clients', 'FSW')	92%	92%	99%	99%
NSP	Needle sharing	Male PWID	10%	10%	4%	4%
NSP	Needle sharing	Female PWID	11%	11%	4%	4%
NSP	Needle sharing	Prisoners	0%	0%	0%	0%

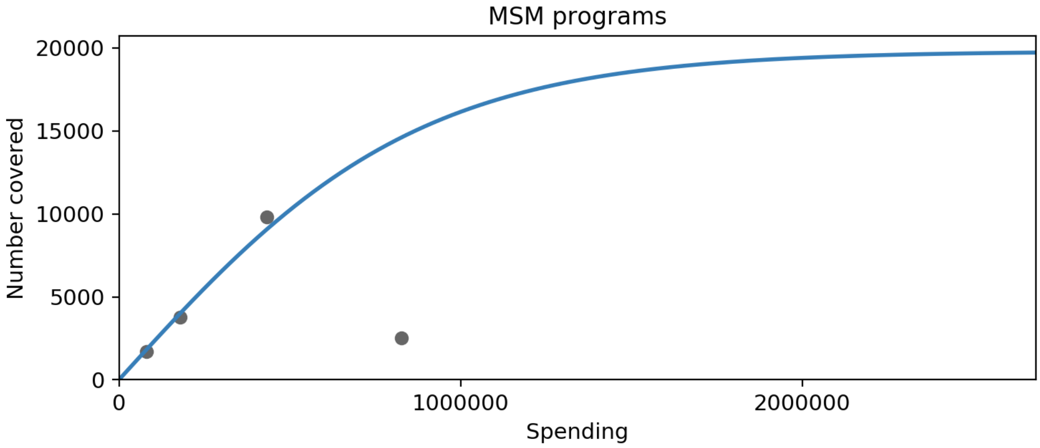
Appendix 4. Cost functions

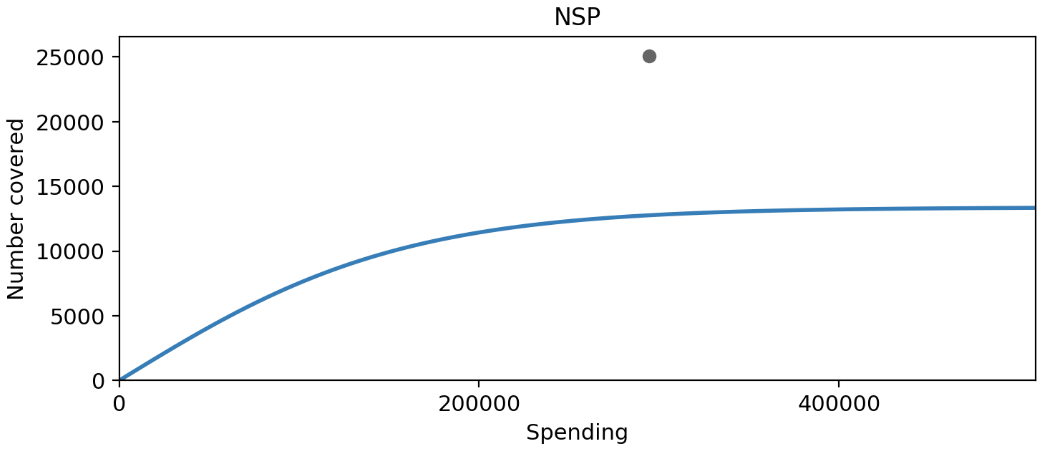


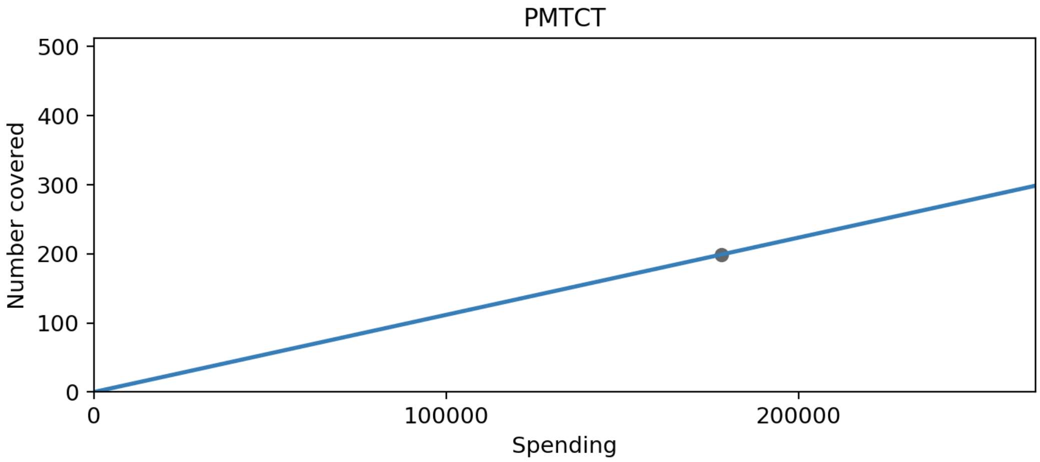


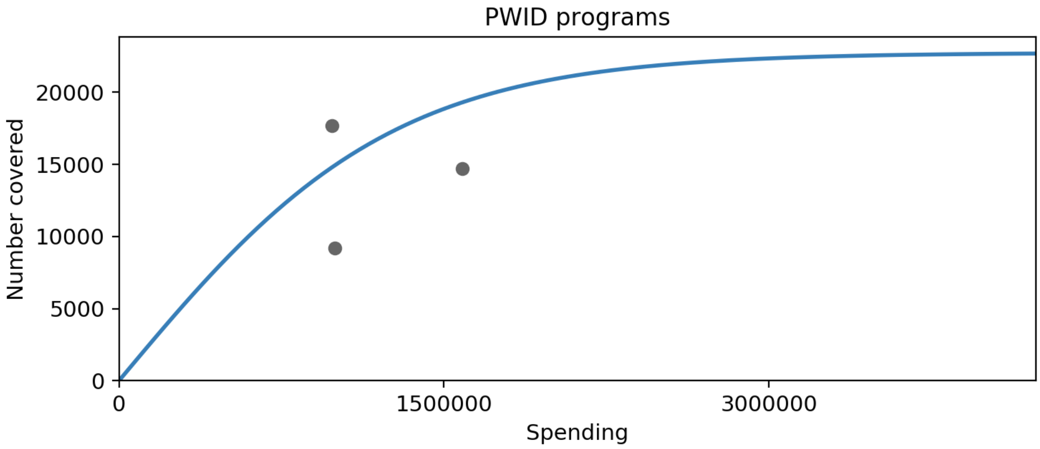

FSW programs
Number covered
0
1000
2000
3000
4000
5000
6000
0
400000
800000
Spending

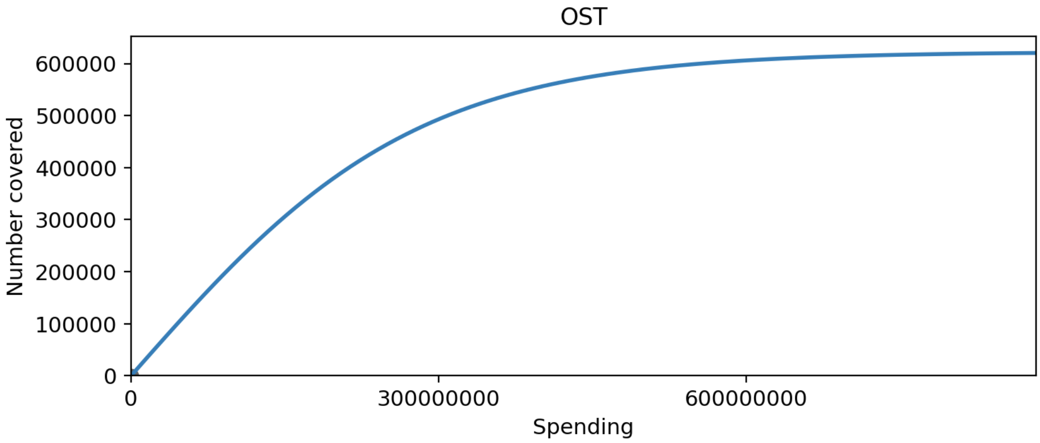

HTS
Number covered
0
1000000
2000000
3000000
4000000
0
5000000
10000000
Spending


MSM programs
Number covered
0
5000
10000
15000
20000
0
1000000
2000000
Spending


NSP
Number covered
25000
20000
15000
10000
5000
0
0
200000
400000
Spending


PMTCT
Number covered
500
400
300
200
100
0
0
100000
200000
Spending


PWID programs
Number covered
20000
15000
10000
5000
0
0
1500000
3000000
Spending


OST
Number covered
600000
500000
400000
300000
200000
100000
0
0
300000000
600000000
Spending

Appendix 5. Annual HIV budget allocations at varying budgets

Table A5. Annual HIV budget allocations at varying budgets for 2019 to 2030

	100% latest reported (2018)	50% optimized	100% optimized	150% optimized	200% optimized
Targeted HIV program					
Antiretroviral therapy (ART)	$1,575,992	$2,000,608	$3,214,003	$3,745,380	$3,875,150
Prevention of mother-to-child transmission (PMTCT)	$178,072	$93,382	$178,072	$178,072	$178,072
Condoms and social and behavior change communication (SBCC) (general population)	$129,198	$0	$0	$0	$0
HIV testing services (HTS) (general population)	$544,629	$0	$0	$0	$1,117,343
HIV testing and prevention programs targeting FSW	$261,087	$0	$189,685	$372,577	$472,621
HIV testing and prevention programs targeting MSM	$433,367	$0	$309,326	$866,276	$1,333,622
HIV testing and prevention programs targeting PWID	$984,129	$0	$260,281	$1,344,266	$1,885,396
Needle-syringe programs (NSP)	$294,585	$106,540	$249,692	$340,230	$395,501
Opiate substitution therapy (OST)	$490,427	$245,214	$490,427	$490,427	$525,266
Total targeted HIV program budget	$4,891,486	$2,445,744	$4,891,486	$7,337,228	$9,782,971
Total non-targeted HIV program budget	$5,108,532				
Total HIV program budget	$10,000,018				

Table A6. Maximum estimated achievable HIV budget to minimize new HIV infections and HIV-related deaths by 95% under optimized allocation

Maximum impact budget	Reduction in HIV infections in 2030 compared with 2018	Reduction in HIV-related deaths in 2030 compared with 2018	Reduction in HIV infections in 2030 compared with 2010	Reduction in HIV-related deaths in 2030 compared with 2010
825%	58% (298)	61% (112)	77% (716)	54% (82)

Estimated as the budget required to achieve 95% of the maximum reduction in infections and deaths achievable. This is the maximum reduction in infections and deaths with the current mix of programs, delivered with program impact as modeled here. Additional reduction in infections and deaths could be realized if the modeled programs could be delivered more cost-efficiently or if additional targeted HIV programs were to be implemented.