Resource optimization to maximize the HIV response in Kazakhstan

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 Kazak 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 58% (status quo) to 68% (optimized) in 2019, with high coverage levels maintained to 2030.
- **Scaling up investment for needle-syringe programs for people who inject drugs (PWID).** It is estimated that over 30% of new HIV infections occurred among people who inject drugs (PWID) in 2018 in Kazakhstan. Under optimized allocation of 100% budget, some investment in HIV testing and prevention programs targeting PWID programs should be maintained. As additional resources become available investment in NSP programs should continue to be scaled-up, along with investment in testing and prevention programs targeting PWID.
- **Maintaining some investment for HIV testing and prevention programs targeting men who have sex with men (MSM)**. Given that over 60% of new HIV infections occurred among MSM in 2018 in Kazakhstan, investment in HIV testing and prevention programs targeting this group should be scaled-up at the 100% budget level. Should additional resources become available, investment in MSM programs should continue to be scaled-up, along with investment in PrEP targeting MSM.

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

Kazakhstan has a concentrated HIV epidemic among key populations including PWID, MSM, and female sex workers (FSW). HIV prevalence is greatest among PWID, at 7.9% in 2017.[1] A rise is HIV prevalence among MSM has been reported from 3.2% in 2015 to 6.2% in 2017.[2] HIV prevalence has remained relatively stable among female sex workers (FSW), latest reported as 7.0% in 2017.[3] Since 2010, new HIV infections have increased by 39% and HIV-related deaths by 32%.[4]

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 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 Kazakhstan. Epidemiological and program data was provided by the Kazakhstan 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.[5]

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 (MSMW)

    - Males who inject drugs (MWID)
    - Females who inject drugs (FWID)
    - 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)
- Pre-exposure prophylaxis targeting (PrEP) MSM
- 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

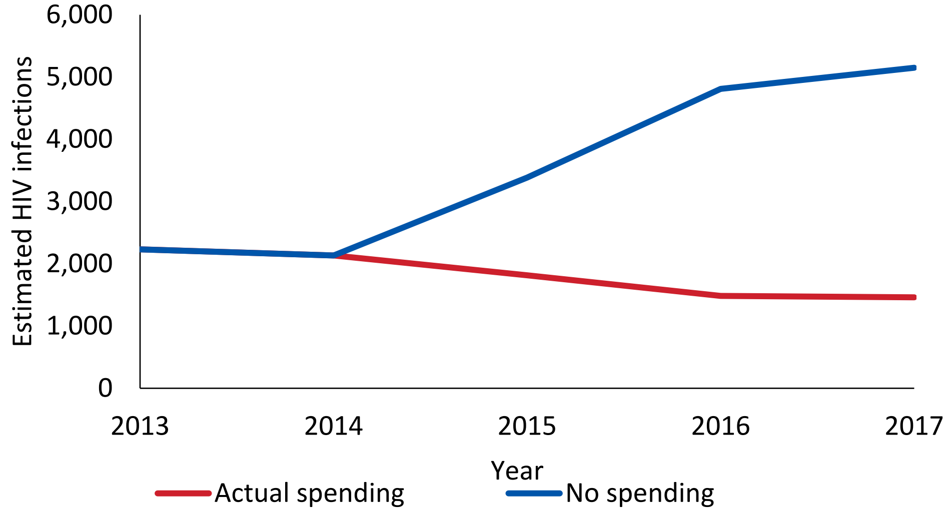
To minimize new HIV infections and HIV-related deaths by 2030 objectives functions were weighted 1 to 1 for infections to deaths.

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 HIV spending on the status of HIV in Kazakhstan, all spending on targeted HIV programs was removed from 2015 to 2017, representing the previous Global Fund funding cycle period (spending on non-targeted HIV programs was not considered). 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 170% more new HIV infections (almost 8,300 more infections) and over 220% more HIV-related deaths (approximately 2,800 more deaths) over this period (figure 1). The total annual HIV program spending in 2018 amounted to US$38,008,076 of which the estimated share of Global Fund contribution was 2.5%.



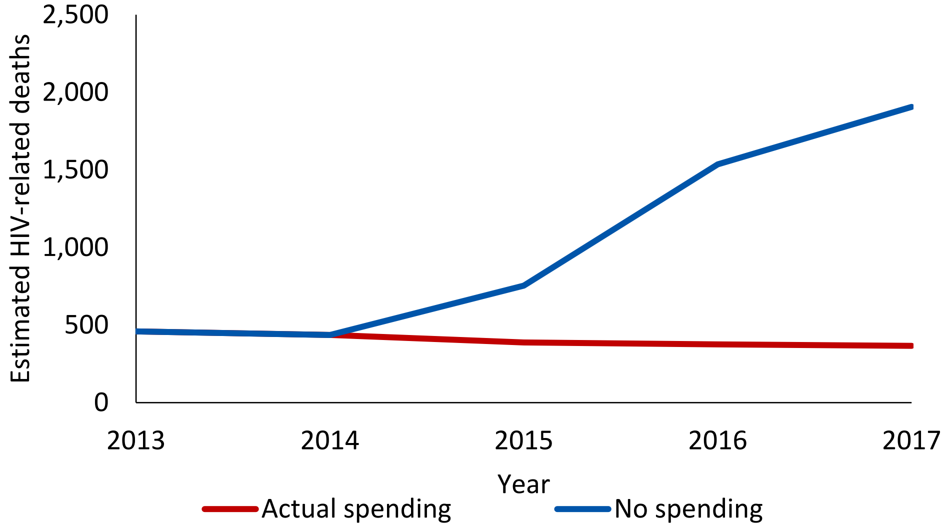


Figure 1. Estimated new HIV infections and HIV-related deaths in the absence of HIV program spending from 2015 to 2017

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

As of 2018, the latest reported HIV program budget for Kazakhstan was US$38,008,076 with approximately 8.2% of the total budget having been invested in non-targeted HIV programs (figures 2 and 3). As non-targeted HIV programs are not considered within the optimization, budgets for these programs are fixed. Optimization results suggest scaling up ART, which could lead to increased treatment coverage from 58% (status quo) to 68% (optimized) in 2019 with high coverage levels maintained to 2030 (figures 2 and 3; table A4).

At 100% optimized budget results suggest scaling up investment for needle syringe programs (NSP) and maintaining investment in HIV testing and prevention programs targeting PWID (figure 2; table A4), given over 30% of new HIV infections occurred among PWID in 2018. Investment in PWID and NSP programs should be scaled up as additional resources become available.

Given that over 60% of new HIV infections in Kazakhstan are estimated to have occurred among MSM in 2018, results suggest scaling up investment for HIV testing and prevention programs targeting MSM (figures 2 and 3; table A4). Should additional resources become available, investment in MSM programs should continue to be scaled-up, along with investment in PrEP targeting MSM (figure 2; table A4).

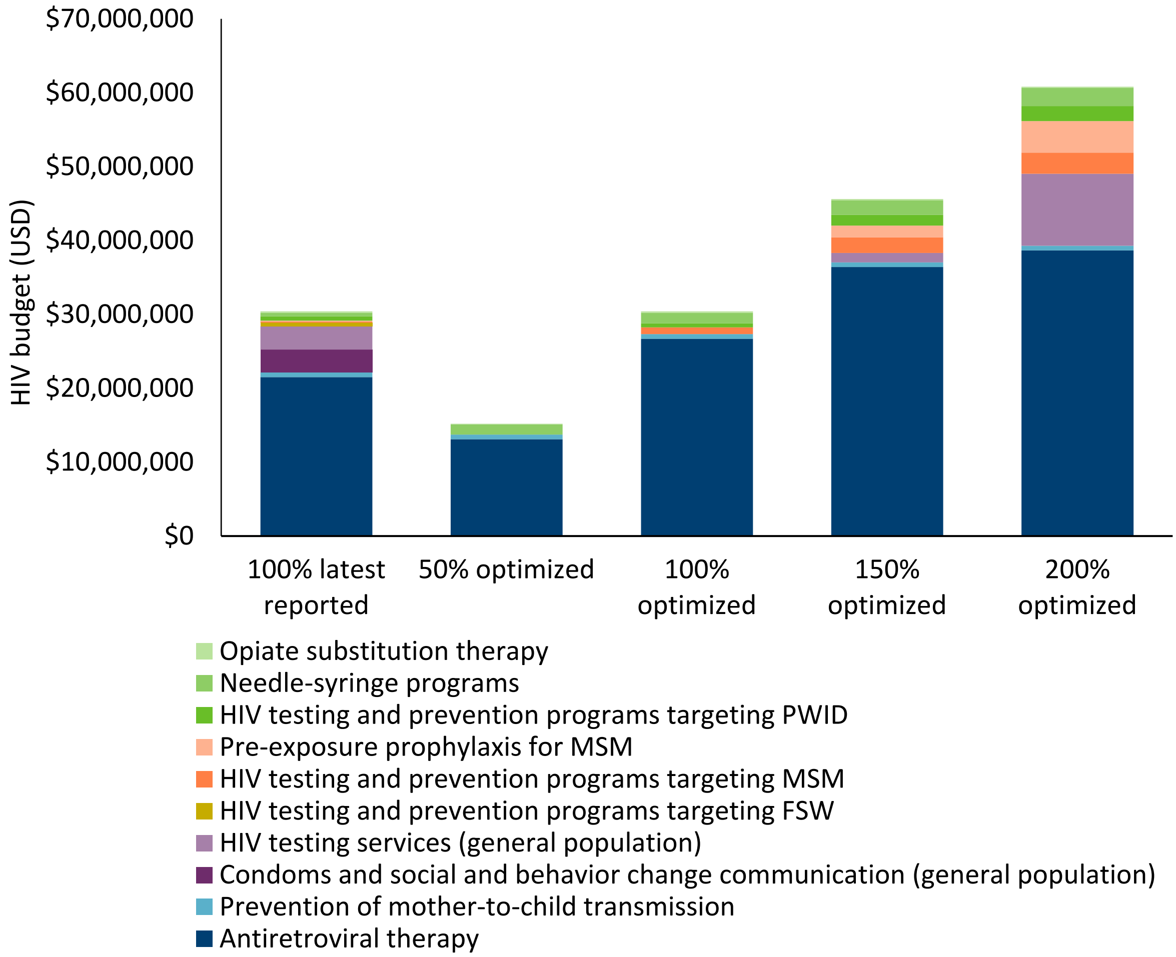


Figure 2. Optimized allocations under varying levels of annual HIV budgets for 2019 to 2030, to minimize new infections and HIV-related deaths by 2030

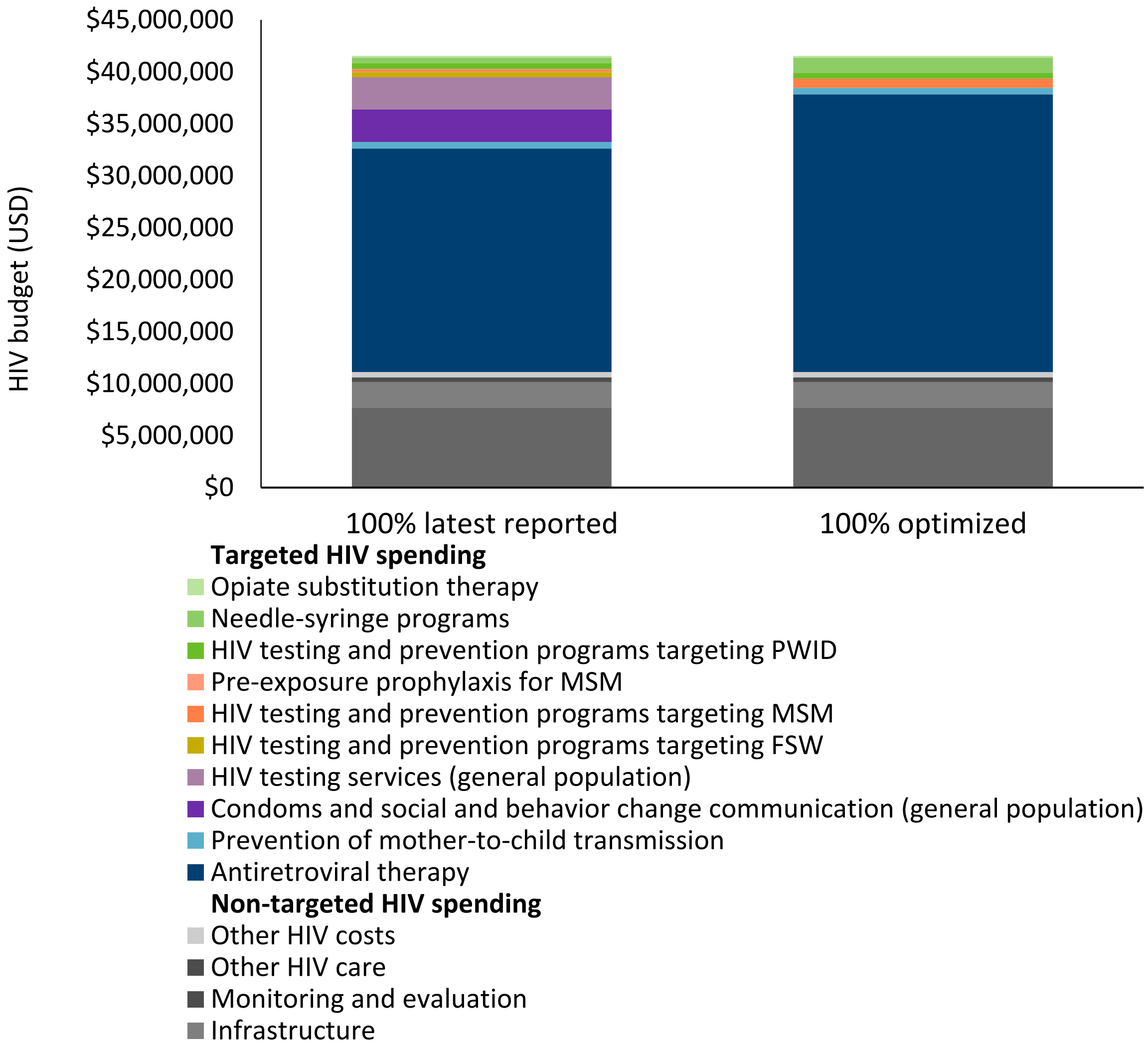


Figure 3. Optimized HIV annual resource allocation for 2019 to 2030 to minimize new infections and HIV-related deaths by 2030. Non-targeted HIV program budgets are shown here, but are not considered within the optimization, but spending is fixed.

Under 100% optimized annual budget to minimize new HIV infections and HIV-related deaths from 2019 to 2030, it is estimated that by 2030 an additional almost 30% of new HIV infections could be averted (7,500 more infections averted) and 25% more HIV-related deaths could be averted (2,000 more deaths averted) compared with the latest reported allocation being maintained over the same period (figure 4). By 2030, an additional 52,000 DALYs could be averted under 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 65% (17,000 more infections averted), HIV-related deaths by 60% (4,700 more deaths averted), and HIV-related DALYs by 55% (117,000 more DALYs averted) compared with the latest reported budget level and allocation (figure 4). It is estimated that investment beyond 370% will only have 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).

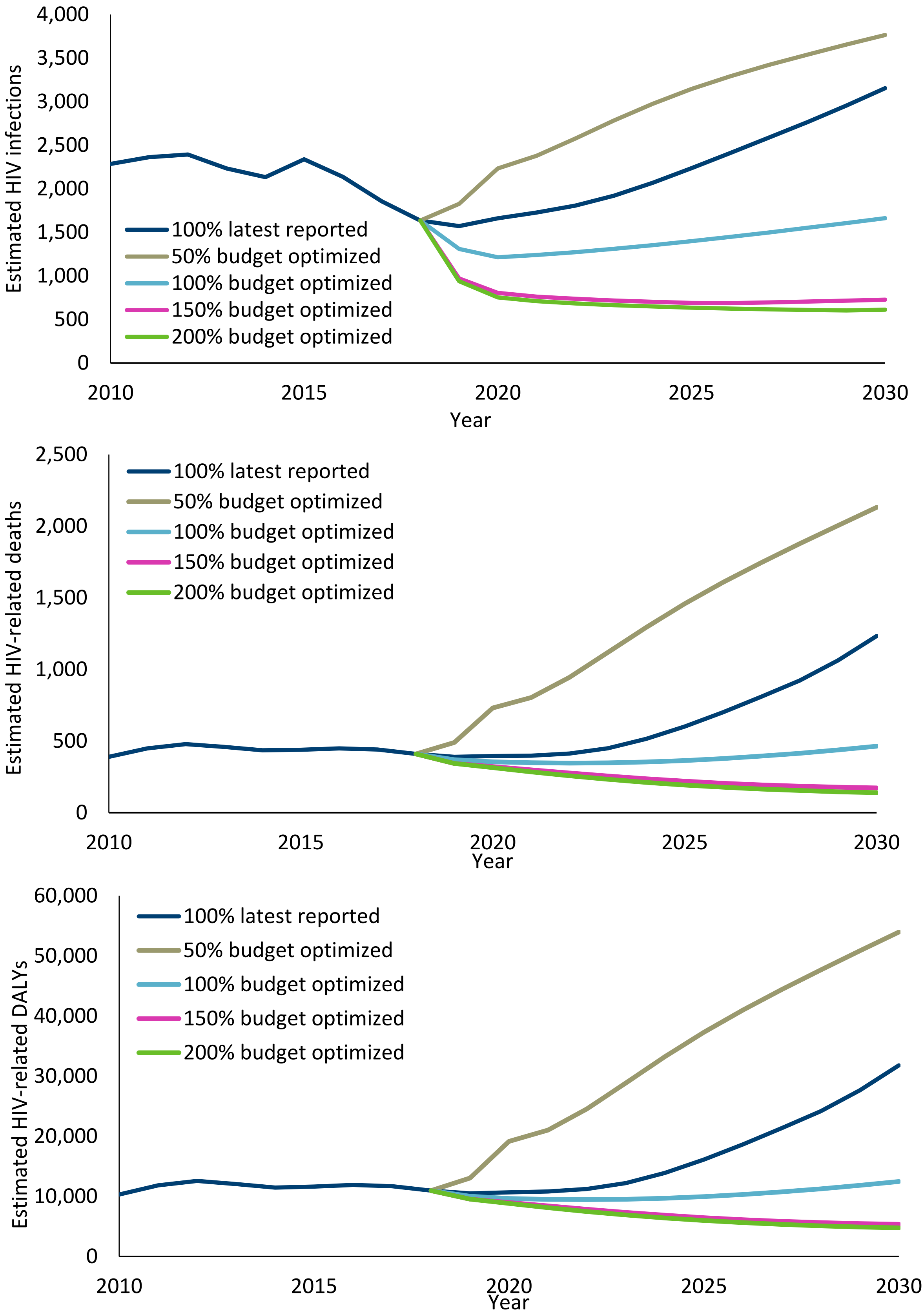


Figure 4. Estimated new HIV infections, HIV-related deaths, and HIV-related DALYs under optimized varying annual budget levels for 2019 to 2030 to minimize infections and deaths by 2030

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 79% of people living with HIV will be diagnosed, 69% of those diagnosed will receive treatment, and 72% of those on treatment will achieve viral suppression (figure 5). Even with increased budget, optimization results suggest that 90-90-90 targets will not be met by 2020, as this is such a short timeframe.

To approach 95-95-95 targets, it is estimated that the annual HIV program budget from 2019 to 2030 should be increased to 160% of the latest reported budget level (an additional $13M annually) and optimized with prioritization of antiretroviral therapy (ART), HIV testing and prevention programs targeting PWID, HIV testing and prevention programs targeting MSM, and HIV testing for the general population (figure 6). By 2030, this condition could facilitate Kazakhstan to have 95% of people living with HIV be aware of their status, 98% of those diagnosed on treatment, and 95% of those on treatment to have achieved viral suppression (figure 5).

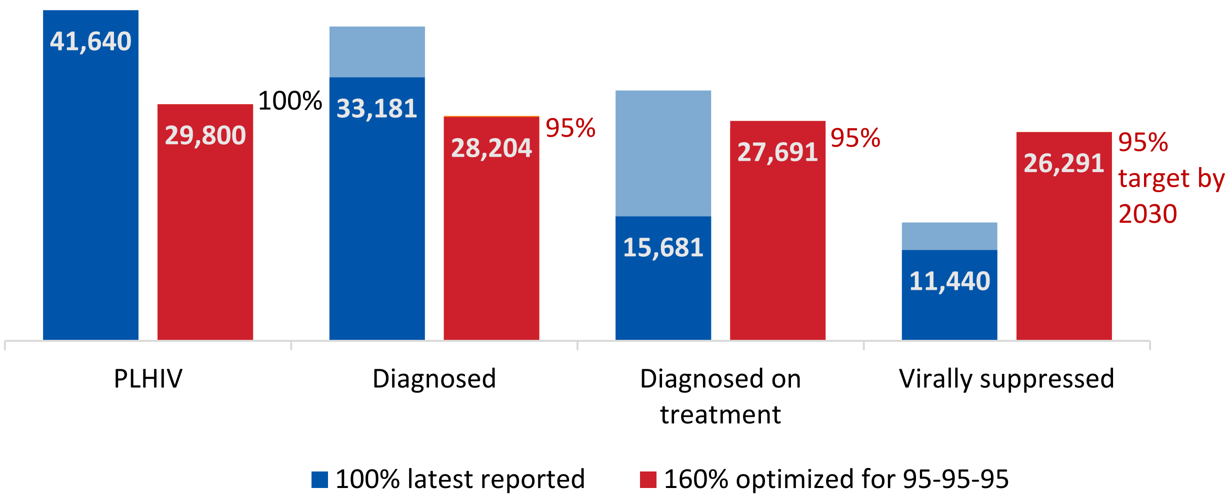


Figure 5. HIV cascade under optimized resource allocation to best achieve 95-95-95 targets by 2030. Dark blue bars represent progress towards 95-95-95 targets under 100% latest reported budget, with light blue bars showing the gap to achieving targets. Red bars represent progress towards 95-95-95 targets under 160% optimized resource allocation to best achieve 95-95-95 targets, with light red bars showing the gap to achieving targets.

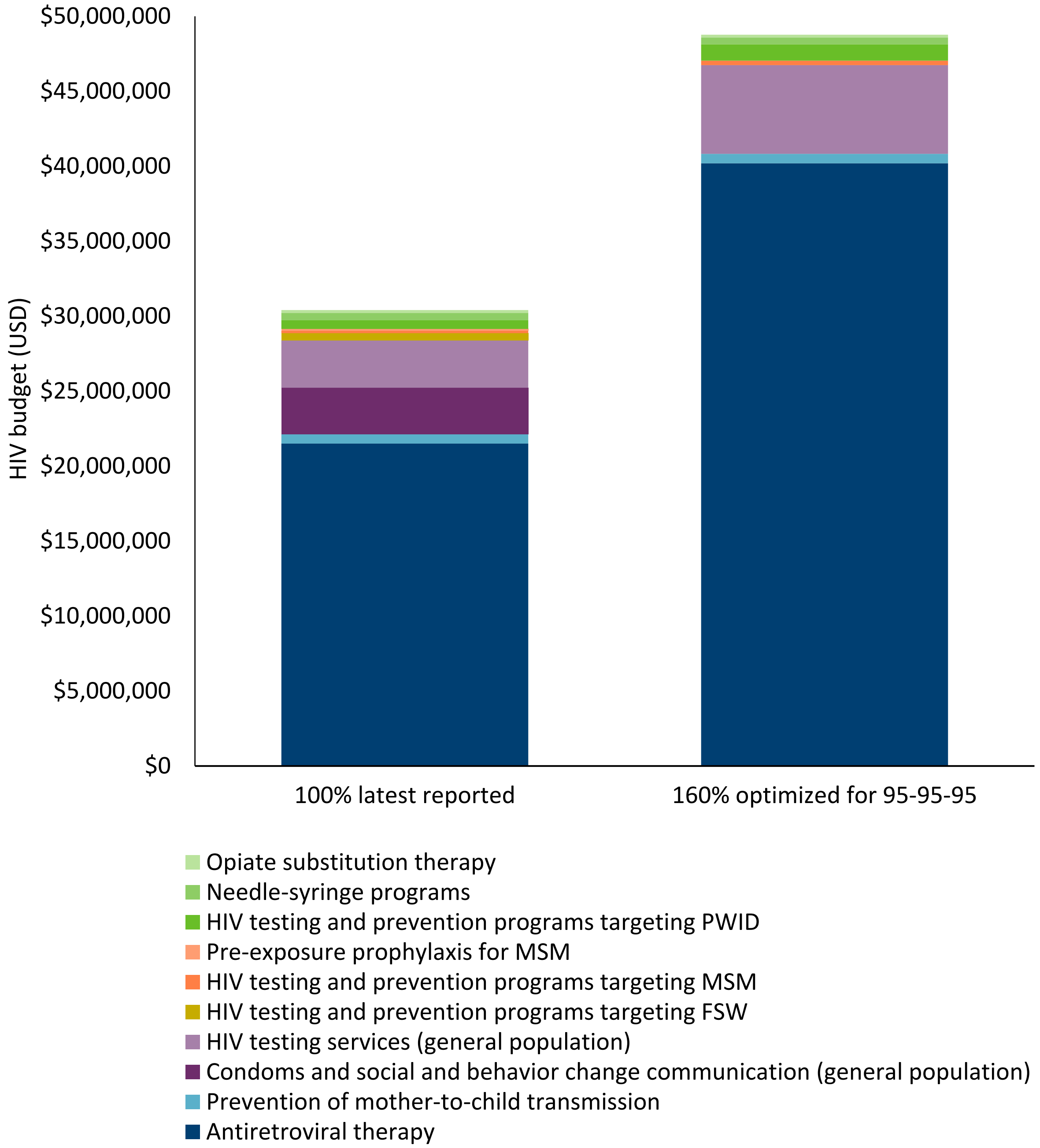


Figure 6. Optimized HIV budget level and allocation to best achieve 95-95-95 targets by 2030

Compared with latest reported 100% budget allocation, by 2030 under optimized allocation of 160% budget towards achieving 95-95-95 targets it is estimated that an additional 80% of new HIV infections could be averted (approximately 21,000 more infections averted) and an additional 70% of HIV-related deaths could be averted (approximately 6,00 more deaths averted) (figure 8).

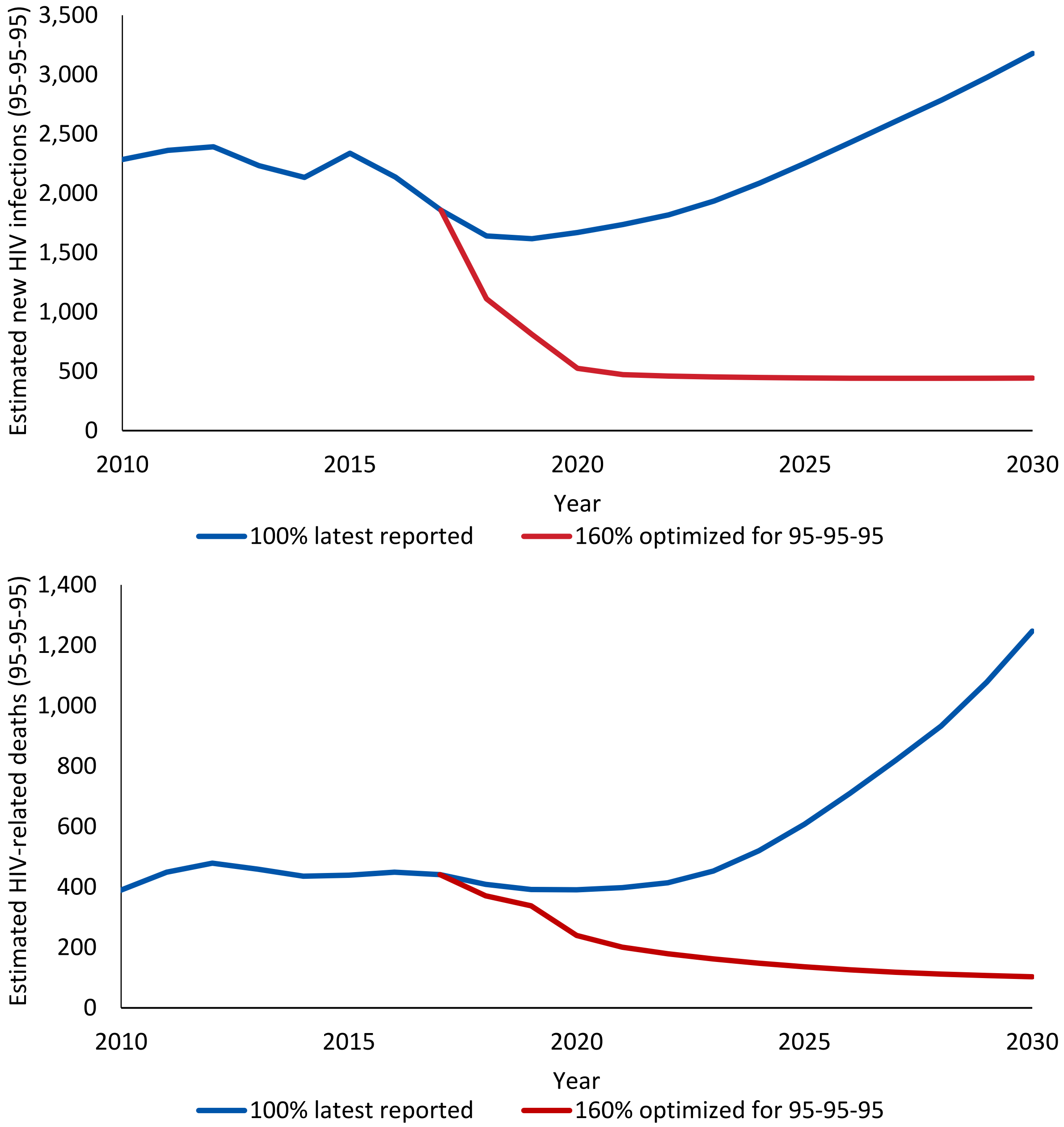


Figure 8. Estimated new HIV infections and HIV-related deaths under optimized allocation of 160% budget towards best achieving 95-95-95 targets by 2030

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

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

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

4. Kazakhstan country progress report, UNAIDS, accessed December 2019. https://www.unaids.org/en/regionscountries/countries/kazakhstan

5. 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%
	Prevention for mother-to-child transmission (PMTCT)	90%
	Pre-exposure prophylaxis (PrEP)	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

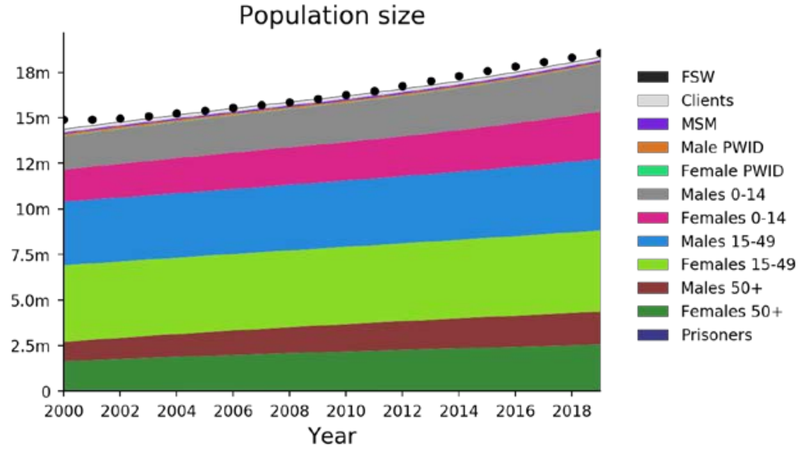
Source: Optima HIV User Guide Volume VI Parameter Data Sources

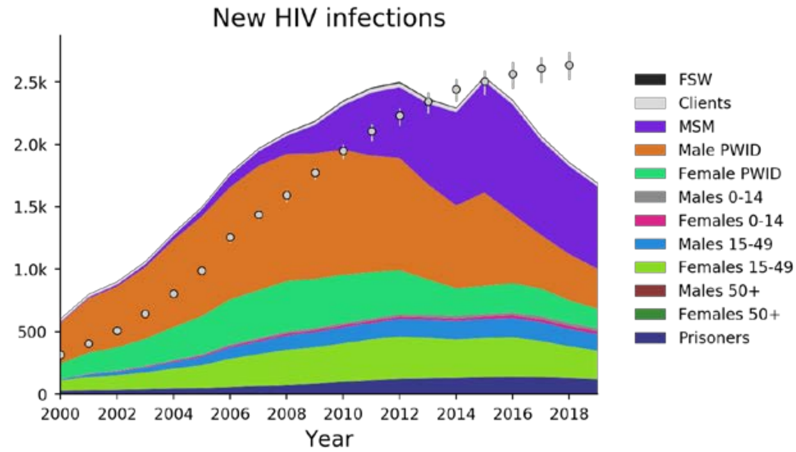
Table A2. Model parameters: treatment recovery and CD4 changes due to ART, and death rates

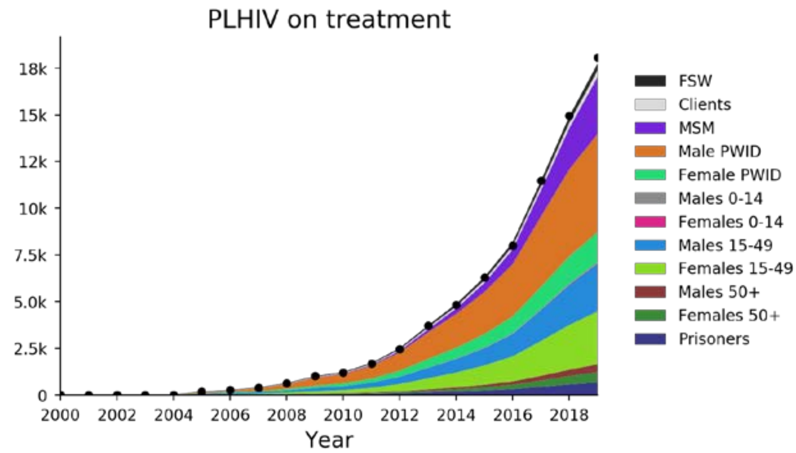
Treatment recovery due to suppressive ART (average years to move)		
	CD4 (350-500) to CD4 (>500)	2.20
	CD4 (200-350) to CD4 (350-500)	1.42
	CD4 (50-200) to CD4 (200-350)	2.14
	CD4 (<50) to CD4 (50-200)	0.66
	Time after initiating ART to achieve viral suppression (years)	0.20
	Number of VL tests recommended 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%

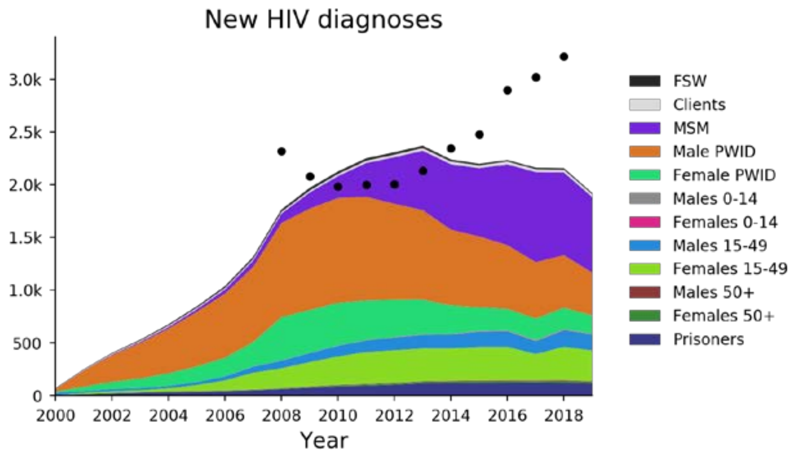
Source: Optima HIV User Guide Volume VI Parameter Data Sources

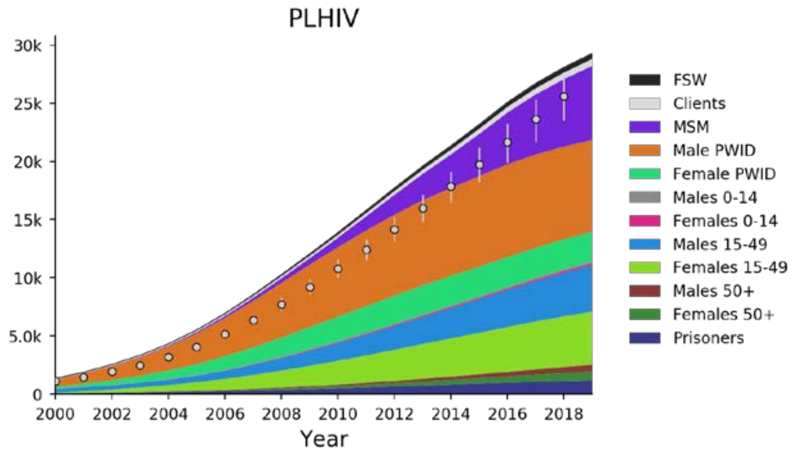
Appendix 2. Model calibration

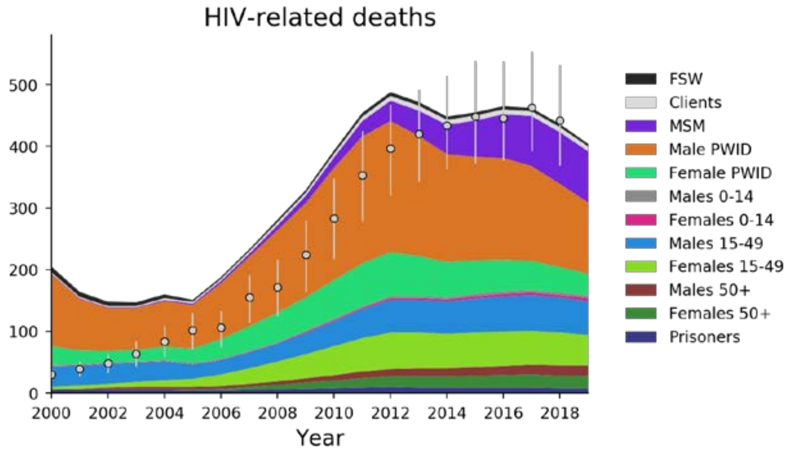


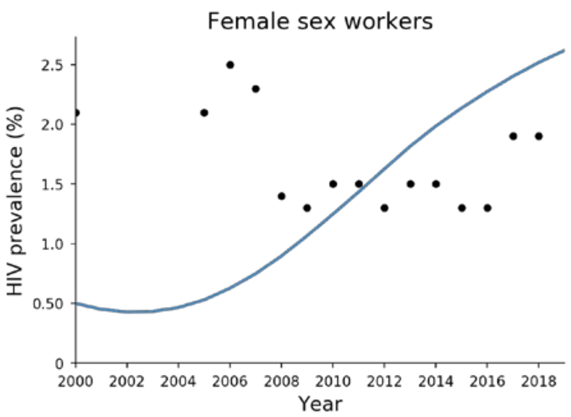


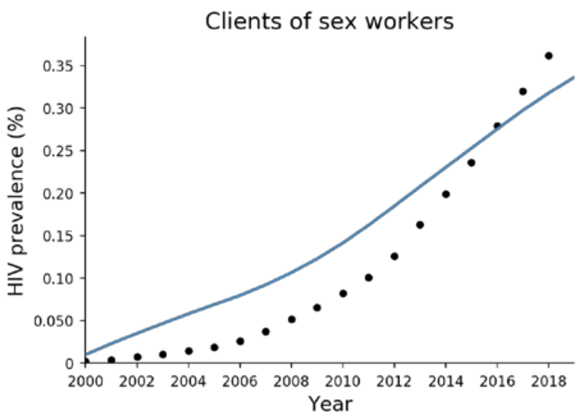


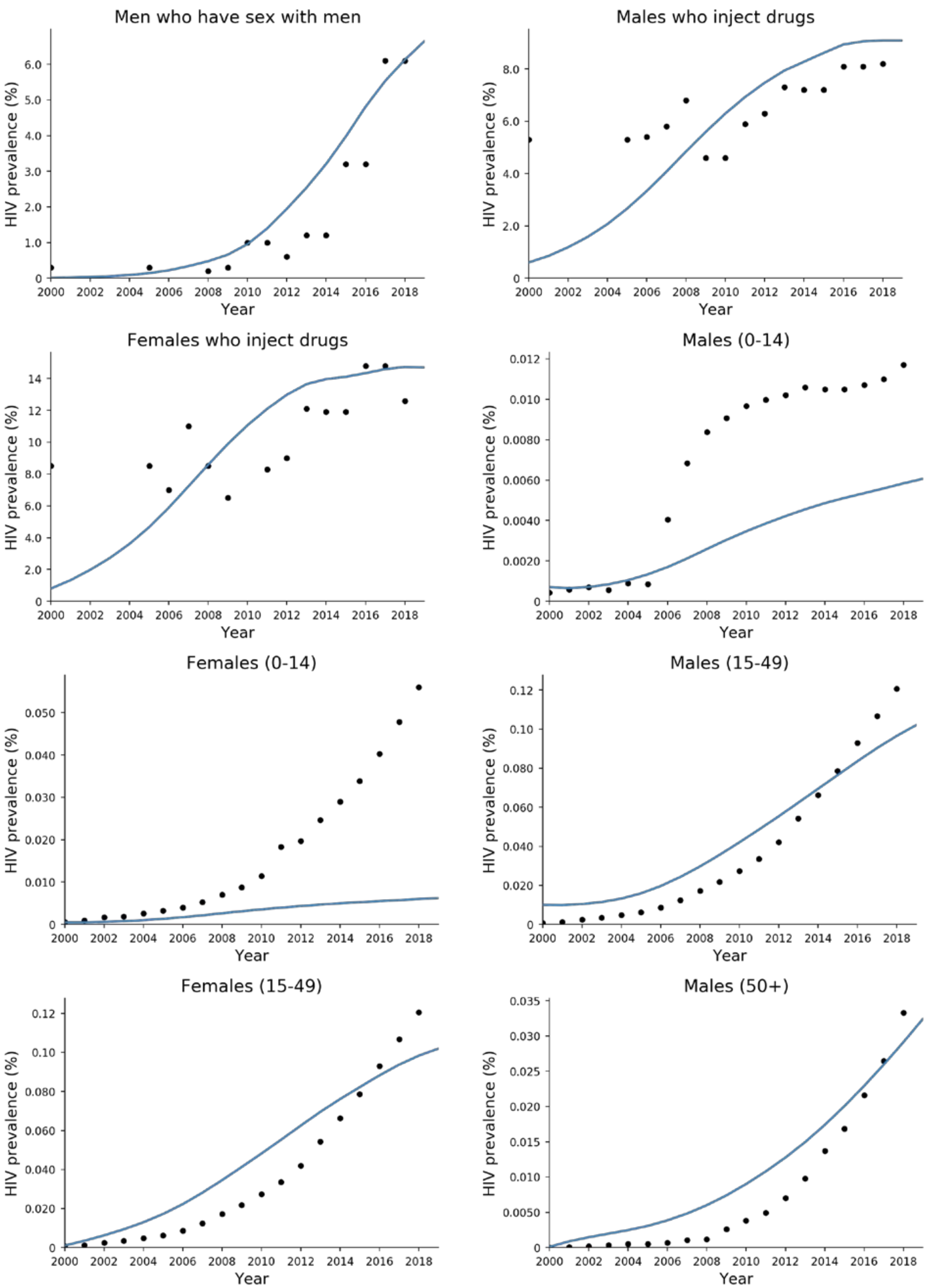

New HIV diagnoses
3.0k
2.5k
2.0k
1.5k
1.0k
500
0
2000 2002 2004 2006 2008 2010 2012 2014 2016 2018
Year
FSW
Clients
MSM
Male PWID
Female PWID
Males 0-14
Females 0-14
Males 15-49
Females 15-49
Males 50+
Females 50+
Prisoners

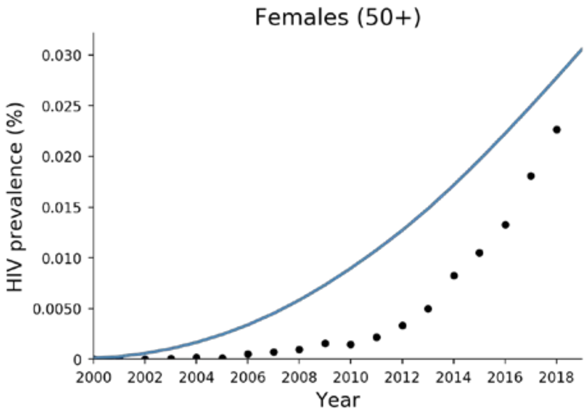

PLHIV
30k
25k
20k
15k
10k
5.0k
0
2000 2002 2004 2006 2008 2010 2012 2014 2016 2018
Year
FSW
Clients
MSM
Male PWID
Female PWID
Males 0-14
Females 0-14
Males 15-49
Females 15-49
Males 50+
Females 50+
Prisoners

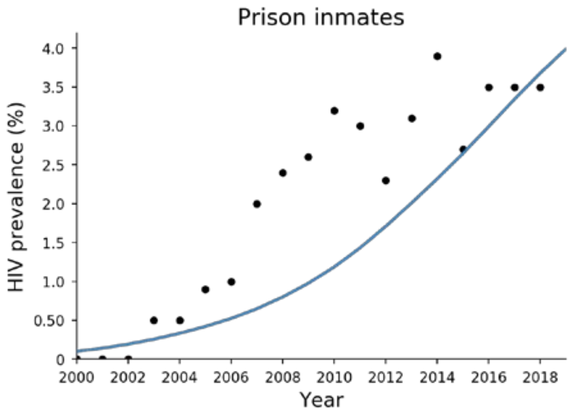

HIV-related deaths
500
400
300
200
100
0
2000 2002 2004 2006 2008 2010 2012 2014 2016 2018
Year
FSW
Clients
MSM
Male PWID
Female PWID
Males 0-14
Females 0-14
Males 15-49
Females 15-49
Males 50+
Females 50+
Prisoners


Female sex workers
HIV prevalence (%)
2.5
2.0
1.5
1.0
0.50
0
2000 2002 2004 2006 2008 2010 2012 2014 2016 2018
Year


Clients of sex workers
HIV prevalence (%)
0.35
0.30
0.25
0.20
0.15
0.10
0.050
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)	$1,438.22	95%	100%
HIV testing services (general population)	$1.18	85%	95%
HIV testing and prevention targeting FSW	$28.10	85%	95%
HIV testing and prevention targeting MSM	$19.10	85%	95%
HIV testing and prevention targeting PWID	$10.40	85%	95%
Needle-syringe program (NSP)	$8.70	70%	80%
Opiate substitution therapy (OST)	$493.40	10%	10%
Prevention of mother-to-child transmission (PMTCT)	$860.30	95%	100%
Pre-exposure prophylaxis (PrEP) for MSM	$105.00	45%	55%
Condoms and social and behaviour change communication (SBCC)	$0.80	85%	95%

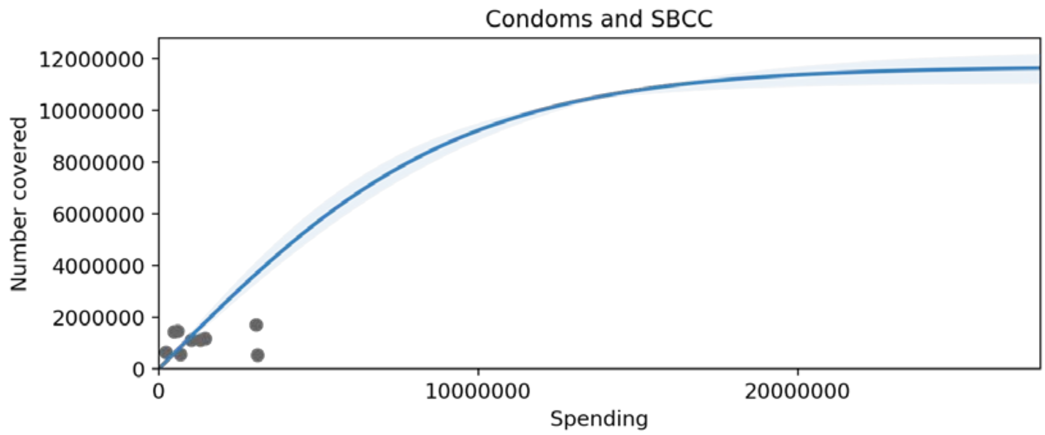
Table A4. Values used to inform HIV program cost functions

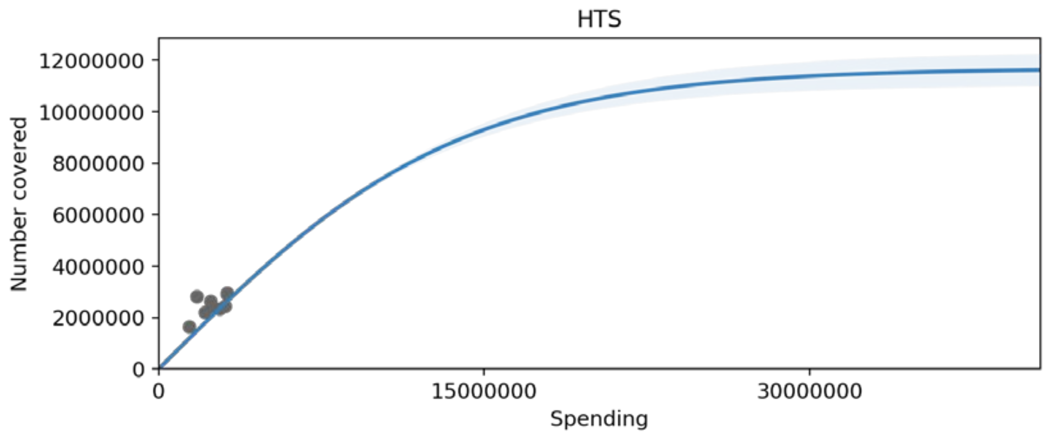
Program	Parameter	Population interactions or populations	In absence of any programs		At max attainable coverage	
			low	high	low	high
HTS	HIV testing rate	FSW	29%	29%	85%	85%
FSW programs	HIV testing rate	FSW	29%	29%	91%	100%

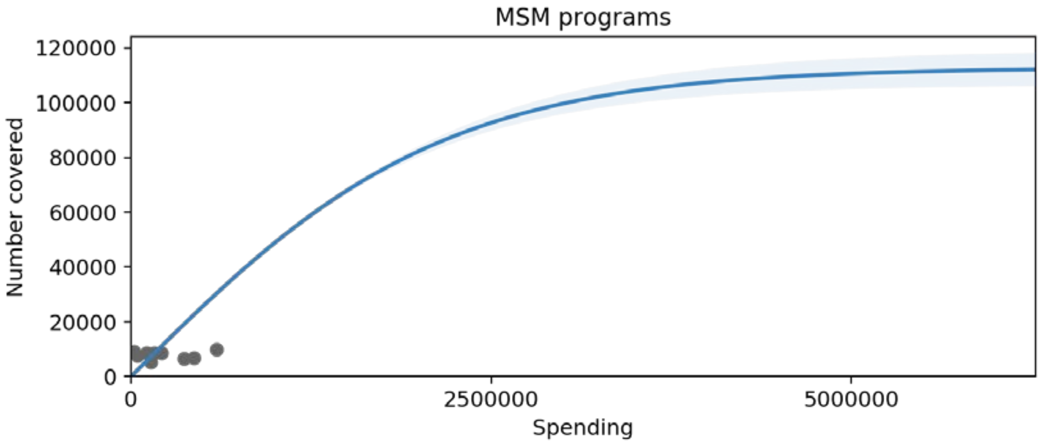
Program	Parameter	Population interactions or populations	In absence of any programs		At max attainable coverage	
			low	high	low	high
HTS	HIV testing rate	Clients	52%	52%	100%	100%
MSM programs	HIV testing rate	MSM	60%	60%	150%	150%
HTS	HIV testing rate	MSM	60%	60%	80%	85%
PWID programs	HIV testing rate	Male PWID	30%	30%	100%	100%
HTS	HIV testing rate	Male PWID	30%	30%	34%	34%
PWID programs	HIV testing rate	Female PWID	30%	30%	100%	100%
HTS	HIV testing rate	Female PWID	30%	30%	79%	79%
HTS	HIV testing rate	Males 15-49	20%	20%	50%	50%
HTS	HIV testing rate	Females 15-49	40%	40%	50%	50%
HTS	HIV testing rate	Males 50+	6%	6%	39%	39%
HTS	HIV testing rate	Females 50+	1%	1%	70%	70%
Condoms and SBCC	condom use (casual acts)	('Clients', 'Females 15-49')	77%	77%	90%	90%
MSM programs	condom use (casual acts)	('MSM', 'MSM')	85%	85%	95%	95%
Condoms and SBCC	condom use (casual acts)	('MSM', 'MSM')	85%	85%	89%	89%
Condoms and SBCC	condom use (casual acts)	('Male PWID', 'Female PWID')	73%	73%	73%	73%
PWID programs	condom use (casual acts)	('Male PWID', 'Female PWID')	73%	73%	78%	78%
Condoms and SBCC	condom use (casual acts)	('Male PWID', 'Females 15-49')	57%	57%	86%	86%
PWID programs	condom use (casual acts)	('Male PWID', 'Females 15-49')	57%	57%	90%	90%
Condoms and SBCC	condom use (casual acts)	('Males 15-49', 'Females 15-49')	73%	73%	98%	98%
Condoms and SBCC	condom use (casual acts)	('Males 50+', 'Females 15-49')	46%	46%	71%	71%
Condoms and SBCC	condom use (casual acts)	('Males 50+', 'Females 50+')	24%	24%	44%	44%

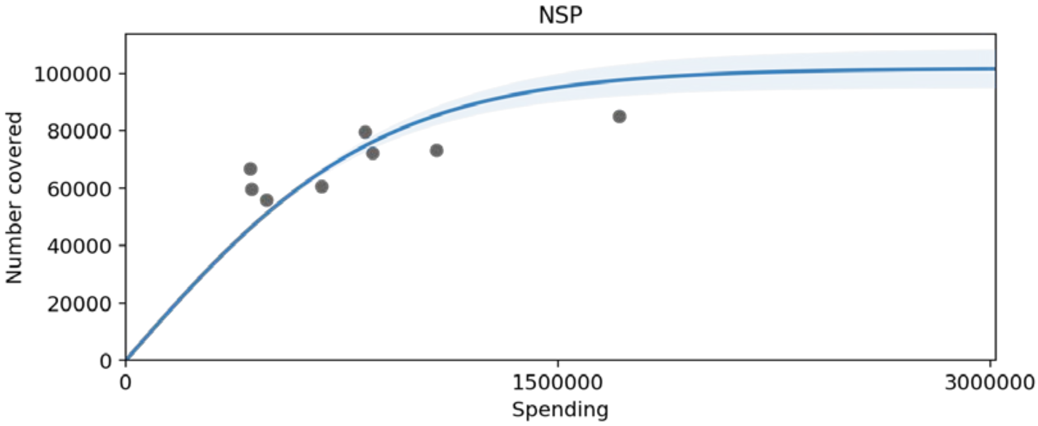
Program	Parameter	Population interactions or populations	In absence of any programs		At max attainable coverage	
			low	high	low	high
Condoms and SBCC	condom use (casual acts)	('Prisoners', 'Prisoners')	25%	25%	42%	42%
FSW programs	condom use (commercial acts)	('Clients', 'FSW')	25%	25%	95%	95%
MSM programs	condom use (commercial acts)	('MSM', 'MSM')	92%	92%	95%	95%
NSP	Needle sharing	Male PWID	10%	10%	4%	4%
NSP	Needle sharing	Female PWID	20%	20%	7%	7%
NSP	Needle sharing	Prisoners	20%	20%	7%	7%
PrEP	PrEP	MSM	0%	0%	50%	50%

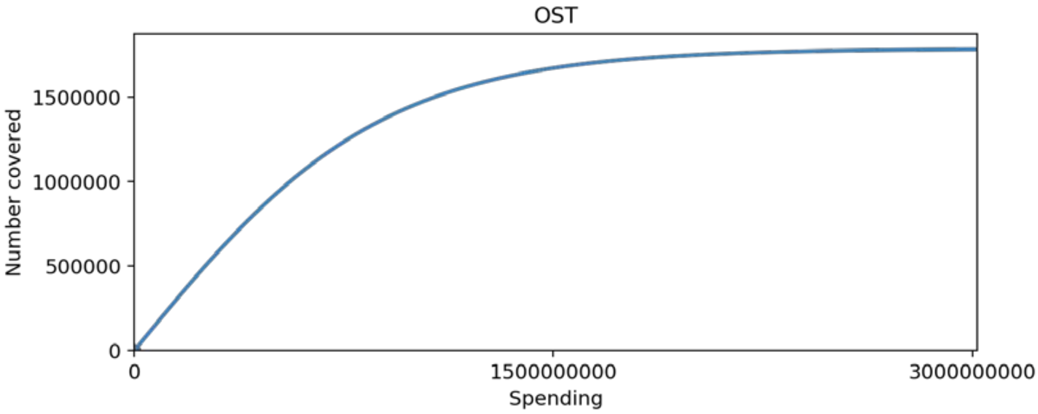
Appendix 4. Cost functions

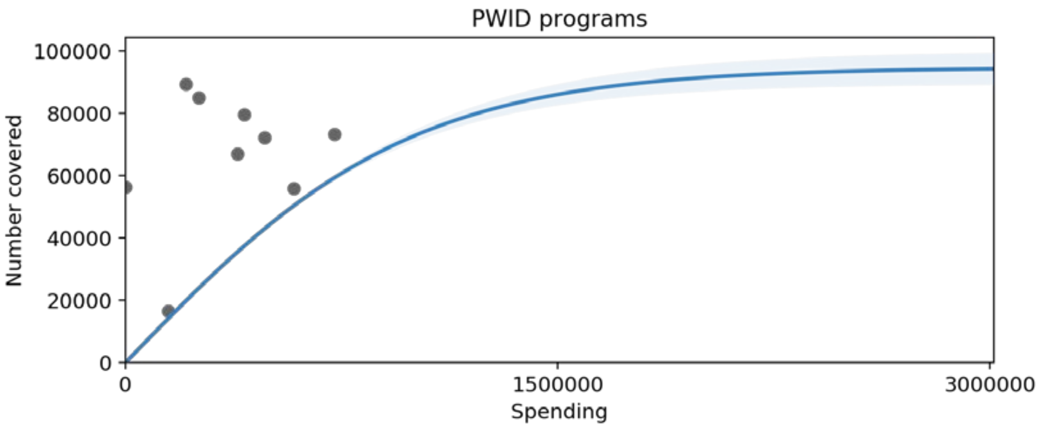


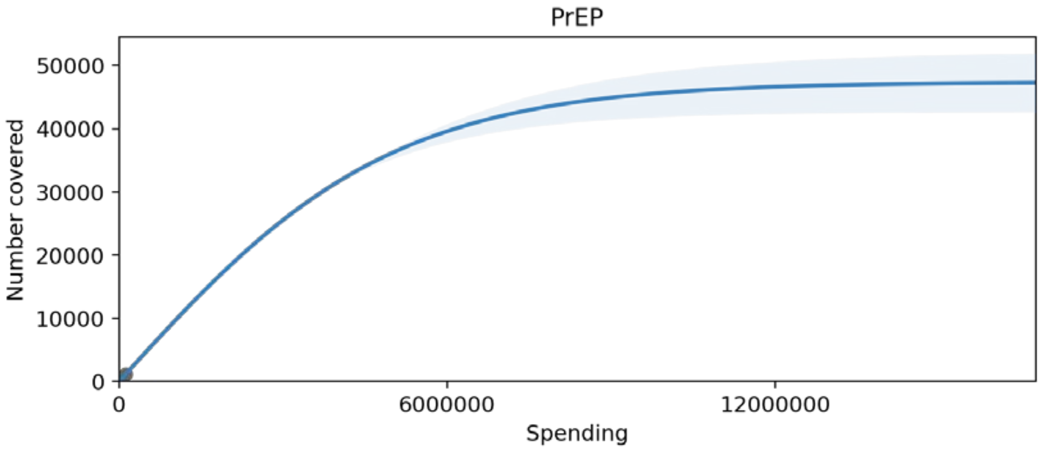


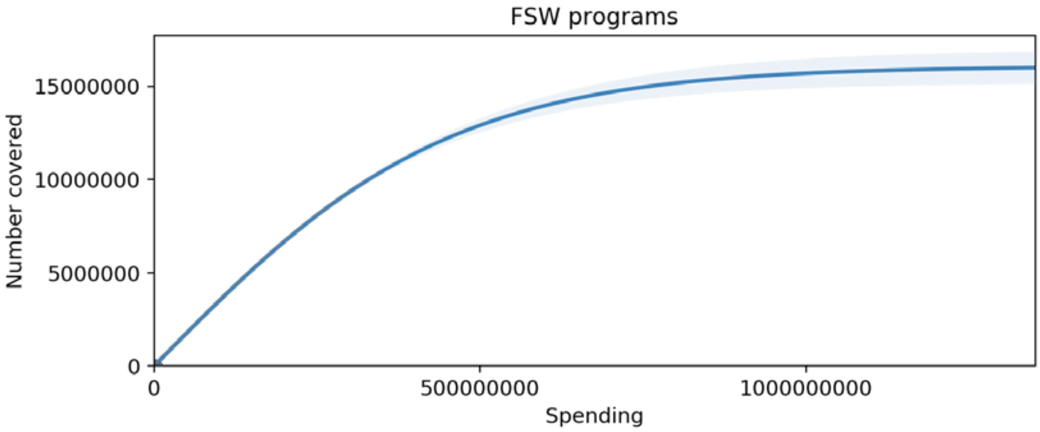

MSM programs
Number covered
120000
100000
80000
60000
40000
20000
0
0
2500000
5000000
Spending

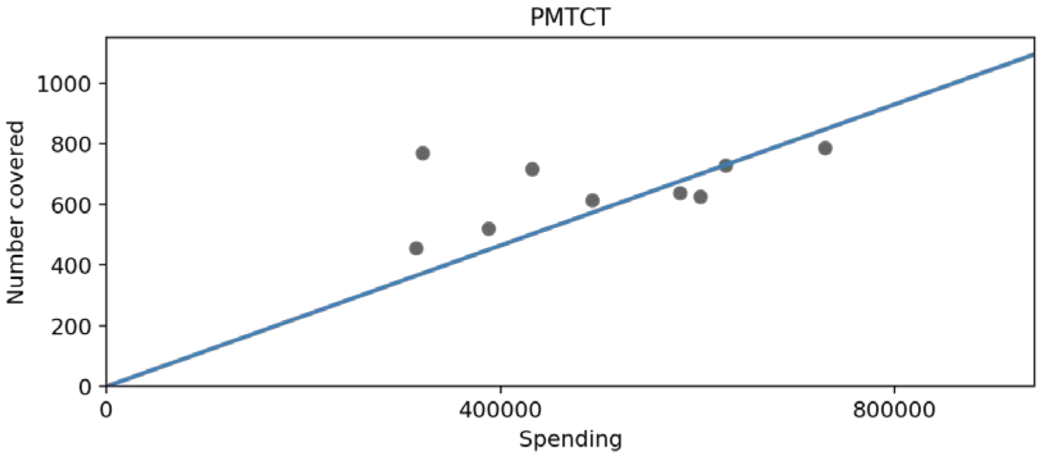

NSP
Number covered
100000
80000
60000
40000
20000
0
0
1500000
3000000
Spending

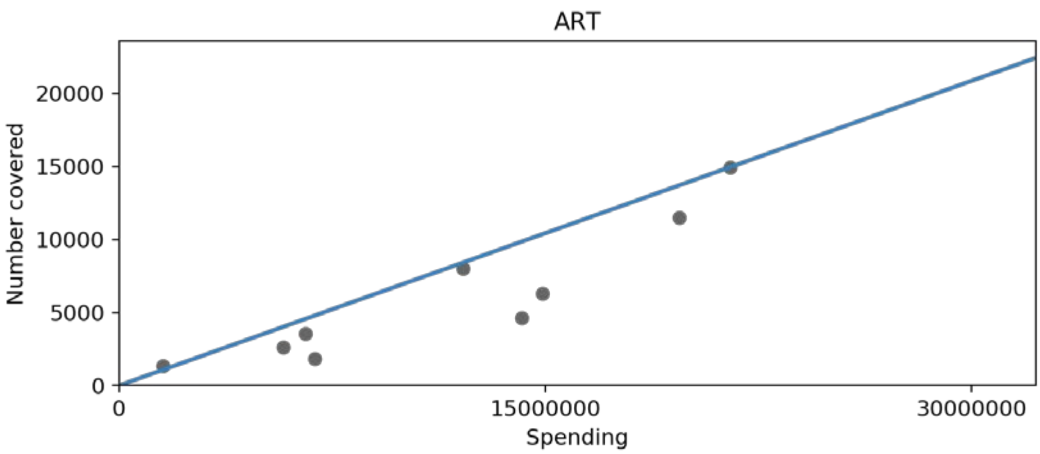

OST
Number covered
1500000
1000000
500000
0
0
1500000000
3000000000
Spending


PWID programs
Number covered
100000
80000
60000
40000
20000
0
0
1500000
3000000
Spending


PrEP
Number covered
0
10000
20000
30000
40000
50000
0
6000000
12000000
Spending


FSW programs
Number covered
0
5000000
10000000
15000000
0
500000000
1000000000
Spending


PMTCT
Number covered
0
200
400
600
800
1000
0
400000
800000
Spending


ART
Number covered
0
5000
10000
15000
20000
0
15000000
30000000
Spending

Appendix 5. Annual HIV budget allocations at varying budgets

Table A4. 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)	$21,502,813	$13,097,950	$26,710,617	$36,401,369	$38,660,075
Prevention of mother-to-child transmission (PMTCT)	$628,030	$628,030	$628,030	$628,030	$628,030
Condoms and social and behavior change communication (SBCC) (general population)	$3,094,527	$0	$0	$0	$0
HIV testing services (HTS) (general population)	$3,163,951	$0	$0	$1,285,474	$9,751,701
HIV testing and prevention programs targeting FSW	$474,288	$0	$0	$0	$0
HIV testing and prevention programs targeting MSM	$163,798	$0	$894,056	$2,118,480	$2,845,020
Pre-exposure prophylaxis for MSM	$122,024	$0	$0	$1,582,844	$4,281,982
HIV testing and prevention programs targeting PWID	$583,958	$0	$547,759	$1,463,072	$2,024,812
Needle-syringe programs (NSP)	$487,656	$1,384,542	$1,440,583	$1,948,265	$2,442,404
Opiate substitution therapy (OST)	$191,934	$95,967	$191,934	$191,934	$191,934
Non-targeted HIV program					
Enabling environment	$33,312	$33,312	$33,312	$33,312	$33,312
Human resources	$7,625,793	$7,625,793	$7,625,793	$7,625,793	$7,625,793
Infrastructure	$2,486,824	$2,486,824	$2,486,824	$2,486,824	$2,486,824
Monitoring and evaluation	$67,242	$67,242	$67,242	$67,242	$67,242
Management					
Other HIV care	$377,255	$377,255	$377,255	$377,255	$377,255
Other HIV costs	$534,348	$534,348	$534,348	$534,348	$534,348
Total HIV program budget	$41,537,753	$26,331,264	$41,537,753	$56,744,243	$71,950,732

Table A5. 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
369%	70% (1,143)	68% (279)	78% (1,800)	80% (4)

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.