Resource optimization to maximize the HIV response in Tajikistan

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 Tajikistani 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) and prevention of mother-to-child transmission (PMTCT)**, which could lead to increased treatment coverage of people diagnosed with HIV from 71% (status quo) to 87% (optimized) in 2019, with high coverage levels maintained to 2030.
- **Maintaining some investment for HIV testing and prevention programs targeting female sex workers (FSW)**. A portion of investment in HIV testing and prevention programs targeting this group should be maintained at the 100% budget level, with scaled up as additional resources become available.
- **Scaling up investment for HIV testing and prevention programs for migrants as additional resources become available.** As additional resources become available, investment in migrant programs should be scaled-up.
- **Scaling up investment for HIV testing and prevention programs for people who inject drugs (PWID) as additional resources become available.** Given estimated that over 20% of new HIV infections occurred among PWID in 2018 in Tajikistan, PWID programs should be scaled-up if additional resources become available.

Given relatively low new HIV infections among the general population, it is **not recommended to prioritize HIV investment 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

In Tajikistan, as of 2018 it is estimated that new HIV infections increased by over 20%, while HIV-related deaths decreased by 5% since 2010.[1] Tajikistan has an HIV epidemic concentrated among key populations including FSW, men who have sex with men (MSM), PWID, and migrants. HIV prevalence among FSW, MSM, and PWID has remained relatively stable, at 3.2% among FSW in 2018[2], 2.0% among MSM,[3] and 11.9% among PWID.[4] Although HIV prevalence among migrants was relatively low reported at 0.4% in 2013[5], given their relatively large population size, with 744, 000 migrants registered in 2013 (representing 9% of the total population) this group is particular focus for Tajikistan's HIV response.[6]

In 2017, the country adopted a new national program to combat HIV infection in the Republic of Tajikistan for 2017-2020.[7] To enhance the HIV response, Tajikistan intends to increase coverage of harm reduction services targeting PWID and to increase the number of people living with HIV on treatment.[7]

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 Tajikistan. Epidemiological and program data was provided by the Tajikistan 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.[8]

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 (MSM)
    - Labour migrants (migrants)
    - Females who inject drugs (FWID)
    - Males who inject drugs (MWID)
- 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)
- HIV testing and prevention targeting PWID
- HIV testing and prevention targeting MSM
- HIV testing and prevention targeting migrants
- HIV testing and prevention targeting FSW
- HIV testing services (HTS) for the general population
- Condoms and social and behaviour change communication (SBCC)
- Prevention of mother-to-child transmission (PMTCT)
- Opiate substitution therapy (OST)

Model constraints

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

Model weightings

Objective weightings to minimize new HIV infections and HIV-related deaths by 2030 were weighted as 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 Tajikistan, all spending on targeted HIV programs (non-targeted HIV program spending was not considered) 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. This is 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 140% more new HIV infections (almost 3,500 more HIV infections) and over 180% more HIV-related deaths (approximately 1,600 more HIV-related deaths) over this period (figure 1). The total annual spending of the HIV program in 2018 amounted to US$7.2M, of which the estimated share of the Global Fund contribution is approximately 60%.

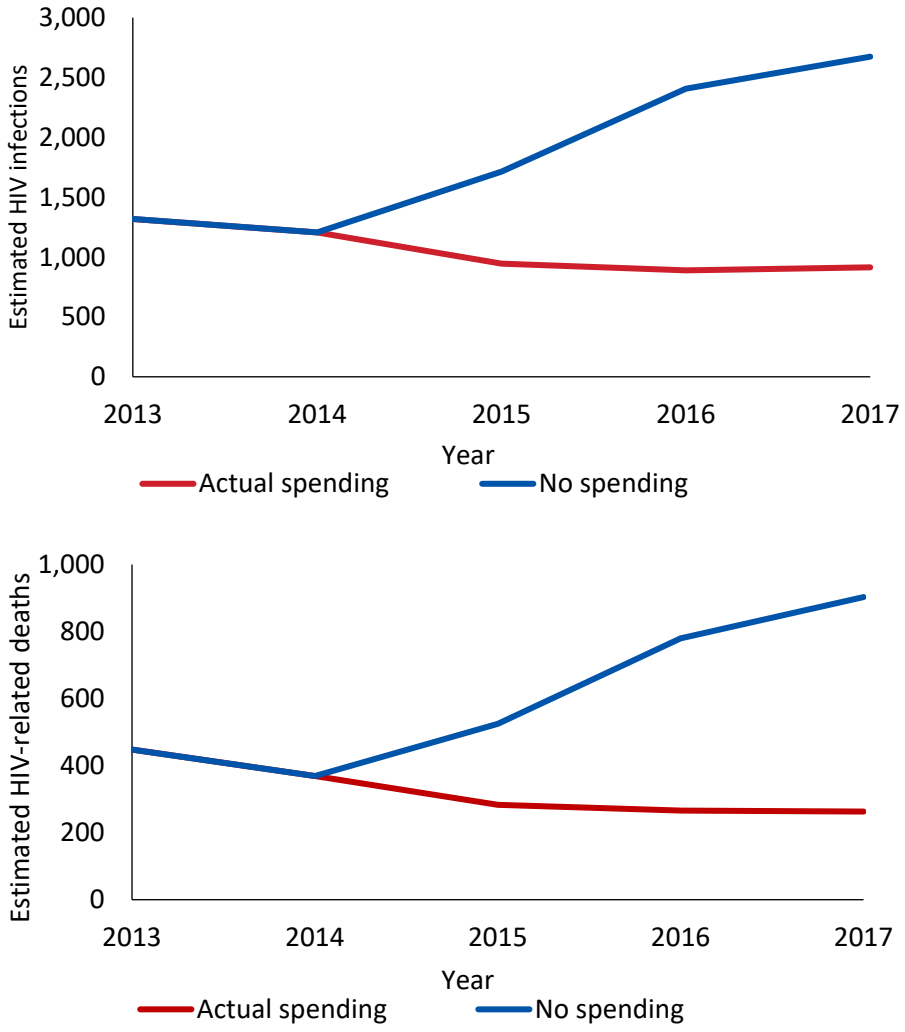

Figure 1. Estimated new HIV infections and HIV-related deaths in the absence of HIV program spending from 2015 to 2017

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

Tajikistan has a latest reported HIV program budget of US$7.2M in 2018 with approximately 20% of the overall budget 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 and PMTCT, which could lead to increased treatment coverage of people needing treatment or those newly diagnosed with HIV from 71% (status quo) to 87% (optimized) in 2019 with high coverage levels maintained to 2030 (figures 2 and 3; table A4).

At 100% optimized budget, results suggest maintaining some investment for HIV testing and prevention programs targeting FSW (figures 2 and 3; table A4). It is estimated 4% of new HIV infections in Tajikistan occurred among FSW in 2018. Should additional resources become available, investment in FSW programs should scaled-up (figure 2; table A4). As additional resources become available beyond 100% budget allocation, HIV investment should be targeted towards HIV testing and prevention programs targeting migrants, given that a marked amount of new HIV infections occur among this group. HIV testing and prevention programs targeting PWID should be scaled up as additional resources become available, as it is estimated that 20% of new HIV infections in Tajikistan occurred among PWID in 2018.

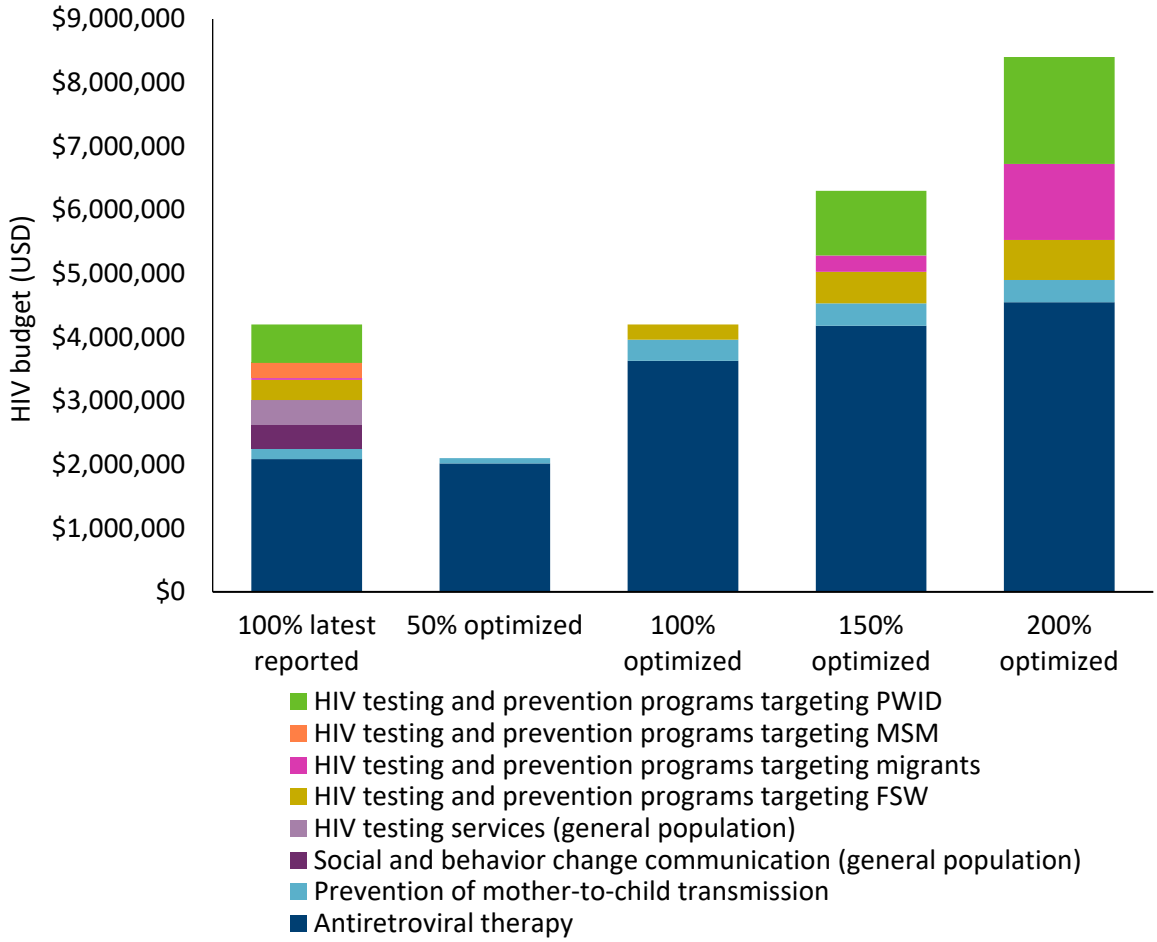

Figure 2. Optimized allocations under varying levels of annual HIV budgets for 2019 to 2030, to minimize new infections and HIV-related deaths by 2030.

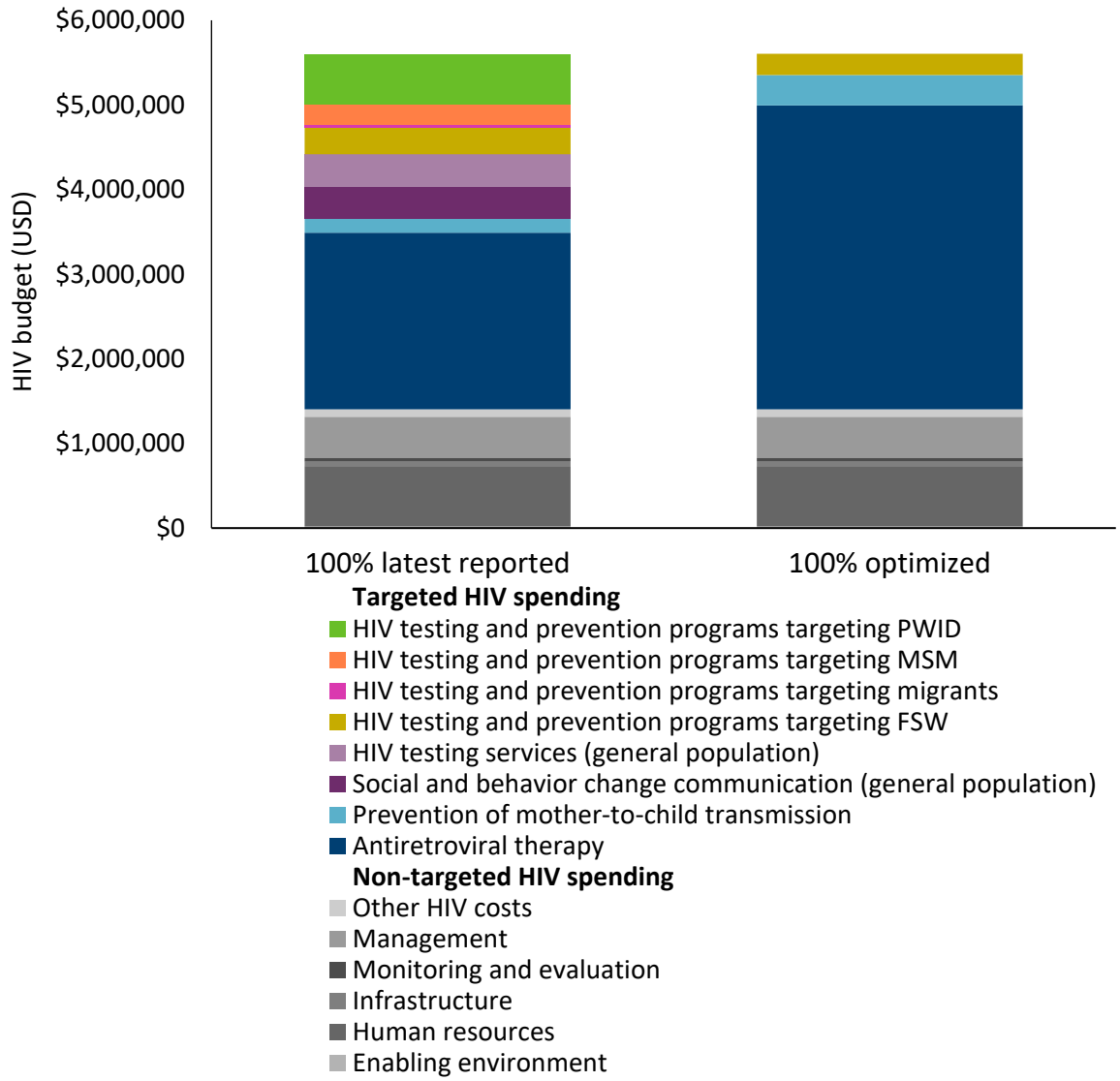

Figure 3. Optimized HIV annual resource allocation, 2019 to 2030 to minimize new infections and HIV-related deaths by 2030. Non-targeted HIV program budgets are shown here but are not considered within the optimization.

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 40% of new HIV infections could be averted (5,900 more infections averted) and 45% more HIV-related deaths could be averted (2,700 more deaths averted) compared with the latest reported allocation being maintained over the same period (figure 4). By 2030, an additional 67,000 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 60% (9,000 more infections averted), HIV-related deaths by 60% (3,500 more deaths averted), and HIV-related DALYs by 60% (89,000 more DALYs averted) compared with the latest reported budget level and allocation (figure 4). It is estimated that investment beyond 1,600% 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).

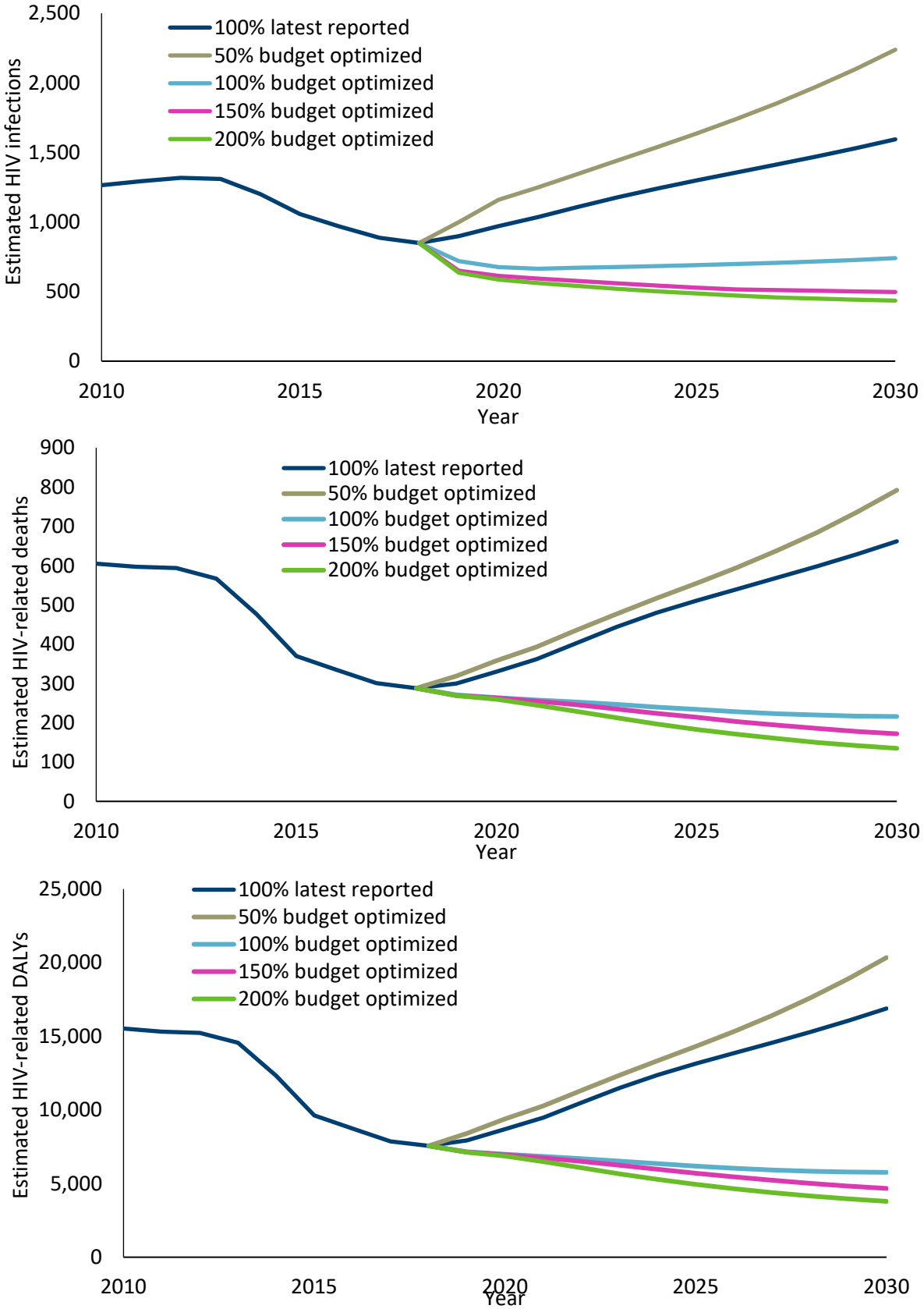

Figure 4. Estimated new HIV infections, HIV-related deaths, and HIV-related DALYs under optimized varying annual budget levels 2019 to 2030 to minimize infections and deaths by 2030

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, 64% of people living with HIV will be diagnosed, 57% of those diagnosed will receive treatment, and 68% of those on treatment will achieve viral suppression. Even with an 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 170% of the latest reported budget level (an additional US$3M annually) and optimized with prioritization of antiretroviral therapy (ART), HIV testing and prevention programs targeting migrants, and HIV testing and prevention programs targeting FSW (figure 6). In 2030, the number of people living with HIV were estimated as 20,000 and that Tajikistan could have 93% of these people living with HIV diagnosed with HIV, 95% of those diagnosed on treatment, and 95% of those on treatment to have achieved viral suppression (figure 5).

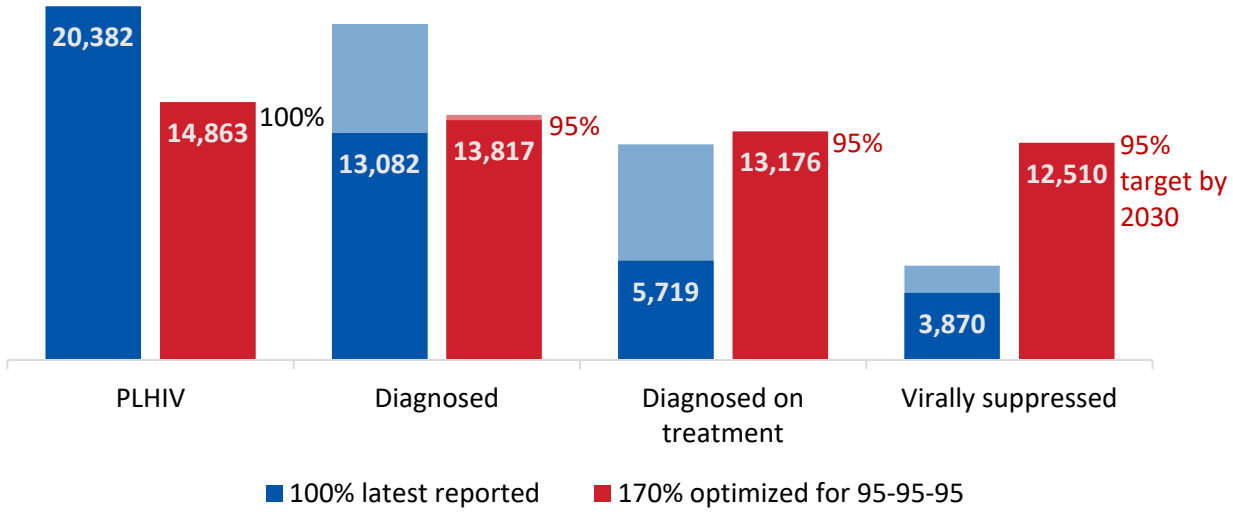

Figure 5. HIV cascade under optimized resource allocation to best achieve 95-95-95 targets by 2030. Dark blue bars represent progress towards 95-95-95 targets under 100% latest reported budget, with light blue bars showing the gap to achieving targets. Red bars represent progress towards 95-95-95 targets under 170% optimized resource allocation to best achieve 95-95-95 targets, with light red bars showing the gap to achieving targets.

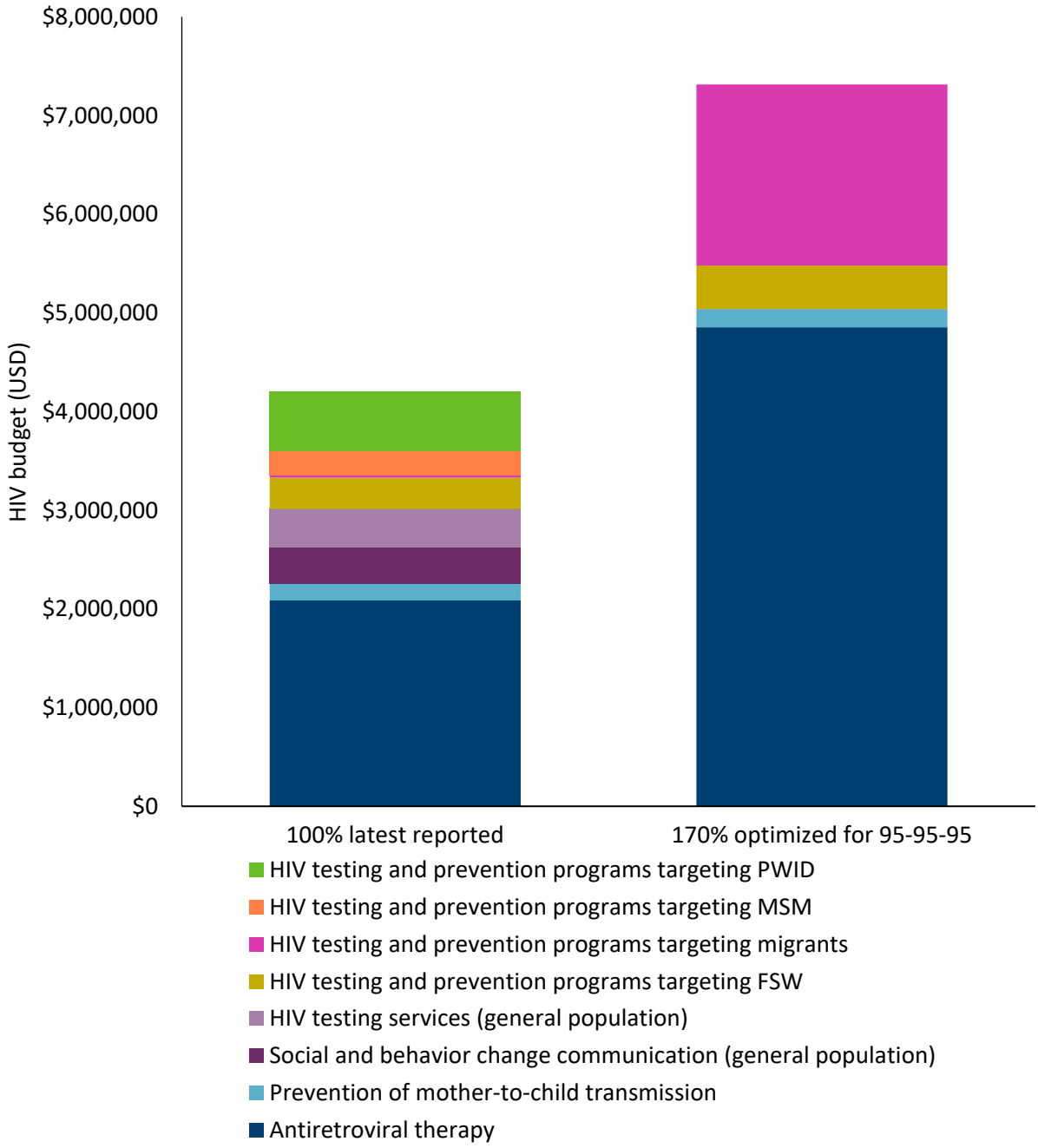

Figure 6. Optimized HIV budget level and allocation to best achieve 95-95-95 targets by 2030

Compared with latest reported 100% budget allocation, by 2030 under optimized allocation of 170% budget towards achieving 95-95-95 targets it is estimated that an additional 70% of new HIV infections could be averted (approximately 10,000 more infections averted) and 80% of HIV-related deaths could be averted (approximately 4,000 more deaths averted) (figure 8).

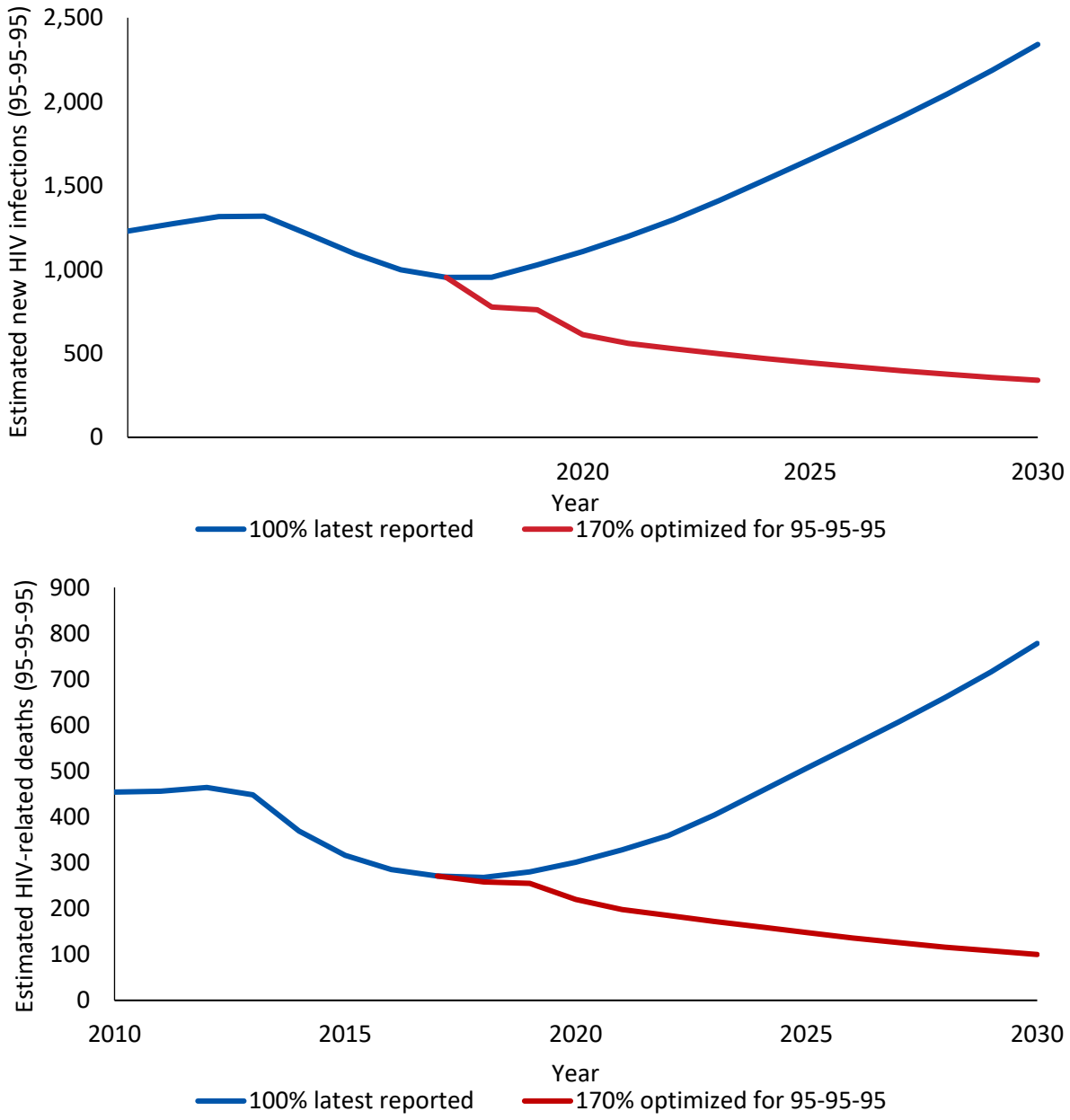

Figure 8. Estimated new HIV infections and HIV-related deaths under optimized allocation towards best achieving 95-95-95 targets by 2030

Study limitations

As with any modelling study, there are limitations that should be taken into account when considering 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.

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. Tajikistan country overview, UNAIDS, accessed December 2019. https://www.unaids.org/en/regionscountries/countries/tajikistan

2. Integrated Bio-behavioral surveillance and population size estimation survey among Female sex workers in Tajikistan, 2018.

3. Integrated Bio-behavioral surveillance and population size estimation survey among men who have sex with men in Tajikistan, 2018.

4. Integrated Bio-behavioral surveillance and population size estimation survey among people who inject drugs in Tajikistan, 2018.

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6. HIV Programme Review in Tajikistan: Evaluation report, World Health Organisation, 2014.

7. Country progress report – Tajikistan, Global AIDS Monitoring 2018. UNAIDS, 2018.

8. 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%
	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

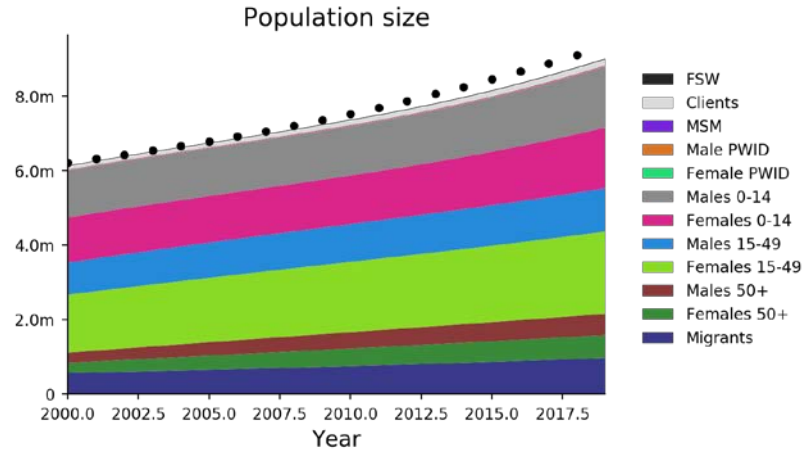
Source: Optima HIV User Guide Volume VI Parameter Data Sources

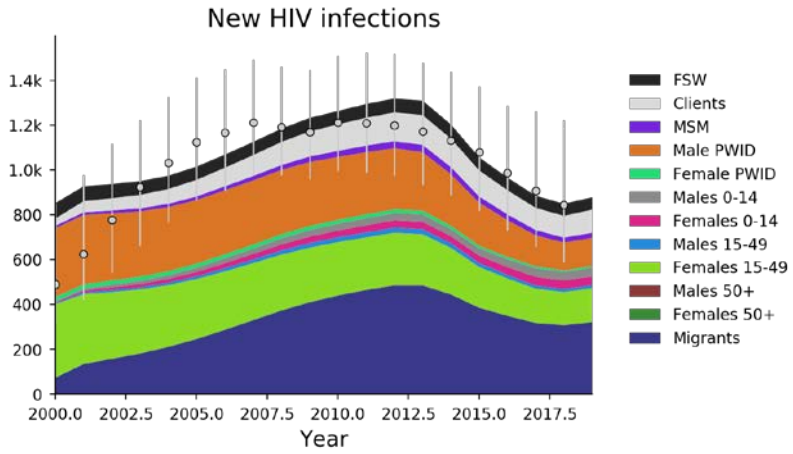
Table A2. Model parameters: treatment recovery and CD4 changes due to ART, and death rates

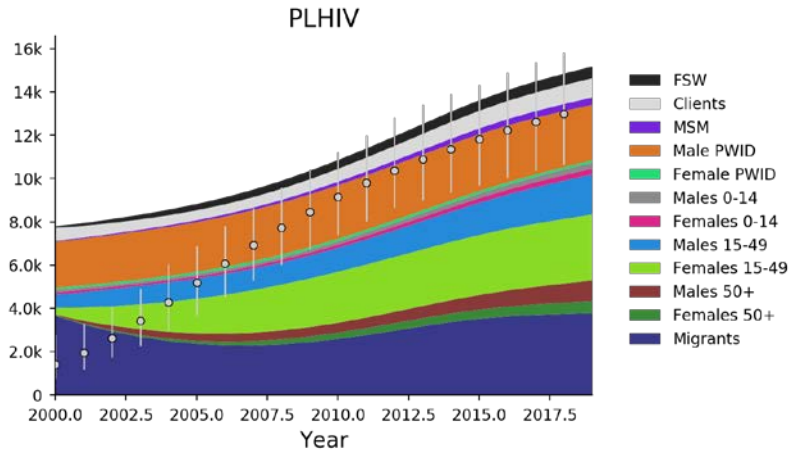
Treatment recovery due to suppressive ART (average years to move)		
	CD4 (350-500) to CD4 (>500)	2.20
	CD4 (200-350) to CD4 (350-500)	1.42
	CD4 (50-200) to CD4 (200-350)	2.14
	CD4 (<50) to CD4 (50-200)	0.66
	Time after initiating ART to achieve viral suppression (years)	0.20
	Number of VL tests recommended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

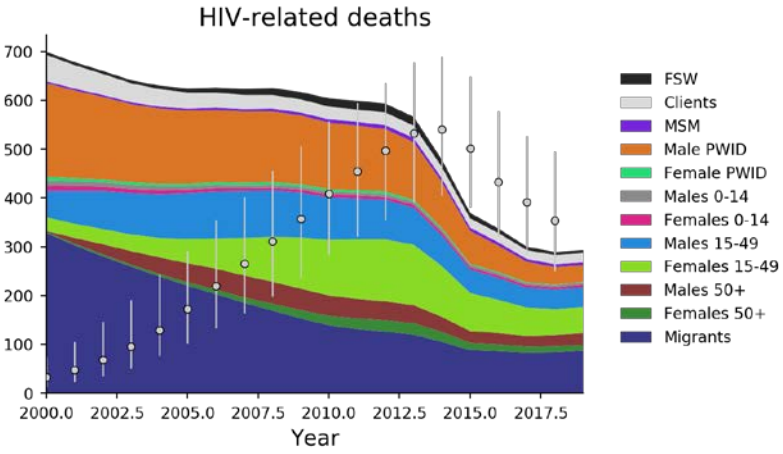
Source: Optima HIV User Guide Volume VI Parameter Data Sources

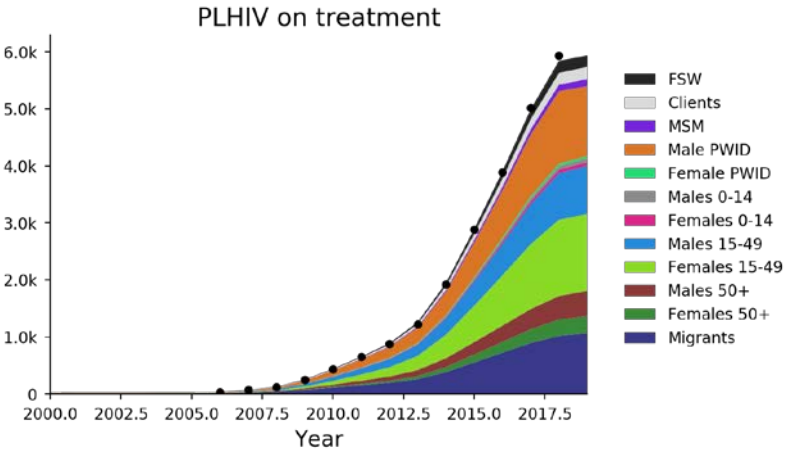
Appendix 2. Model calibration

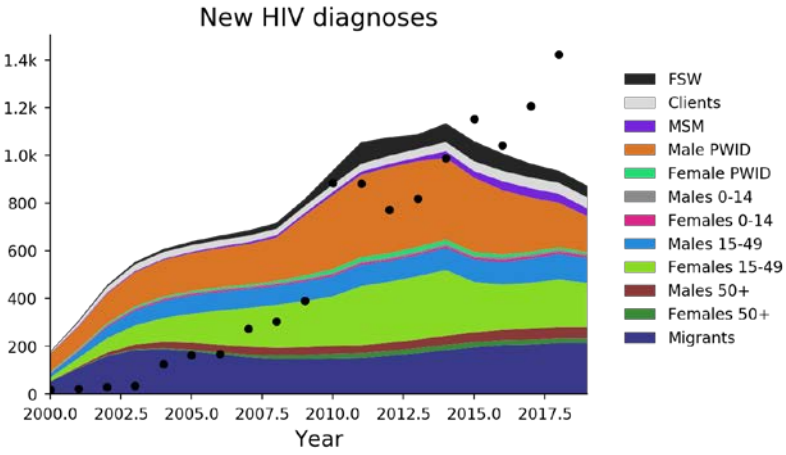


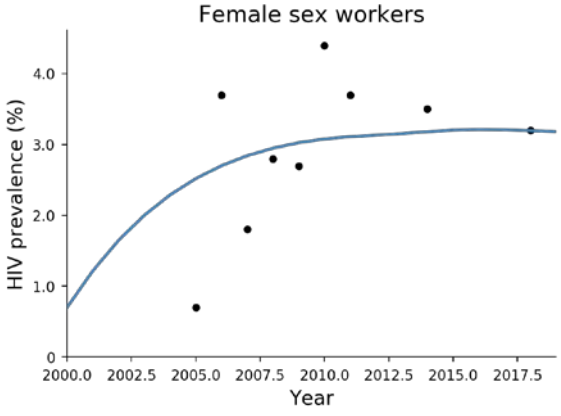


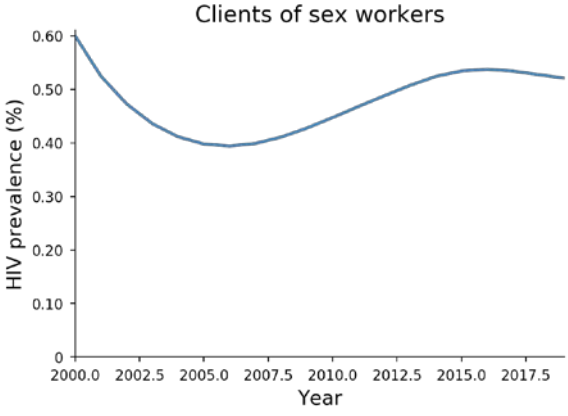


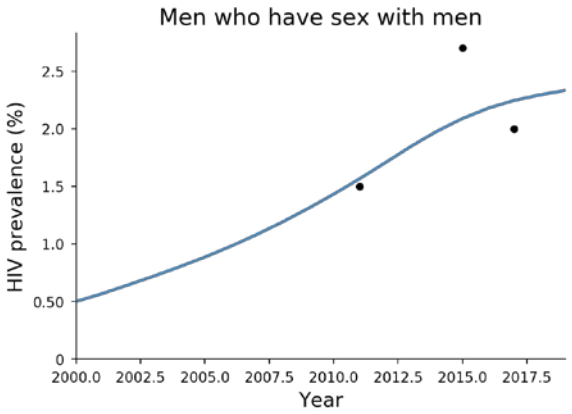

HIV-related deaths
700
600
500
400
300
200
100
0
2000.0
2002.5
2005.0
2007.5
2010.0
2012.5
2015.0
2017.5
Year
FSW
Clients
MSM
Male PWID
Female PWID
Males 0-14
Females 0-14
Males 15-49
Females 15-49
Males 50+
Females 50+
Migrants

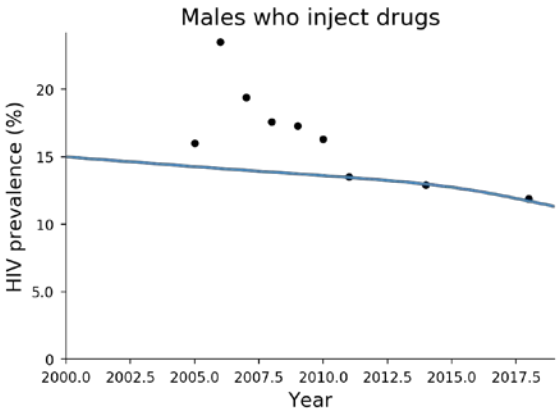

PLHIV on treatment
6.0k
5.0k
4.0k
3.0k
2.0k
1.0k
0
2000.0
2002.5
2005.0
2007.5
2010.0
2012.5
2015.0
2017.5
Year
FSW
Clients
MSM
Male PWID
Female PWID
Males 0-14
Females 0-14
Males 15-49
Females 15-49
Males 50+
Females 50+
Migrants

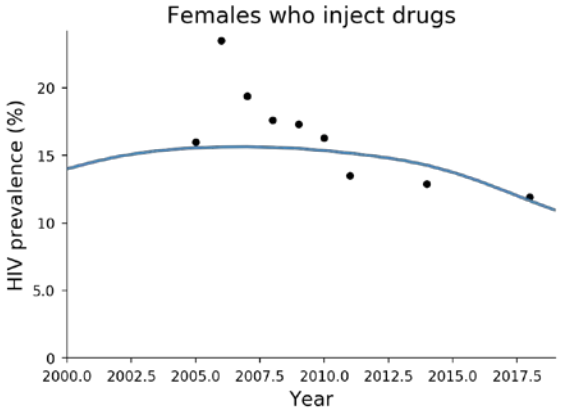

New HIV diagnoses
1.4k
1.2k
1.0k
800
600
400
200
0
2000.0
2002.5
2005.0
2007.5
2010.0
2012.5
2015.0
2017.5
Year
FSW
Clients
MSM
Male PWID
Female PWID
Males 0-14
Females 0-14
Males 15-49
Females 15-49
Males 50+
Females 50+
Migrants

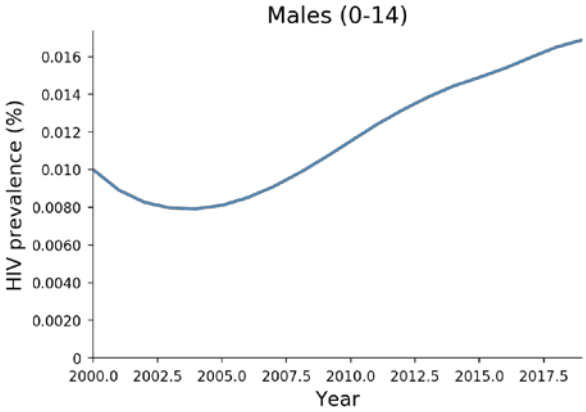

Female sex workers
HIV prevalence (%)
4.0
3.0
2.0
1.0
0
2000.0
2002.5
2005.0
2007.5
2010.0
2012.5
2015.0
2017.5
Year

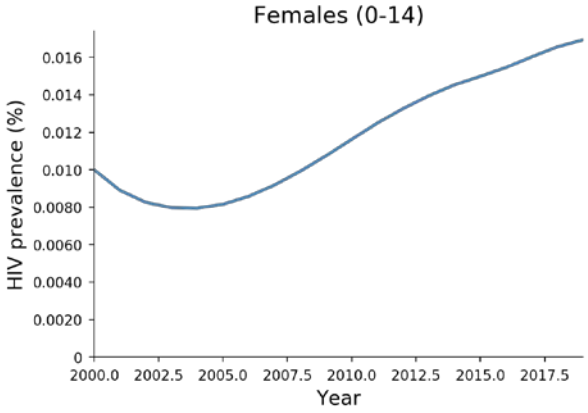

Clients of sex workers
HIV prevalence (%)
0.60
0.50
0.40
0.30
0.20
0.10
0
2000.0
2002.5
2005.0
2007.5
2010.0
2012.5
2015.0
2017.5
Year

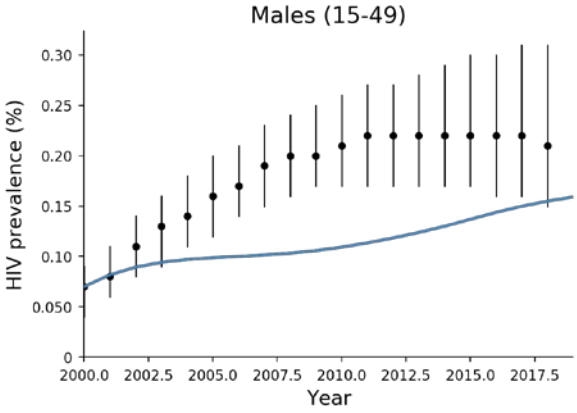

Men who have sex with men
HIV prevalence (%)
2.5
2.0
1.5
1.0
0.50
0
2000.0 2002.5 2005.0 2007.5 2010.0 2012.5 2015.0 2017.5
Year

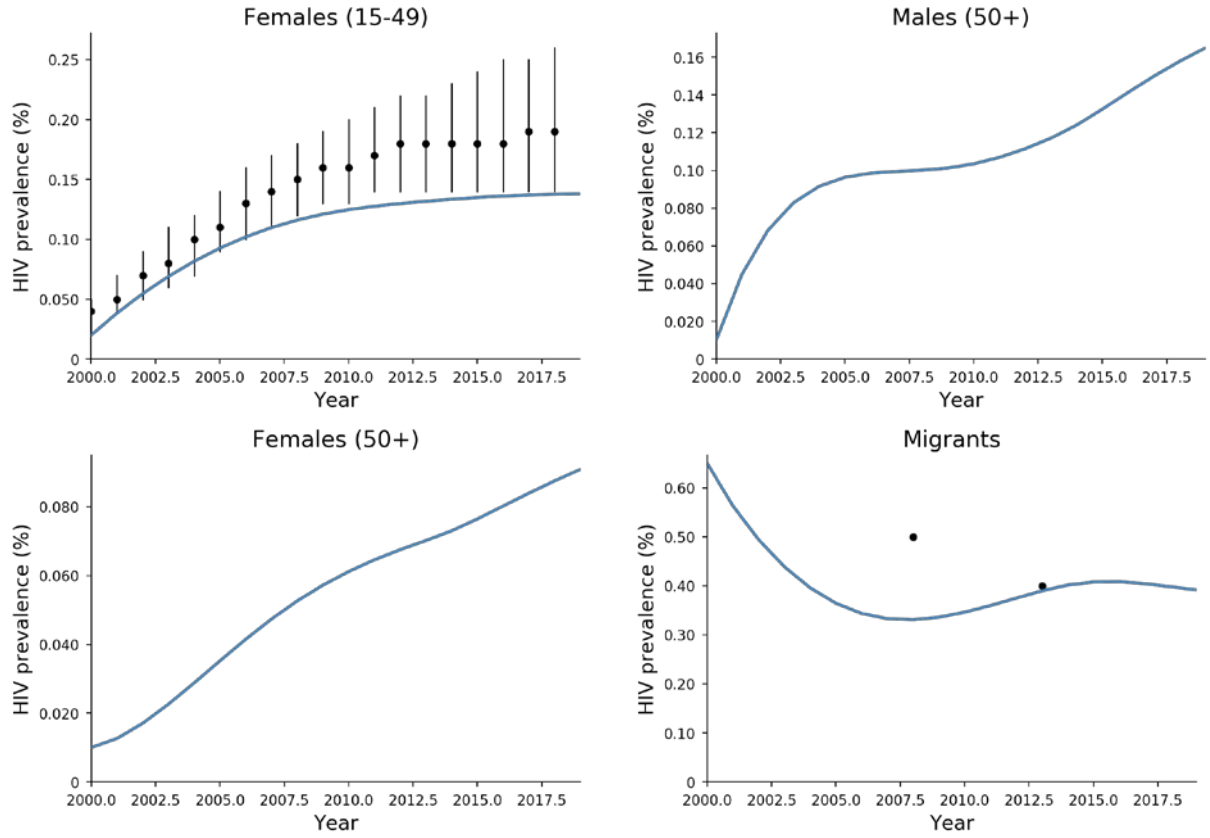

Males who inject drugs
HIV prevalence (%)
20
15
10
5.0
0
2000.0 2002.5 2005.0 2007.5 2010.0 2012.5 2015.0 2017.5
Year


Females who inject drugs
HIV prevalence (%)
20
15
10
5.0
0
2000.0 2002.5 2005.0 2007.5 2010.0 2012.5 2015.0 2017.5
Year


Males (0-14)
HIV prevalence (%)
0.016
0.014
0.012
0.010
0.0080
0.0060
0.0040
0.0020
0
2000.0 2002.5 2005.0 2007.5 2010.0 2012.5 2015.0 2017.5
Year


Females (0-14)
HIV prevalence (%)
0.016
0.014
0.012
0.010
0.0080
0.0060
0.0040
0.0020
0
2000.0 2002.5 2005.0 2007.5 2010.0 2012.5 2015.0 2017.5
Year


Males (15-49)
HIV prevalence (%)
0.30
0.25
0.20
0.15
0.10
0.050
0
2000.0 2002.5 2005.0 2007.5 2010.0 2012.5 2015.0 2017.5
Year



Appendix 3. HIV program costing

Table A3. HIV program unit costs and saturation values

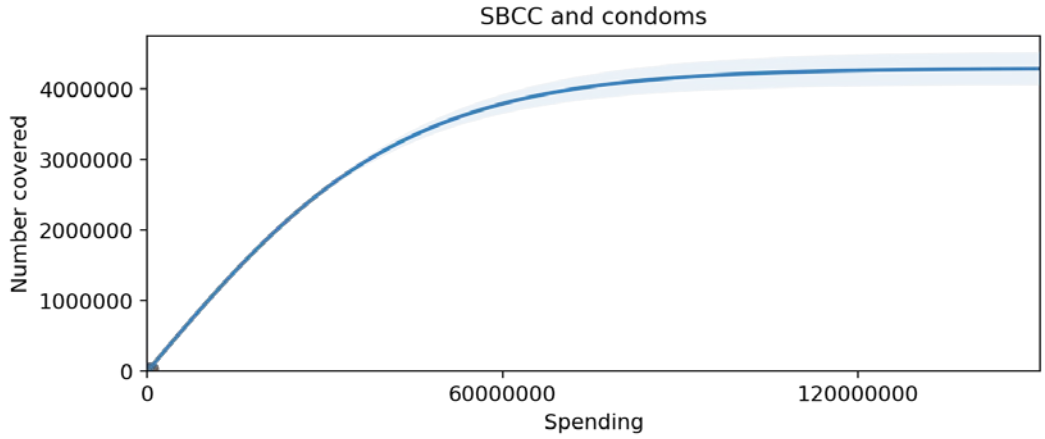
HIV programs	Unit cost (USD)	Saturation (low)	Saturation (high)
Antiretroviral therapy (ART)	$364.86	85%	95%
HIV testing services (general population)	$21.11	70%	85%
HIV testing and prevention targeting FSW	$29.81	70%	80%
HIV testing and prevention targeting MSM	$34.77	80%	90%
HIV testing and prevention targeting migrants	$10.45	70%	80%
HIV testing and prevention targeting PWID	$95.90	80%	90%
Condoms and social and behaviour change communication (SBCC)	$10.07	85%	95%
Prevention of mother-to-child transmission (PMTCT)	$757.91	90%	100%

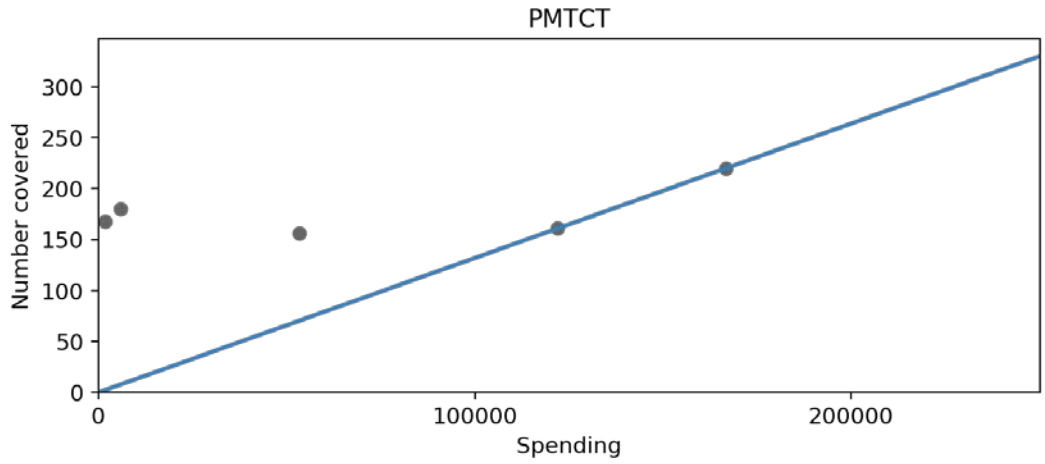
Table A4. Values used to inform HIV program cost functions

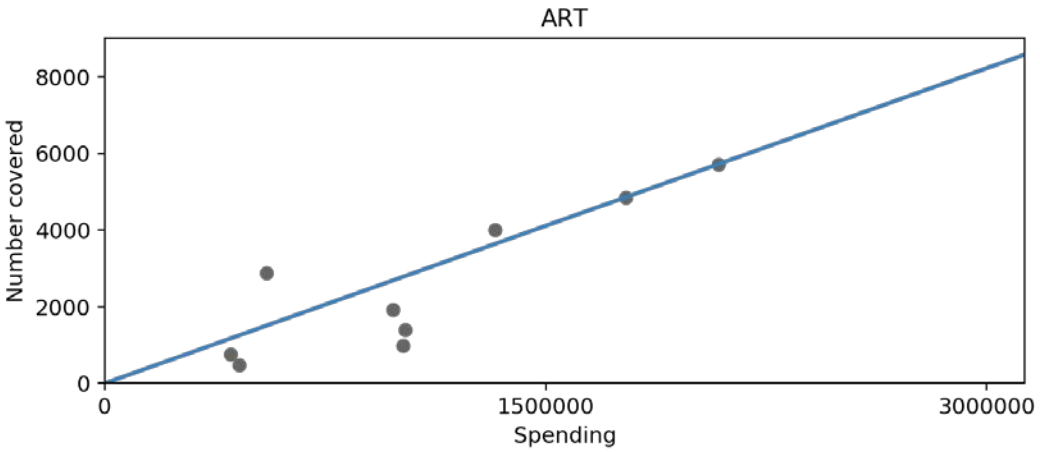
HIV programs	Parameters	Population interactions or populations	In absence of any programs		At max attainable coverage	
			low	high	low	high
FSW programs	condom use (commercial acts)	Clients, FSW	12%	26%	70%	80%
MSM programs	condom use (casual acts)	MSM, MSM	75%	81%	80%	95%
SBCC and condoms	condom use (casual acts)	Clients, Females 15-49	34%	34%	60%	82%
SBCC and condoms	condom use (casual acts)	Male PWID, Females 15-49	20%	30%	46%	70%
PWID programs	condom use (casual acts)	Male PWID, Females 15-49	20%	30%	80%	90%
SBCC and condoms	condom use (casual acts)	Males 15-49, Females 15-49	32%	47%	32%	47%
SBCC and condoms	condom use (casual acts)	Males 50+, Females 15-49	23%	25%	33%	58%
SBCC and condoms	condom use (casual acts)	Males 15-49, Females 50+	45%	45%	61%	76%
Migrants	condom use (casual acts)	Migrants, Females 15-49	32%	37%	46%	66%
SBCC and condoms	condom use (casual acts)	Migrants, Females 15-49	32%	37%	33%	43%
Migrants	condom use (casual acts)	Migrants, Females 50+	37%	42%	53%	73%
SBCC and condoms	condom use (casual acts)	Migrants, Females 50+	37%	42%	39%	49%
PWID programs	condom use (casual acts)	Male PWID, Female PWID	50%	57%	80%	95%
SBCC and condoms	condom use (casual acts)	Males 15-49, FSW	51%	56%	51%	56%
SBCC and condoms	condom use (casual acts)	Males 50+, Females 50+	29%	31%	30%	39%
FSW programs	HIV testing rate	FSW	22%	36%	84%	94%
HTS	HIV testing rate	Clients	1%	1%	21%	21%
MSM programs	HIV testing rate	MSM	14%	23%	43%	48%
PWID programs	HIV testing rate	Male PWID	40%	53%	85%	85%
PWID programs	HIV testing rate	Female PWID	57%	65%	91%	96%

HIV programs	Parameters	Population interactions or populations	In absence of any programs		At max attainable coverage	
			low	high	low	high
HTS	HIV testing rate	Males 15-49	6%	9%	99%	99%
HTS	HIV testing rate	Females 15-49	11%	20%	100%	100%
HTS	HIV testing rate	Males 50+	2%	2%	92%	92%
HTS	HIV testing rate	Females 50+	1%	1%	86%	96%
Migrants	HIV testing rate	Migrants	0%	1%	250%	250%
PWID programs	Needle sharing	Male PWID	3%	4%	1%	1%
PWID programs	Needle sharing	Female PWID	4%	5%	1%	1%

Appendix 4. Cost functions






ART
Number covered
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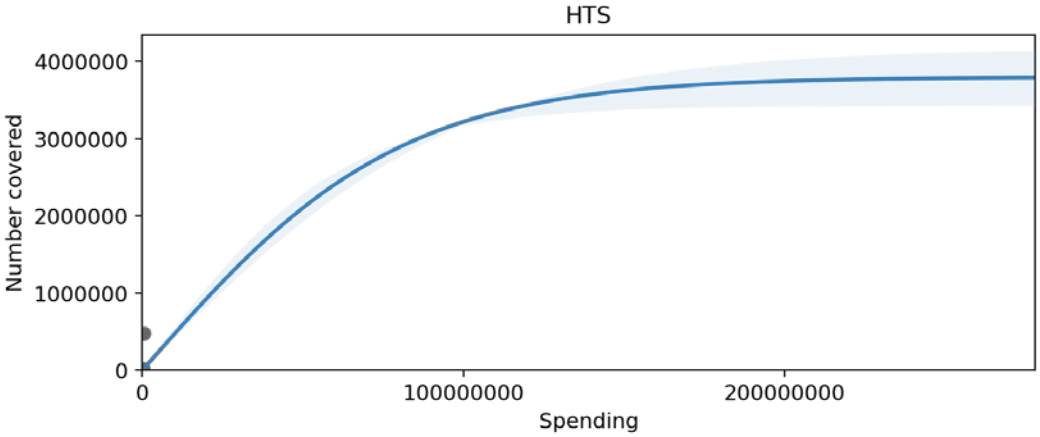
6000
4000
2000
0
0
1500000
3000000
Spending


HTS
Number covered
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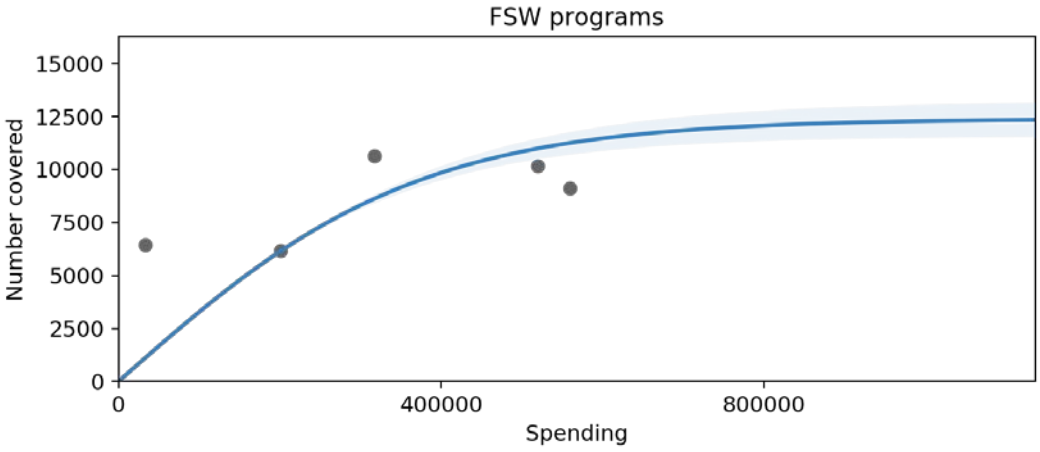
3000000
2000000
1000000
0
0
100000000
200000000
Spending


FSW programs
Number covered
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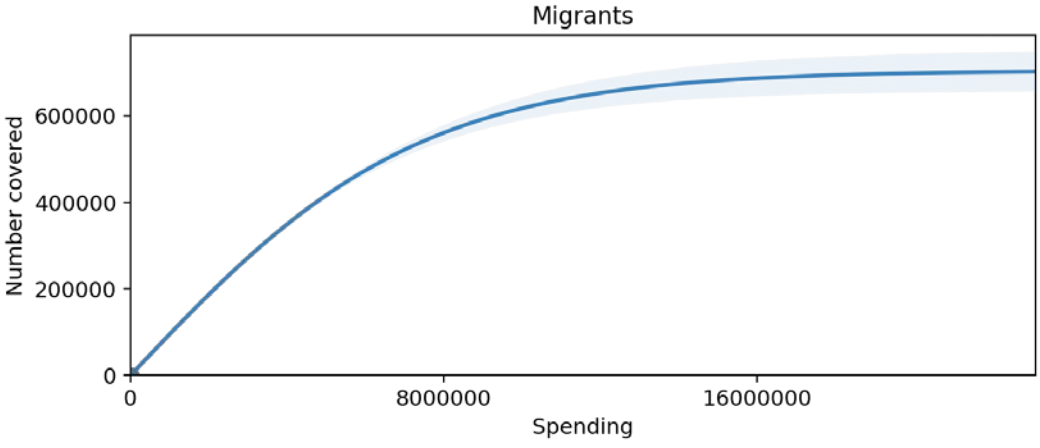
12500
10000
7500
5000
2500
0
0
400000
800000
Spending


Migrants
Number covered
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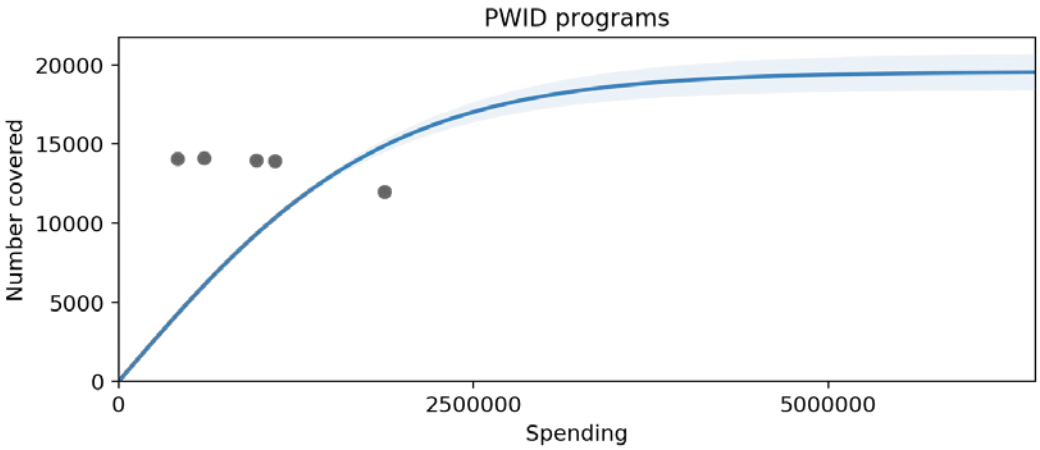
400000
200000
0
0
8000000
16000000
Spending


PWID programs
Number covered
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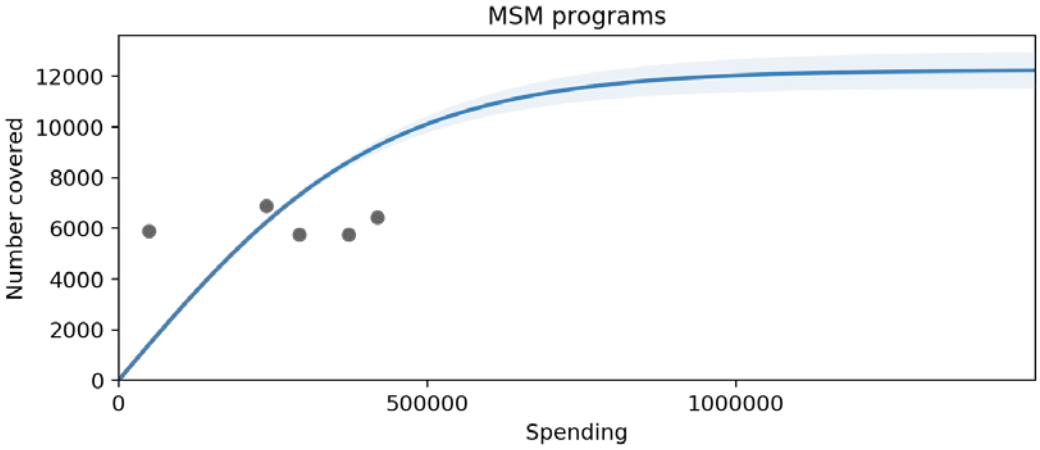
15000
10000
5000
0
0
2500000
5000000
Spending


MSM programs
Number covered
12000
10000
8000
6000
4000
2000
0
0
500000
1000000
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)	$2,086,630	$2,017,043	$3,590,548	$4,216,584	$4,576,792
Prevention of mother-to-child transmission (PMTCT)	$166,741	$83,371	$359,710	$386,694	$380,876
Social and behavior change communication (SBCC) (general population)	$367,692	$0	$0	$0	$0
HIV testing services (HTS) (general population)	$392,328	$0	$0	$0	$0
HIV testing and prevention programs targeting FSW	$316,997	$0	$250,568	$550,293	$662,384
HIV testing and prevention programs targeting migrants	$27,174	$0	$0	$198,320	$1,152,563
HIV testing and prevention programs targeting MSM	$239,818	$0	$0	$0	$0
HIV testing and prevention programs targeting PWID	$603,447	$0	$0	$949,350	$1,629,039
Non-targeted HIV program					
Enabling environment	$20,048	$20,048	$20,048	$20,048	$20,048
Human resources	$711,621	$711,621	$711,621	$711,621	$711,621
Infrastructure	$54,747	$54,747	$54,747	$54,747	$54,747
Monitoring and evaluation	$40,410	$40,410	$40,410	$40,410	$40,410
Management	$484,675	$484,675	$484,675	$484,675	$484,675
Other HIV costs	$91,311	$91,311	$91,311	$91,311	$91,311
Total HIV program budget	$7,006,454	$4,906,040	$7,006,454	$9,106,867	$11,207,281

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 to 2018	Reduction in HIV-related deaths in 2030 compared to 2018	Reduction in HIV infections in 2030 compared to 2010	Reduction in HIV-related deaths in 2030 compared to 2010
1,600%	63% (500)	70% (200)	75% (950)	86% (500)

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 the current program impacts. Additional reductions in infections and deaths could be realized if the current programs could be delivered more cost-efficiently or additional targeted HIV programs were to be implemented.