



2020

Resource optimization to maximize the HIV response in Eastern Europe and Central Asia

Findings from Optima HIV modeling analyses
across 11 countries in Eastern Europe and Central Asia

Contents

List of figures.....	2
List of tables.....	3
Acknowledgements.....	3
Executive summary.....	5
Study objectives.....	7
Methodology.....	8
Populations and HIV programs modeled.....	8
Model constraints.....	8
Model objective function.....	8
Regional findings.....	8
Objective 1: To estimate how many new HIV infections and HIV-related deaths were averted as a result of 2015-2017 HIV program spending for 11 countries in EECA.....	11
Objective 2: To estimate the optimized HIV resource allocations and the resulting impact reallocation would have on HIV incidence, mortality, and DALYs for 11 countries in EECA.....	11
Objective 3: To estimate how much it will cost theoretically to achieve 95-95-95 by 2030 under optimized allocation for 11 countries in EECA.....	17
Study limitations.....	20
Conclusions.....	21
References.....	21
Appendix tables.....	22

List of figures

Figure 1: HIV programme budgets and Global Fund contributions for 11 countries in EECA.....	9
Figure 2: Latest reported HIV programme budgets and non-targeted HIV program spending for 11 countries in EECA.....	10
Figure 3: Antiretroviral (ART) unit costs from the 2014 and 2019 HIV efficiency analysis studies.....	10
Figure 4: Estimated new HIV infections and HIV-related deaths averted from 2015-2017 HIV program spending for 11 countries in EECA.....	11
Figure 5: Latest reported annual HIV budget allocation (100%) and optimized HIV allocation for 2019 to 2030 for all 11 countries in EECA.....	14
Figure 6: Latest reported annual HIV budget allocation (100%) and optimized allocations under varying budget levels for 2019 to 2030 for all 11 countries in EECA.....	14
Figure 7: Latest reported annual HIV budget allocations (left bars) versus optimized allocations (right bars) for 2019 to 2030 for the 11 countries in EECA.....	15
Figure 8: Estimated new HIV infections, HIV-related deaths, and HIV-related DALYs under varying levels of optimized annual budget for 2019 to 2030.....	17
Figure 9: HIV cascade for 2030 under optimized resource allocation for all 11 countries in EECA to best achieve 95-95-95.....	17
Figure 10: Latest reported HIV budget level and allocation (100%) and the budget increased to 180% under optimized allocation to best achieve 95-95-95 by 2030 for all 11 countries in EECA.....	18
Figure 11: Latest reported HIV budget level and allocation (left bars) and increased optimized budgets to best achieve 95-95-95 targets by 2030 (right bars).....	19
Figure 12: Estimated new HIV infections and HIV-related deaths under optimized allocation towards best achieving 95-95-95 targets by 2030.....	20

List of tables

Table 1: Countries where it is recommended to scale-up HIV testing and prevention programs targeting the main key populations 12

Acknowledgements

This study is the second analysis of HIV allocative efficiency modelling conducted among countries in Eastern Europe and Central Asia; the first analysis was conducted in 2014 and became the basis of a collaboration of various institutions and individuals who have all made essential contributions to the work presented in this report. The study and analysis were funded jointly by the Global Fund to Fight AIDS, Tuberculosis and Malaria (Global Fund) and Joint United National Programme on HIV/AIDS (UNAIDS). Report writing and analysis was conducted by the Burnet Institute (Sherrie Kelly, Aaron Osborne, Anna Roberts). Support, coordination, and input was provided by the national programmes in the 11 participating countries, by Global Fund (Corina Maxim, Shufang Zhang, Aleksandrina Iovita, Dumitru Laticevski, Inga Cujanova), and UNAIDS (Eleanora Hvardziova, Vinay Saldanha).

Substantial strategic and technical inputs were also provided by technical consultants from each participating country, supported by UNAIDS and respective national Monitoring and Evaluation bodies. The team would also like to thank all County AIDS Coordinators, additional stakeholders, and the following national programme representatives:

Country	Representative	Country	Representative
Armenia	Lilit Khachatryan Naira Sergeeva Roza Babayan (UNAIDS) Ruben Hovhannisyan Trdat Grigoryan		Bokazhanova Aliya (UNAIDS) Ganina Lolita Kalinich Nataliya Kasymbekova Sairankul Petrenko Irina Yelizaryeva Alla
Azerbaijan	Afet Nazarli Egyana Alieva Esmira Almammadova	Kyrgyzstan	Akaev Zamirbek Asybalieva Nazgul Bolotbekov Aibek Sarybaeva Meerim (UNAIDS)
Belarus	Elena Fisenko Iryna Pashek (UNAIDS) Pavel Yurouski Svetlana Sergeenko Vera Ilyenkova (UNAIDS)	Moldova	Hmelevskaia Ludmila Igor Condrat Iurie Climasevski Lilia Gantea Svetlana Plamadeala (UNAIDS) Svetlana Popovici
Georgia	Ketevan Stvilia Otar Chokoshvili	Romania	Adrian Streinu-Cercel
Kazakhstan			

Country	Representative
	Alexandra Mărdărescu
	Claudiu Şchiopu
	Fidelie Kalambayi
	Lavinia Lopăţică
	Mariana Mărdărescu
Tajikistan	
	Dilshod Saiburhonov
	Iftihor Boboev
	Karimov Saifuddin (UNAIDS)
	Numon Abduhamedov
Ukraine	
	Hanna Blyumina
	Ihor Kuzin

Country	Representative
	Katerina Sharapka
	Natalia Salabai
	Roksolana Kulchynska
	Roman Hailevich (UNAIDS)
	Yana Sazonova
Uzbekistan	
	Alisher Aliev
	Bobur Yuldashev
	Dildora Mustafaeva
	Maksudova Charoskhon (UNAIDS)
	Sergey Kargin

Executive summary

To maintain the HIV response in Eastern Europe and Central Asia (EECA), national HIV programs must be sustainably financed. With planned transition away from donor support, there will be increased demand on domestic HIV financing. Strengthened commitments by national governments is critical. It is more important than ever to invest available HIV resources cost-effectively to maximize impact. Allocative efficiency modeling analyses were conducted in 11 countries in EECA through partnership with the country Governments, the Global Fund to Fight AIDS, Tuberculosis and Malaria, UNAIDS, and the Burnet Institute. Participating countries included Armenia, Azerbaijan, Belarus, Georgia, Kazakhstan, Kyrgyzstan, Moldova, Romania, Tajikistan, Ukraine, and Uzbekistan. The Optima HIV model was applied to estimate the optimized resource allocation across a mix of HIV programs in each country. It is anticipated that recommendations from this study, as summarized below, will inform respective National Strategic Plans and Global Fund funding applications, as well as Global Fund funding decisions and to inform plans for transitioning from international to domestically funded HIV response.

HIV funding in the EECA region increased 20% overall in the 2017-2019 Global Fund funding cycle (US\$1.9B for 2017-2019) compared with the 2014-2016 cycle (\$1.6B for 2014-2016), with an 18% increase in domestic, public, and private sources from \$1.1B to \$1.3B and by 8% from the Global Fund contribution from \$196M to \$213M (2018 spending was used for 2019 as proxy, since 2019 values were not available; sources: UNAIDS estimates, Global Fund disbursement reports, UNGAA, GARPR, and GAM reports as reported in the [UNAIDS HIV Financial Dashboard](#) (1). The Global Fund contribution represented 13% of the total HIV budget for EECA for 2014-2016 and 11% for 2017-2019.

It is estimated that 1.7 million people were living with HIV in Eastern Europe and Central Asia in 2018 (2). It is one of the only regions in the world where the HIV epidemic continues to grow, with an annual increase in new HIV infections of 27% between 2010 and 2018. The epidemic is primarily concentrated among key populations, particularly among people who inject drugs (PWID) (3). There is growing evidence of rising HIV epidemics among gay men and other men who have sex with men who are often under recognised by several national HIV responses (4).

In 2014-2015, an HIV allocative efficiency analysis was conducted for nine countries in the EECA region using the Optima HIV model with support from the World Bank, UNAIDS, the Global Fund, and other partners. Following up on recommendations from this previous study, there have been significant improvements in these EECA regional countries, including adoption of updated HIV testing and treatment protocols, reductions in treatment costs, and improvements in service delivery leading to cost savings. Pursuant to this study, updated allocative efficacy modeling analyses were conducted in 11 countries in EECA to estimate the optimized allocation of HIV resources to maximize outcomes with findings described below (adding Azerbaijan and Romania).

It was found that past investments have had an important impact on the HIV response in the EECA region. Had the HIV programs not been implemented from 2015 to 2017 in these 11 countries in the region, it is estimated that there could have been over 170% more new HIV infections (almost 93,500 more) and almost 150% more HIV-related deaths (approximately 48,900 more) over this period.

While the recommendations for each country analysis were independent and tailored to the epidemic setting in each country, results from participating countries were examined to draw any regional findings, trends, or common themes.

Key recommendations for HIV resource optimization in EECA include:

- **Scaling up antiretroviral therapy (ART) as the top priority** in all eleven countries in the EECA region included in this study and overall in the region from around 70% to almost 85% of the total budget from 2019 to 2030 to ensure those diagnosed receive treatment and to increase treatment coverage across the region from an estimated 56% (status quo) to 83% (optimized) in 2019, with recommendations to maintain high coverage levels to 2030. Levels of increased investment in ART at the latest budget levels range from essentially the same for Romania (98.5% to 98.8% of total targeted HIV program budget, a 1.003-fold increase), to 1.2-fold in Kazakhstan (71% to 88%) and Ukraine (66% to 79%), 1.4-fold in Georgia (30% to 40%), 1.5-fold in Belarus (42% to 62%), 1.6-fold in Armenia (37% to 58%) and Moldova (51% to 81%), 1.7-fold in Azerbaijan (38% to 65%), Tajikistan (50% to 85%), and Uzbekistan (53% to 88%), up to 2.0-fold in Kyrgyzstan (32% to 66%), and for all countries combined by 1.1-fold. To shift funds towards ART, at 100% budget level it is suggested that general population programs including HIV testing services mainly targeting the general population and condoms and SBCC programs be less prioritized. As well, implementation efficiencies have been achieved for ART unit cost for all countries that participated in both waves of studies in 2014 and in 2019 (figure 3). ART should be scaled up at 150% budget in nine countries (Armenia, Azerbaijan, Belarus, Kazakhstan, Kyrgyzstan, Moldova, Tajikistan, Ukraine, and Uzbekistan) and in four countries at 200% budget level (Kyrgyzstan, Moldova, Tajikistan, and Uzbekistan) compared with the latest reported budget level and allocation.
- **Additional resources should be mobilized and cost-effectively invested in treatment as well as in programs targeting key population most at risk.** Generally, the more funds that can be shifted towards key population HIV prevention programs, the bigger the impact on reducing infections and deaths by 2030. Investments in **key population prevention programs** are integral to the HIV response in EECA. While funding priorities for key population programs vary somewhat across countries, common trends across 11 countries in EECA are as follows:
 - **Scale-up HIV testing and prevention programs targeting people who inject drugs (PWID) including needle-syringe programs (NSP)** in Azerbaijan (18% to 29% of total targeted HIV program budget), Kazakhstan (4% to 7%), Romania (0.5% to 0.7%), and the Ukraine (11% to 13%) at the latest reported budget levels. Overall funding at the regional level for PWID programs including NSP for these 11 countries should be maintained. Should additional resources become available, PWID programs should continue to be scaled up in these countries, as well as in Armenia, Belarus, Georgia, Tajikistan, and Uzbekistan.
 - **Scale up HIV testing and prevention programs targeting men who have sex with men (MSM)** at latest reported budget levels in Azerbaijan (1% to 3% of total targeted HIV program budget), Georgia (5% to 6%), Kazakhstan (1% to 3%), Moldova (3% to 4%), and Uzbekistan (0.1% to 0.6%). At the regional level for these 11 countries, funding for this program should be essentially maintained at the combined 100% budget level. Should additional resources become available, MSM programs should be scaled-up in Armenia, Belarus, Kyrgyzstan, Romania, and Ukraine.
 - **HIV testing and prevention programs targeting female sex workers (FSW)** should be scaled up in Azerbaijan (1.92-fold increase, 0.72% to 1.38% of total targeted HIV program budget), Belarus (1.62-fold increase, 3.0% to 4.8%), Moldova (1.23-fold increase, 6.2% to 7.6%), and Uzbekistan (1.48-fold increase, 1.3% to 1.9%) at the latest reported budget levels. Should

additional resources become available, at 150% and 200% budget these programs should continue to be scaled-up in these countries, as well in Georgia, Romania, Tajikistan, and Ukraine (at 200% budget) and at the regional level.

- While the data related to migrant programming has multiple limitations, results suggest that **HIV testing and prevention programs targeting migrants** in Armenia should be scaled up at 100% budget level (from 11% to 17% of total targeted HIV budget) and above. In Tajikistan, investment in migrant programs should only be scaled up if additional resources, at 150% budget and over, become available.
- **Pre-exposure prophylaxis (PrEP)** is a pillar program for HIV prevention which should be implemented following World Health Organization guidelines and for which UNAIDS is supporting countries to scale-up and better target this program. For these 11 countries in EECA, spending on PrEP targeted at MSM has only been reported by Georgia and Kazakhstan. As such, this is an area for further work. Once additional data for the EECA region become available there will be opportunities to expand modelling around PrEP implementation and to examine if lower unit costs will show more cost-effectiveness within the optimization.
- Given the relatively low incidence of HIV among the general population, it is **not recommended to prioritize funding for general population programs, namely HIV testing and condoms and social behaviour change communication at the latest reported budget level**, but rather to target limited funds towards programs for key populations who are at higher-risk of acquiring and transmitting HIV.
- If latest reported budget levels and allocations are maintained from 2019 to 2030, none of the 11 countries in EECA are expected to reach the **95-95-95 targets by 2030**. However, optimizing existing funding could lead to marked progress towards these targets. It is estimated that the combined annual HIV program budgets for 11 countries in EECA should be increased to 180% overall (by \$169M each year), to achieve cascade levels of 91-97-95 regionally by 2030.
- While there are limitations to evaluating the cost-effectiveness of **structural interventions**, there is emerging evidence of their effectiveness, and there is consensus on the importance of these programs, as such these programs should be prioritized as part of the HIV response in the region. Following discussions from the study workshop held in Kiev, Ukraine, in July 2019, while additional findings are anticipated from the upcoming mid-term assessments under the Global Fund Breaking Down Barriers initiative for Kyrgyzstan and Ukraine (theglobalfund.org/en/human-rights), further investigation is needed to determine how such prioritization could be undertaken.

Study objectives

Objective 1: To estimate how many new HIV infections and HIV-related deaths were averted as a result of 2015-2017 HIV program spending for 11 countries in EECA.

Objective 2: To estimate the optimized HIV resource allocations and the resulting impact reallocation would have on HIV incidence, mortality, and DALYs for 11 countries in EECA.

Objective 3: To estimate how much it will theoretically cost to achieve 95-95-95 by 2030 under optimized allocation for 11 countries in EECA.

Methodology

Allocative efficacy modeling analyses were undertaken in 11 participating countries in the Eastern Europe and Central Asia (EECA) region. These analyses were conducted using Optima HIV, an epidemiological model of HIV transmission overlaid 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). Separate country models were informed using demographic, epidemiological, behavioural, programmatic, and expenditure estimates and data. These values were collated from various published sources or were provided by national teams. Separate models for the left bank and right bank were generated for Moldova, with national level results presented in this report. Respective country models were validated by national programmes and key stakeholders during the regional workshop held July 2019 in Kiev, Ukraine. National programmes and key stakeholders were also consulted before and after the workshop to set objectives, build scenarios, and validate results. Full findings for each country are presented in separate country reports. Results presented in this regional report are an aggregate of results from the 11 country analyses.

Populations and HIV programs modelled

Key populations considered in this analysis varied between countries, potentially including female sex workers (FSW), clients of female sex workers (clients), men who have sex with men (MSM), people who inject drugs (PWID), seasonal labour migrants (migrants) in Armenia and Tajikistan. General population groups included males aged 0-14 years, females 0-14, males 15-49, females 15-49, males 50 years and older (males 50+), and females 50 and older (females 50+).

HIV programs considered in this analysis included antiretroviral therapy (ART), prevention of mother-to-child transmission (PMTCT), social and behaviour change communication (SBCC), HIV testing services (HTS) for the general population, HIV testing and prevention targeting key populations including female sex workers (FSW), men who have sex with (MSM), people who inject drugs (PWID), prisoners, and migrants where applicable, needle-syringe programs, opiate substitution therapy (OST), and pre-exposure prophylaxis (PrEP). Details about program unit costs for each country analysis can be found in appendix table A3.

Model constraints

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

Model objective function

The model algorithm aimed to estimate a theoretical optimal distribution of resources and emphasis of different HIV programmatic responses which minimizes both new HIV infections and HIV-related deaths given the local epidemic parameters and data, cost of delivering services, subject to the constraints as defined.

Regional findings

In 2018, the Global Fund invested US\$39.4M in the HIV response for the 11 countries in the Eastern Europe and Central Asia that were considered in this analysis. These funds represent 12% of the total HIV response for these countries (table A2). While Ukraine received the most funding from the Global Fund, US\$14M, this contribution only represented 14% of its total national HIV budget (figure 1). This contrasts with Kyrgyzstan, where Global Fund investments of US\$7M represented 65% of the national budget. Of the 11

countries considered in this analysis, Romania was the only country of that essentially received no HIV disbursements from the Global Fund in 2018 as they had already transitioned out of receiving Global Fund funding.

HIV prevention and treatment programs that have a direct impact on outcomes were included in the optimization analyses and are referred to as targeted programs. Non-targeted HIV programs are those whose impact on the epidemic cannot be readily measured, and include programs such as enabling environment, human resources, management, and other HIV care costs. Spending on such programs varies broadly across the region based on how these programs are defined and implemented, ranging from less than 1% of Romania’s HIV budget was spent on management costs to 78% in Uzbekistan (figure 2), for which as of 2012 approximately half of that was spent on HIV prevention services which could not be classified as targeted HIV prevention programs, approximately a quarter of the non-targeted HIV budget was invested in management and human resources, with other spending on monitoring and evaluation (13% of the total non-targeted HIV program budget, which represents 78% of the total HIV programme budget), on creating an enabling environment (4% of the 78%), infrastructure (2% of the 78%), other HIV care costs (2% of 78%), and programs for orphans and vulnerable children (1% of 78%). Five of the eleven countries invested less than 30% of their total HIV budget on non-targeted programs (Romania (<1%), Azerbaijan (6%), Moldova (22%), Tajikistan (25%), Kazakhstan (27%)), five countries between 30% and 60% (Georgia (38%), Kyrgyzstan (44%), Belarus (45%), Ukraine (48%), Armenia (60%)), and one country, Uzbekistan, over 60% (78%). Then average regional investment in non-targeted HIV programs for all 11 countries in EECA was 34% (with a median 38%). However, the comparability of non-targeted program spending between countries may have limitations, since countries may use different definitions for classifying non-targeted spending, and countries with relatively low HIV burden may have much larger proportional programme overheads.

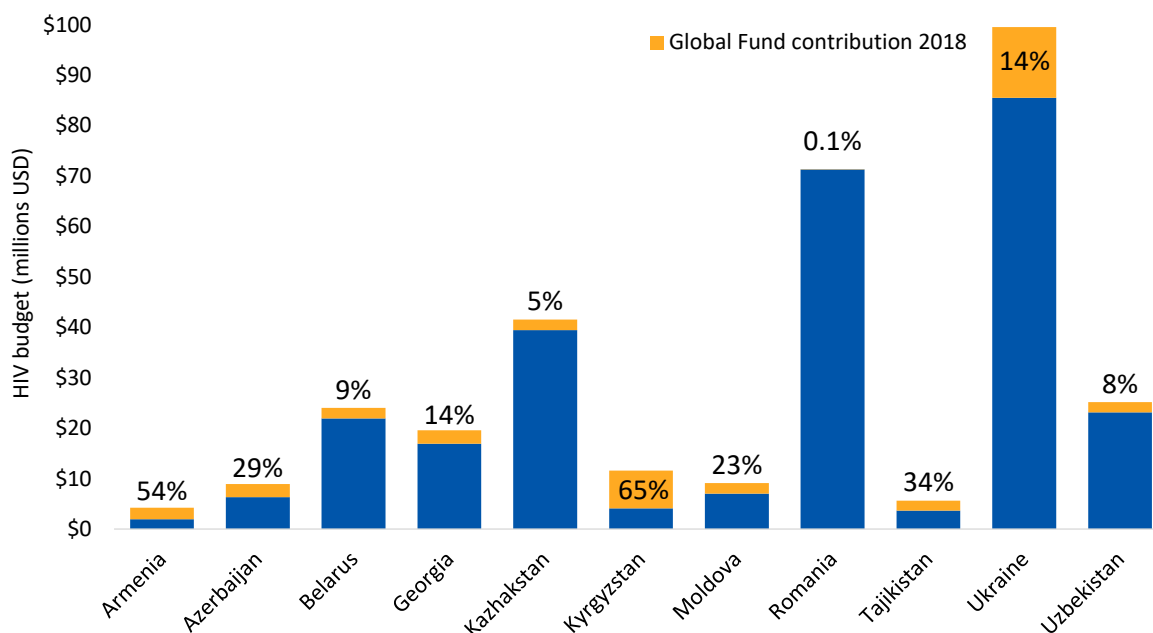


Figure 1: HIV programme budgets and Global Fund contributions for 11 countries in EECA

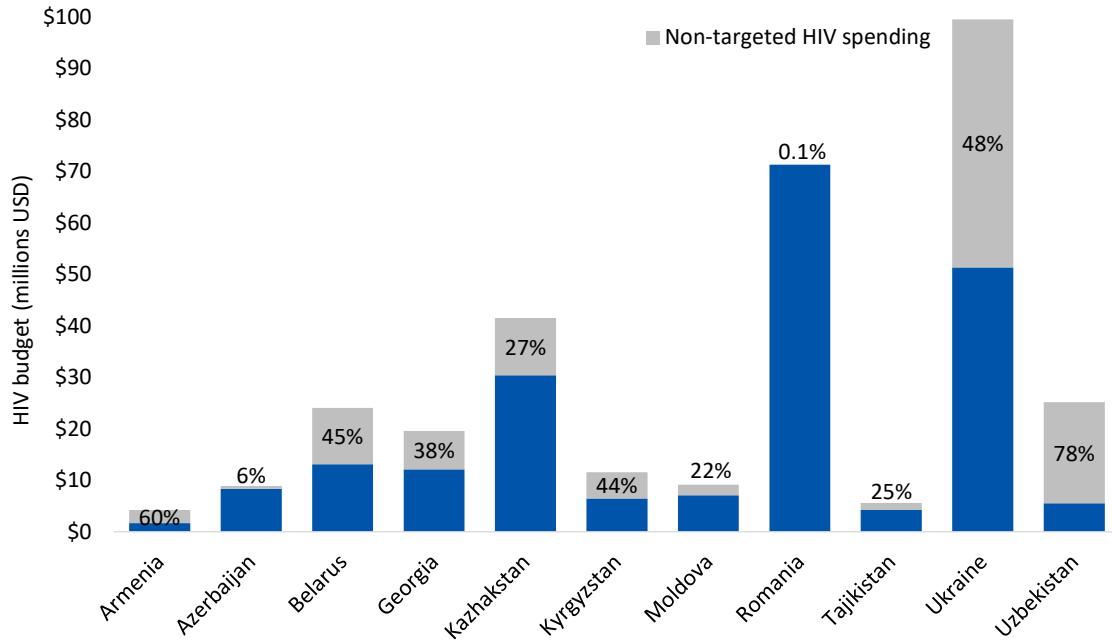


Figure 2: Latest reported HIV programme budgets and non-targeted HIV program spending for 11 countries in EECA

Implementation efficiencies have been achieved for ART unit costs, as shown for all countries that participated in both waves of studies in 2014 and in 2019.

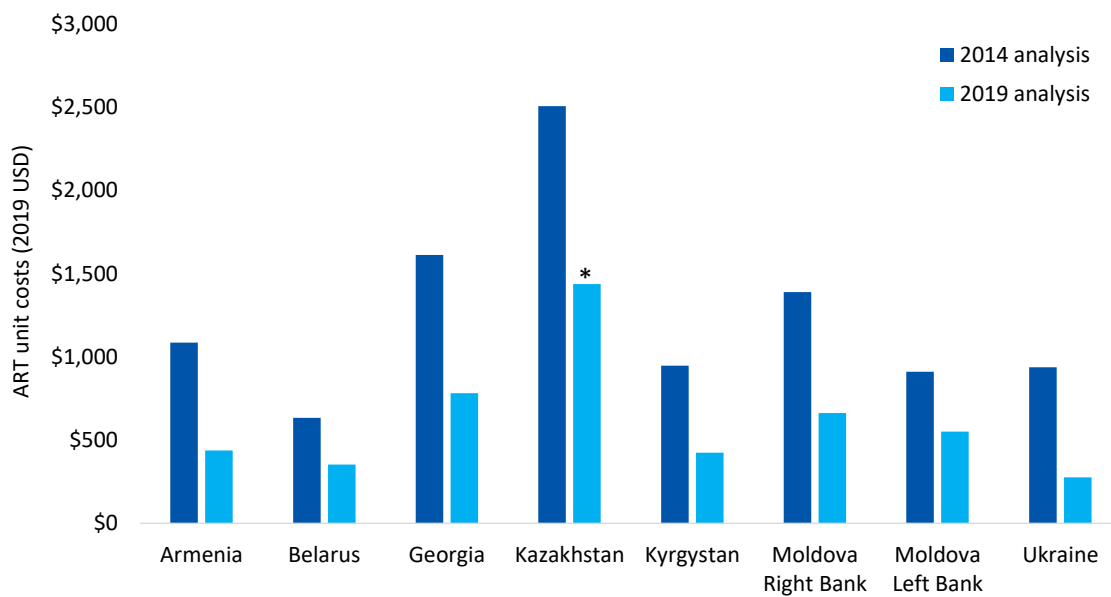


Figure 3: Antiretroviral (ART) unit costs from the 2014 and 2019 HIV efficiency analysis studies

Objective 1: To estimate how many new HIV infections and HIV-related deaths were averted as a result of 2015-2017 HIV program spending for 11 countries in EECA

To estimate the impact of past HIV spending from 2015 to 2017, representing the previous Global Fund funding cycle period, a counterfactual scenario was considered whereby all resources spent on targeted HIV programs during this period were removed for the 11 countries modelled. This was compared with the impact from actual spending for these countries over this period in the region. Non-targeted HIV program spending was not considered.

Had targeted HIV programs not been implemented from 2015 to 2017 in these 11 countries in EECA, it is estimated that there could have been over 170% more new HIV infections (almost 93,500 more) and almost 150% more HIV-related deaths (approximately 48,900 more) over this period (figure 4 and table A1). This highlights the importance of past investment in the HIV response in EECA.

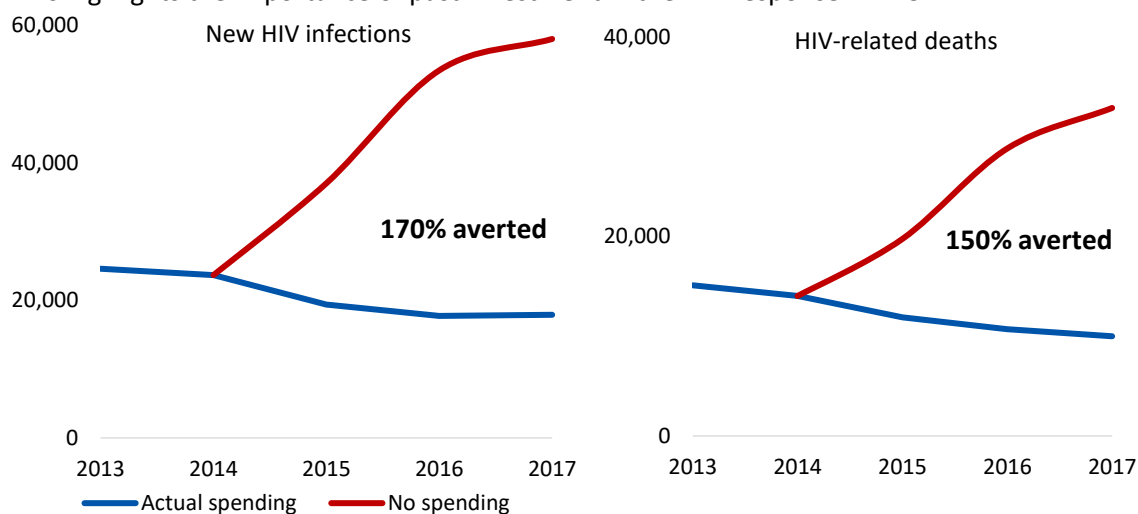


Figure 4: Estimated new HIV infections and HIV-related deaths averted from 2015-2017 HIV program spending for 11 countries in EECA

Objective 2: To estimate the optimized HIV resource allocations and the resulting impact reallocation would have on HIV incidence, mortality, and DALYs for 11 countries in EECA

Overall, treatment and HIV prevention programs targeting key populations should be prioritized in the EECA region.

Optimization analyses suggest **ART** for general and key population groups should be scaled up at 100% budget level for all 11 countries in the EECA region (figures 5-7). Findings suggest that there are a large number of people living with HIV who are diagnosed but not on treatment, therefore, increased investment in ART will allow cumulative treatment coverage for those diagnosed at 100% budget to increase from an estimated 56% (status quo) to 83% (optimized) in 2019, as well as for high coverage levels to be maintained through to 2030. Levels of increased investment in ART at 100% budget level range from essentially the same level in Romania (98.5% to 98.8% of total targeted HIV program budget, a 1.003-fold increase), to 1.2-fold in Kazakhstan (71% to 88%) and Ukraine (66% to 79%), 1.4-fold in Georgia (30% to 40%), 1.5-fold in Belarus (42% to 62%), 1.6-fold in Moldova (51% to 81%) and 1.7-fold in Armenia (38% to 65%), Azerbaijan (38% to 65%), Tajikistan (50% to 85%), and Uzbekistan (53% to 88%), up to 2.0-fold

in Kyrgyzstan (32% to 66%). And overall, for these countries in the region by 1.1-fold. To prioritize ART, at 100% budget level it is suggested that general population programs including HIV testing and condoms and SBCC should be less prioritized. ART should be scaled up at 150% budget in nine countries (Armenia, Azerbaijan, Belarus, Kazakhstan, Kyrgyzstan, Moldova, Tajikistan, Ukraine, and Uzbekistan) and in four countries at 200% budget level (Kyrgyzstan, Moldova, Tajikistan, and Uzbekistan) compared with the latest reported budget level and allocation.

Investments in **HIV testing and prevention programs targeting people who inject drugs (PWID) including needle-syringe programs (NSP)**, independent of treatment (as antiretroviral therapy and opiate substitution therapy are considered separately), should be scaled up at 100% the latest reported budget level in Azerbaijan (18% to 29% of total targeted HIV program budget, 1.6-fold increase), Kazakhstan (4% to 7% of total budget, 1.9-fold increase), Romania (0.5% to 0.7% of total budget, 1.4-fold increase), and the Ukraine (11% to 13% of total budget, 1.2-fold increase) (figure 7 and table 1). Overall funding at the regional level for PWID programs including NSP for these 11 countries should be maintained. These investments should continue to be scaled up as additional investments become available. Should additional resources become available, at 150% and 200% budget levels, PWID programs should continue to be scaled up in Armenia, Belarus, Georgia, Tajikistan, and Uzbekistan.

Funding for **HIV testing and prevention programs targeting men who have sex with men (MSM)** should be scaled up at the latest reported budget level for Azerbaijan (6.0-fold increase, from 0.5% to 3.2% of total targeted HIV program budget), Georgia (1.1-fold increase, 5.0% to 5.7%), Kazakhstan (5.5-fold increase, 0.5% to 3.0%), Moldova (1.4-fold increase, 2.8% to 4.0%), and Uzbekistan (11.0-fold increase, 0.06% to 0.6%) (figure 7 and table 1). At the regional level for these 11 countries, funding for this program should be essentially maintained at 100% budget level under optimized allocation (1.4-fold decrease overall from 1.6% to 1.2% of the overall total regional targeted HIV program budget, figure 5). Should additional resources become available, at 150% and 200% budget levels, MSM programs should be scaled-up in Armenia, Belarus, Kyrgyzstan, Romania, and Ukraine. In Tajikistan, this program was not shown to be cost-effective under currently modelled conditions.

HIV testing and prevention programs targeting female sex workers (FSW) should be scaled up in Azerbaijan (1.9-fold increase, 1.4% to 0.7% of total targeted HIV program budget), Belarus (1.6-fold increase, 3% to 5%), Moldova (1.2-fold increase, 6% to 8%), and Uzbekistan (1.5-fold increase, 1% to 2%) at the latest reported budget levels (figure 7 and table 1). Should additional resources become available, at 150% and 200% budget these programs should continue to be scaled-up in these countries, as well in Georgia, Romania, Tajikistan, and Ukraine (at 200% budget) and at the regional level.

Table 1: Countries where it is recommended to scale-up HIV testing and prevention programs targeting the main key populations

PWID programs	MSM programs	FSW programs
Armenia	Armenia	
Azerbaijan	Azerbaijan	Azerbaijan
Belarus	Belarus	Belarus
Georgia	Georgia	Georgia
Kazakhstan	Kazakhstan	
Kyrgyzstan	Kyrgyzstan	
Moldova*	Moldova†	Moldova†

PWID programs	MSM programs	FSW programs
Romania	Romania	Romania
Tajikistan		Tajikistan
Ukraine	Ukraine	Ukraine
Uzbekistan	Uzbekistan	Uzbekistan

Blue shading: scale-up at latest reported budget. Light blue shading: scale-up only if additional funds become available. *Left Bank only. †Right Bank only.

While data related to migrant programming has multiple limitations, **HIV testing and prevention programs targeting migrants** should be scaled up in Armenia at 100% budget and above. In Tajikistan, investment in these programs should only be scaled up if additional resources to 150% and 200% budget level become available.

Given that new HIV infections are relatively low among the general population, **at 100% budget** it is not recommended to prioritize **HIV programs targeted at the general population**, including HIV testing services and **condoms and social behaviour change communication** in any of the 11 countries in EECA. Funds for these programs should instead be shifted towards treatment and programs targeting key populations. Should additional resources become available, HIV testing targeted at the general population should be scaled up in Uzbekistan.

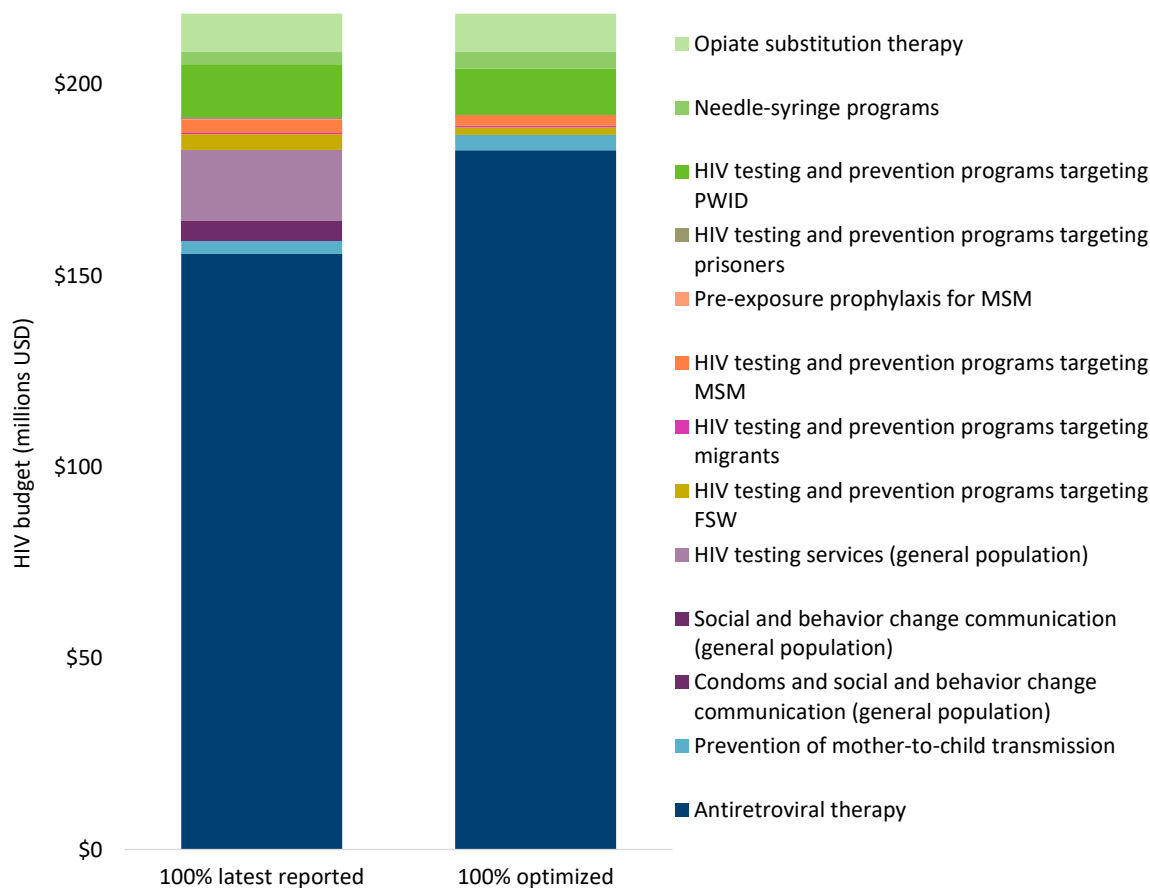


Figure 5: Latest reported annual HIV budget allocation (100%) and optimized HIV allocation for 2019 to 2030 for all 11 countries in EECA

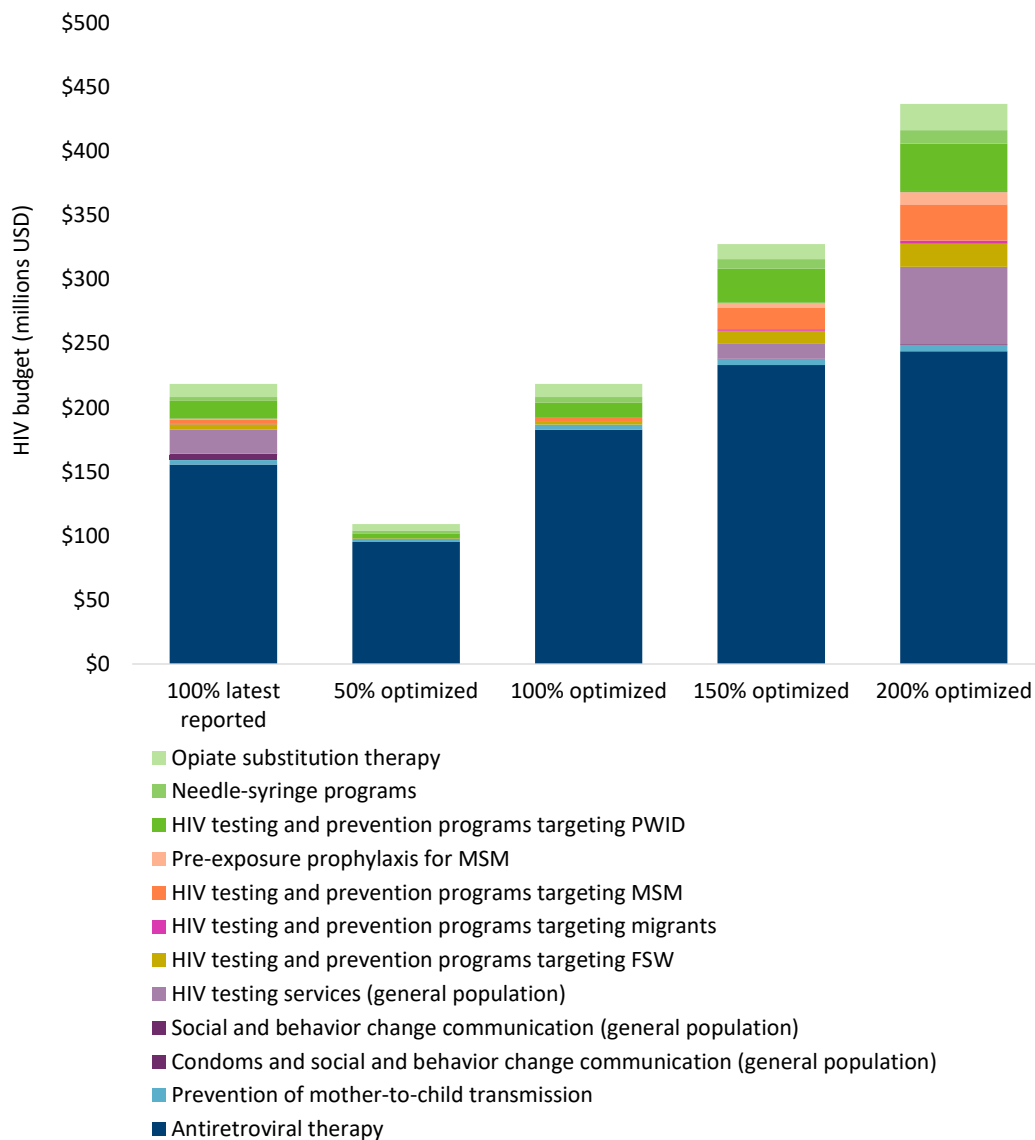


Figure 6: Latest reported annual HIV budget allocation (100%) and optimized allocations under varying budget levels for 2019 to 2030 for all 11 countries in EECA

Recommendations for each country analysis were independent and tailored to the epidemic setting in each country, however, broadly, ART and HIV prevention and testing programs targeting key populations, by priority PWID, MSM, and FSW should be prioritized. These optimization analyses only considered targeted HIV program spending. While non-targeted programs were not considered in these optimizations, 34% of the total budget for the 11 countries in EECA was spent on these programs. Romania spent the least on non-targeted programs, \$64,000 or 0.1% of the total \$77.0M budget and spent nearly their entire national budget on ART (98.5% or \$75.8M). Nevertheless, the recommendation to optimize the budget is to increase spending on ART slightly to 98.8% or \$76.0M, while also scaling up HIV testing and prevention programs targeting PWID (from 0.5% to 0.7% of the total budget including non-targeted programs), and maintaining funding for OST at 0.5% of the total budget. The small amount of funding for

MSM (\$40,000) and FSW programs (\$35,000) was not recommended to be maintained, nor for these programs to be prioritized at this budget level and under these program conditions. This optimization could avert 1% more new HIV infections (approximately 150 more) and HIV-related deaths (approximately 60 more). These are relatively small shifts, however, virtually the entire budget was invested in ART, being constrained so it could not be defunded in the optimization. The HIV epidemic in Romania has been stable over the last few years with an estimated <1,000 new HIV infections annually and 18,000 (16,000-20,000) PLHIV in 2018. In contrast, Uzbekistan spent 71% of their total \$27.5M budget, \$19.6M, on non-targeted HIV programs. With 15% of their total budget, including non-targeted programs, invested on ART in the latest reported budget allocation, it is recommended to scale-up ART as priority to 25% of the total budget from \$4.1M to \$6.9M annually to 2030, alongside scale-up of PMTCT, FSW and MSM programs.

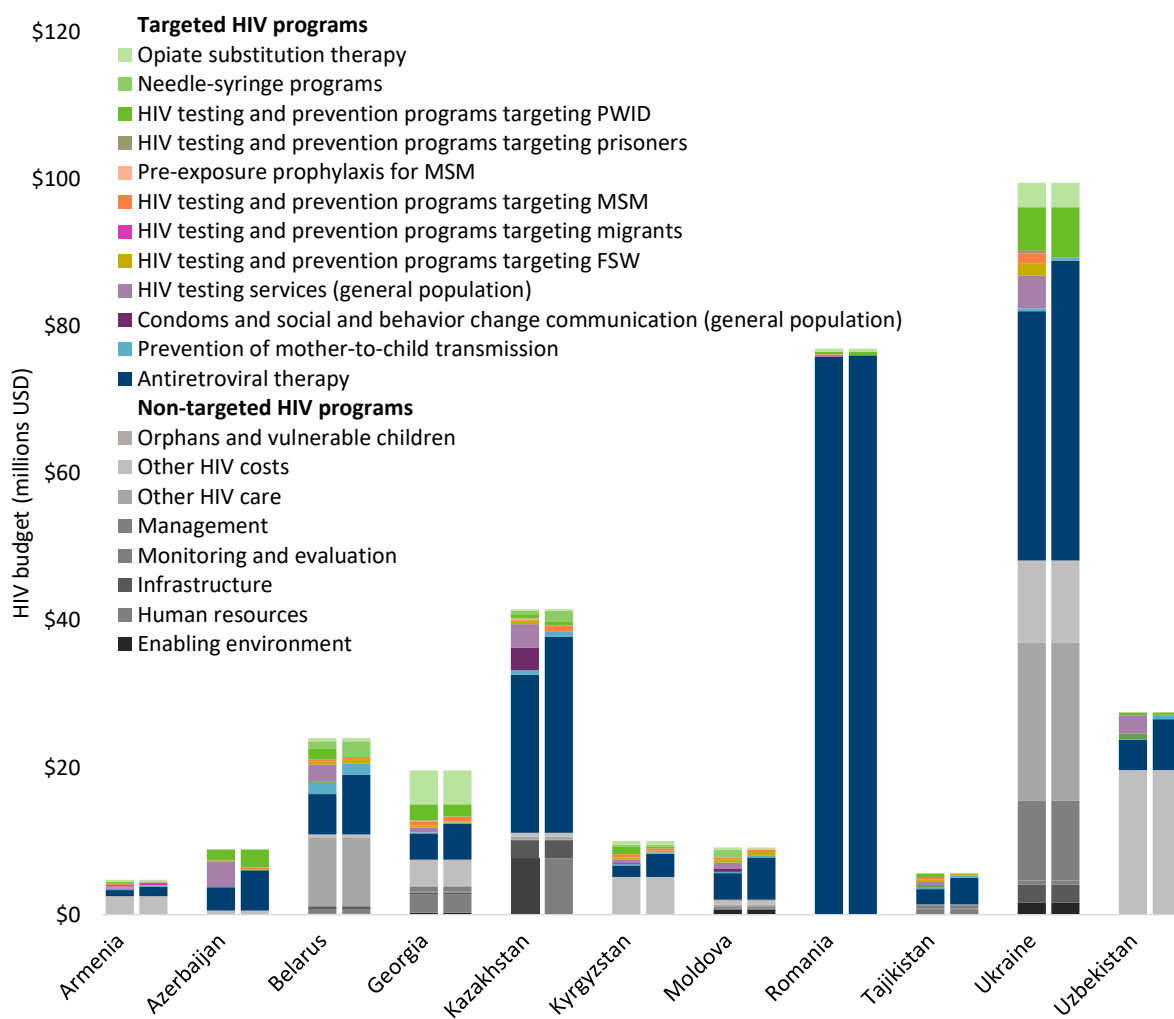


Figure 7: Latest reported annual HIV budget allocations (left bars) versus optimized allocations (right bars) for 2019 to 2030 for 11 countries in EECA

Under 100% optimized annual budget for 2019 to 2030 to minimize new HIV infections and HIV-related deaths over this period, it is estimated that by 2030 30% more new HIV infections could be averted (89,000 more infections averted) and almost 30% more HIV-related deaths could be averted (37,000 more deaths averted) compared with the latest reported allocation being maintained over the same period (figure 8).

If the budget were increased to 150% with optimized allocation, it is estimated that by 2030 new HIV infections could be reduced by over 50% more (140,000 more infections averted) and HIV-related deaths by 40% (51,000 more deaths averted). By 2030, an additional 1.2M DALYs could be averted under optimized budget allocation of 150% budget (almost 40% more) compared with the latest reported budget level (100%) and allocation.

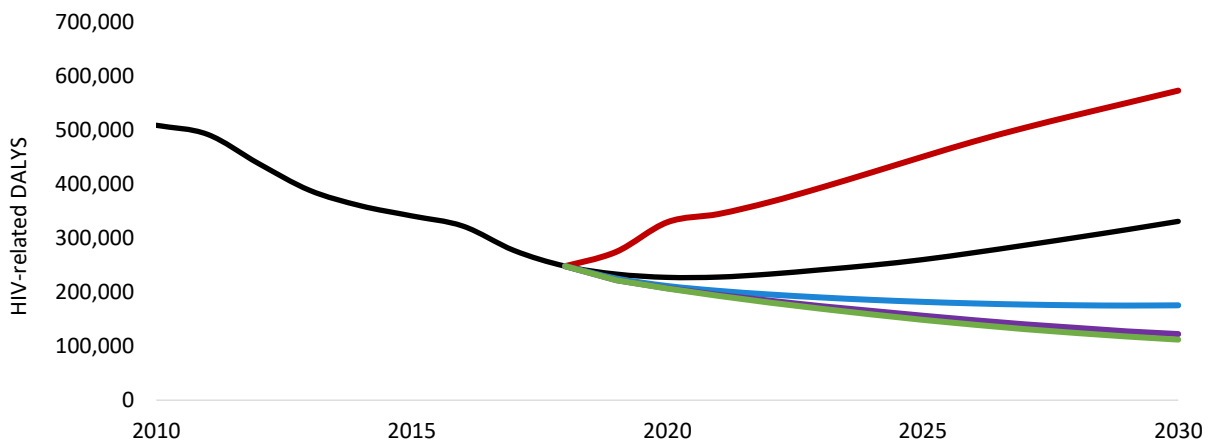
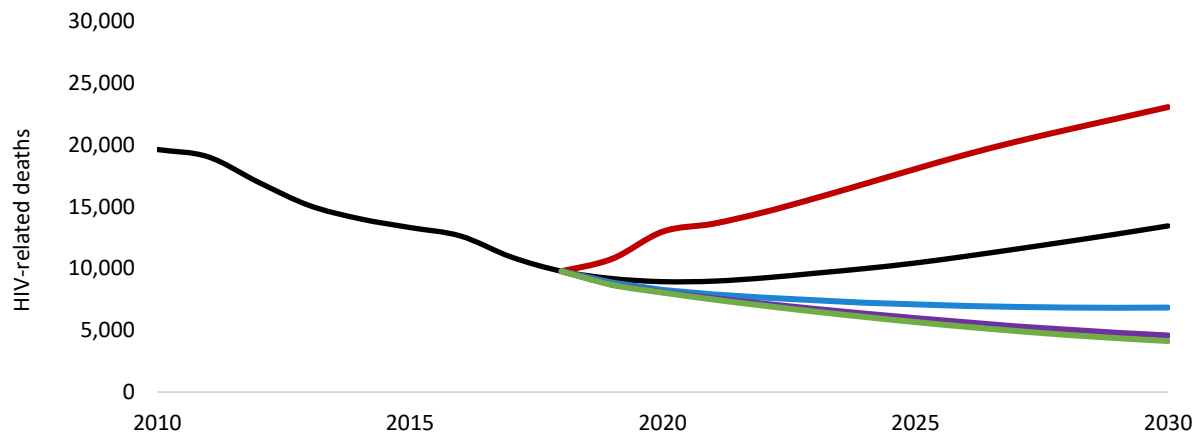
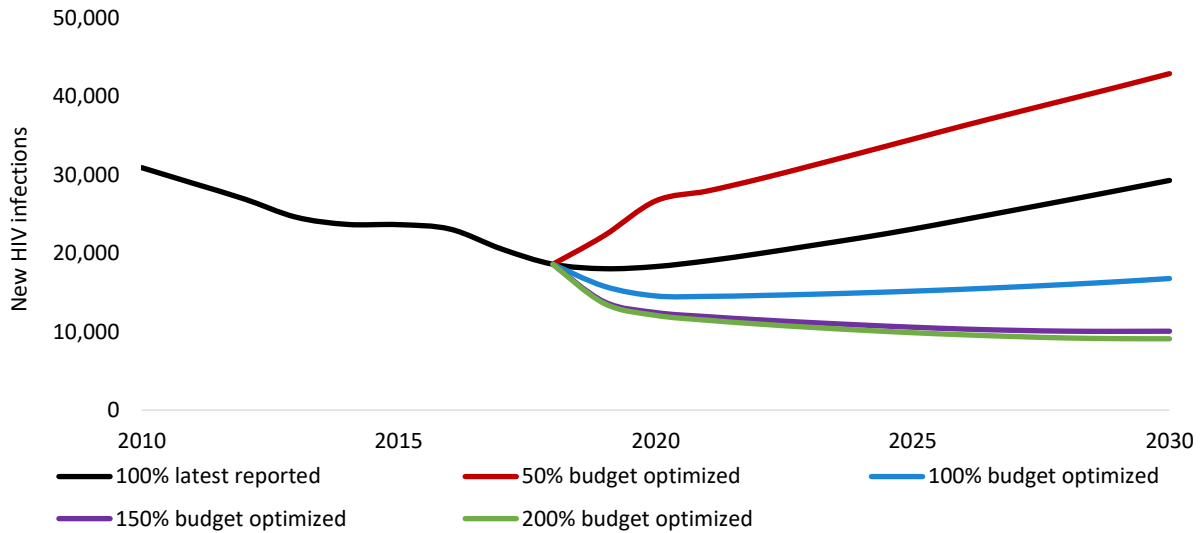


Figure 8: Estimated new HIV infections, HIV-related deaths, and HIV-related DALYs under varying levels of optimized annual budget for 2019 to 2030

Objective 3: To estimate how much it will cost theoretically to achieve 95-95-95 by 2030 under optimized allocation for 11 countries in EECA

Progress towards 90-90-90 targets for the EECA region was reported as 72-53-77 for 2018 (including Albania, Montenegro, North Macedonia, but excluding Uzbekistan) (6). Even with unlimited budget under optimized allocation, study findings suggest that 90-90-90 targets will not be met by the end of 2020, as this is such a short timeframe and there is still progress to be made. If the latest reported budget level and allocation cumulatively for all 11 countries in the EECA region were to be maintained, it is projected that in 2030 73% of people living with HIV will be diagnosed, 67% of those diagnosed will receive treatment, and 81% of those on treatment will achieve viral suppression (figure 9).

To approach 95-95-95 targets, it is estimated that the annual HIV program budget for all 11 countries in EECA for 2019 up to and including for 2030 should be increased to 180% of the total latest reported budgets for these countries (an additional \$169M annually for all countries, figure 10). This assumes the same programs and level of implementation efficiency as latest reported.

In 2030, the regional progress for these countries could be achieved as follows, 91% of people living with HIV be aware of their status, 97% of those diagnosed receive treatment, and 95% of those on treatment to have achieved viral suppression (figure 8). While optimization results are country specific to their national epidemics, scale up of testing is integral to the regional HIV response and is prioritised in eight of the eleven countries (see figure 10).

In 2030

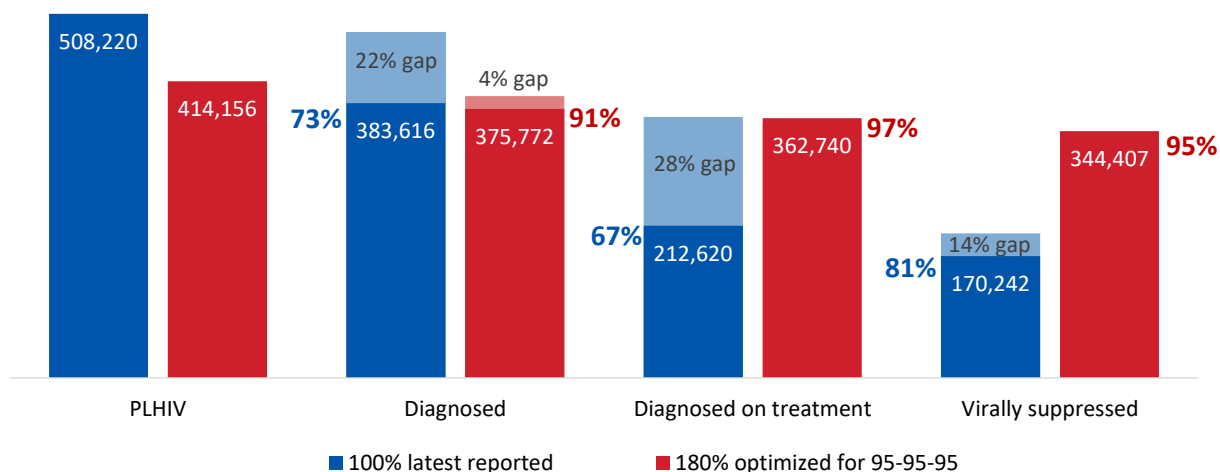


Figure 9: HIV cascade for 2030 under optimized resource allocation for all 11 countries in EECA to best achieve 95-95-95

Dark blue bars: projected progress in 2030 towards 95-95-95 targets under 100% latest reported budget level and allocation. Light blue bars: gap to achieving targets. Red bars: projected progress in 2030 towards 95-95-95 targets with budget increased to 180% of the latest reported budget level optimally allocated to best achieve 95-95-95. Light red bar: gap to achieve the diagnosis target.

To best achieve the 95-95-95 targets by 2030 considering all 11 countries in the EECA region together, it is recommended to increase the overall annual budget to 180%, that is by \$168.8M each year from \$218.5M to \$387.3M for targeted HIV programs only (non-targeted HIV program spending is not considered). HIV testing for general population is to be doubled from 9% in the latest reported budget allocation overall to 20% in the 180% budget level with optimized allocation. Note the contrast with the allocation from objective two, to minimize infections and deaths by 2030, whereby it is not recommended to prioritize this funding. Mainly, increasing HIV testing for general population would increase diagnosis in the region from the low 70% level as reported in 2018 towards 95% targeted by 2030. This assumes no changes in implementation efficiency and an enabling environment to facilitate HIV response, and that focus these areas may speed up the pace in achieving 95-95-95.

Recommended increases in annual HIV programme budget levels with optimized allocation to best achieve 95-95-95 targets by 2030 are shown for each country in figure 11. For Azerbaijan, no increase in budget was deemed necessary, only reallocation of available resources to scale-up ART, PWID, MSM, and FSW programs shifting funds away from HIV testing for the general population and maintaining funding for OST and PMTCT. For three countries, Romania (141%), Armenia (143%), and Belarus (146%) it is recommended to increase budgets to 140% to 150% from 2019 to 2030 to best reach 95-95-95 targets by 2030. A budget increase of between 160% and 200% for three countries, Kazakhstan (160%), Tajikistan (174%), and Georgia (175%), and a more than two-fold increase in budget for four countries, Uzbekistan (215%), Moldova (233%), Kyrgyzstan (239%), and the Ukraine (245%) is recommended

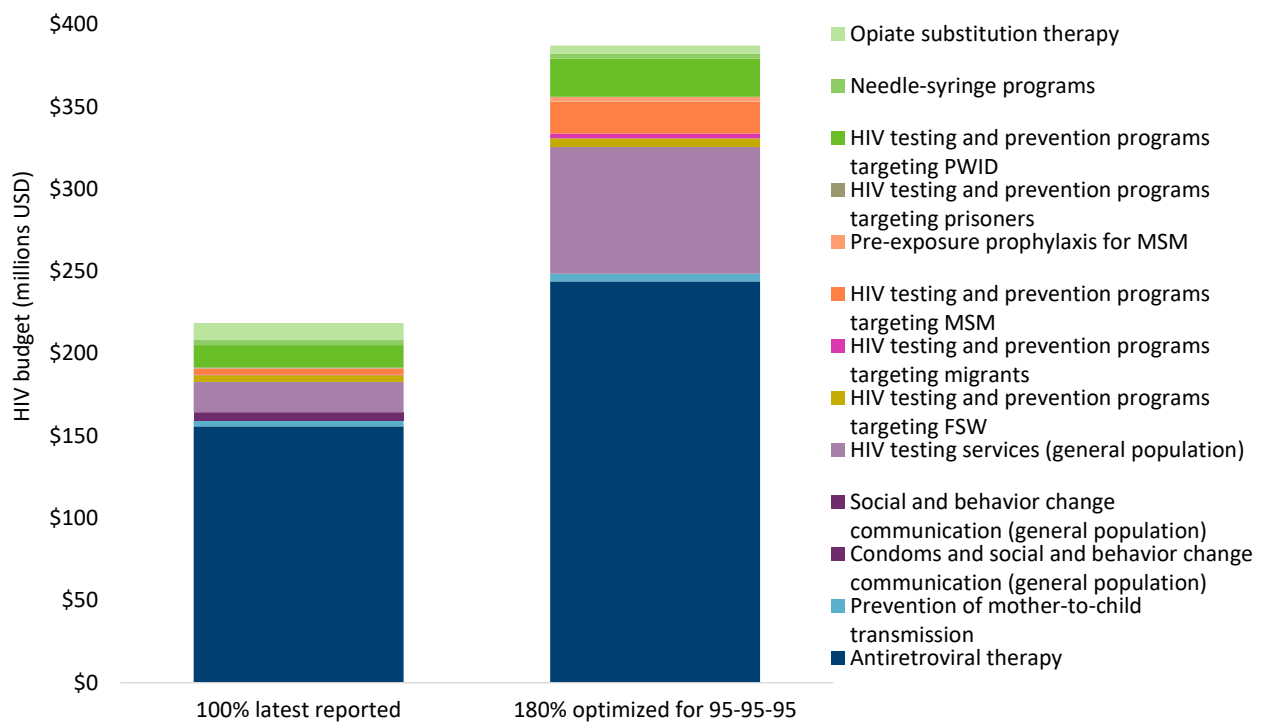


Figure 10: Latest reported HIV budget level and allocation (100%) and the budget increased to 180% under optimized allocation to best achieve 95-95-95 by 2030 for all 11 countries in EECA

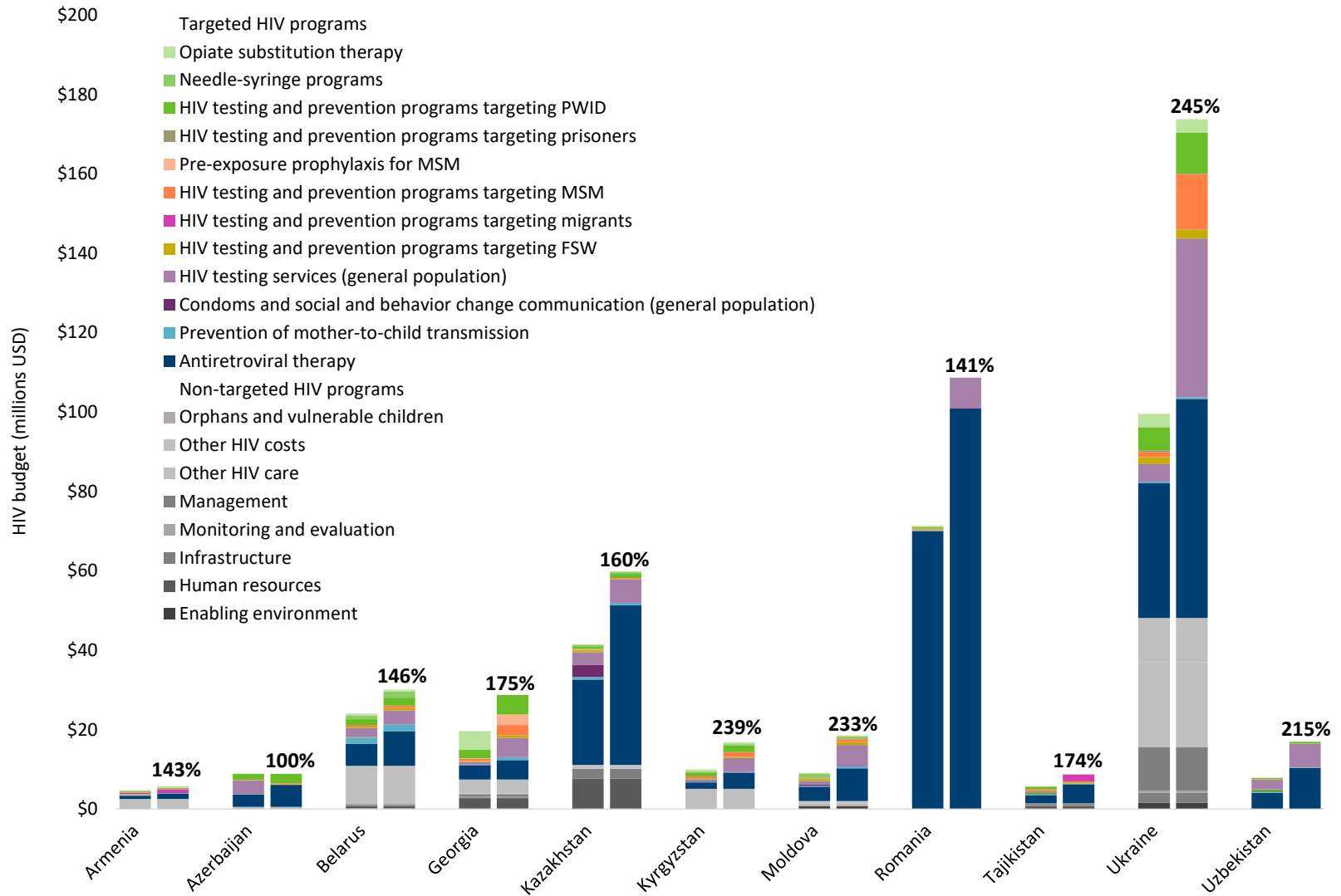


Figure 11: Latest reported HIV budget level and allocation (left bars) and increased optimized budgets to best achieve 95-95-95 targets by 2030 (right bars)

Compared with the latest reported 100% budget allocation, by 2030 under optimized allocation of 180% budget towards achieving 95-95-95 targets it is estimated that 60% more new HIV infections could be averted (approximately 167,000 more infections averted) and 50% of HIV-related deaths could be averted (approximately 64,000 more deaths averted) for the 11 countries in EECA (figure 12).

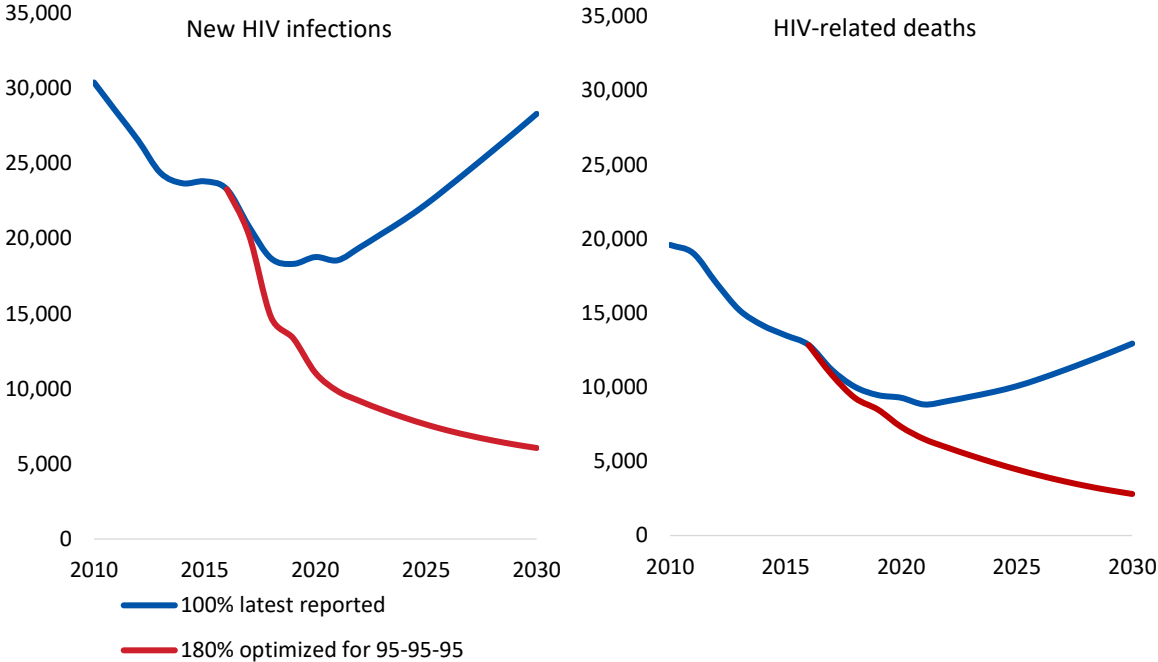


Figure 12: Estimated new HIV infections and HIV-related deaths under optimized allocation towards best achieving 95-95-95 targets by 2030

Study limitations

As with any modeling 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 about 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 inadequate quality or insufficient data, particularly for cost and coverage values informing cost functions. Coupled with epidemic burden, cost functions are a primary factor in modeling optimized resource allocations. Second, we used context-specific values and expert opinion where available, otherwise evidence from systematic reviews of clinical and research studies were used to inform model assumptions. Third, we did not capture the effects of migration of on the HIV epidemic other than for countries with migrant populations. Fourth, this study does not capture the impact of non-targeted HIV programs, there was insufficient evidence to capture the impact of structural interventions, and future technical efficiency changes were not captured in the projections. Finally, these findings are only modeled projections and have not been confirmed in practical settings. The country models used in this study have been calibrated to reflect county-level epidemiological estimates provided by the country team, but validation of results suggesting optimized reallocations that will lead to reductions in infections and deaths in real-world practice has not been done. Shifting resources following evidence from this study will not always be

feasible and may not necessarily be politically favorable but should be considered if there is the will to make a greater impact.

Conclusions

This study demonstrates that optimizing resource allocations across a mix of HIV programs could lead to further reductions in infections, deaths, and DALYs in the EECA region. However, even if the current budgets for the 11 countries in the EECA region are optimized, it is predicted that the 95-95-95 targets will not be reached by 2030. Under the current conditions, quite significant scale up of resources will be required through to 2030 to achieve these targets (180% overall for the countries modeled). However, if drug prices drop, programs for key populations are delivered more efficiently and at lower cost, human rights and gender-related barriers are addressed through social enablers, and additional programs and innovations implemented, less resources would be required to achieve targets. These factors were not forecasted and were not considered in this analysis. The purpose of this modeling 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 identify barriers and underserved populations, and to improve equity, such as through investment in social enablers to remove human rights and gender-related barriers to health services. It could be examined whether resource reallocations have reached diminishing returns or if there is more room for further allocative efficiency. In addition, implementation efficiency and equity of access to services could be explored. More robust data should be collected to inform such additional analyses.

References

1. HIV Financial Dashboards: UNAIDS; 2020 [Available from: <http://hivfinancial.unaids.org/hivfinancialdashboards.html>].
2. AIDSinfo. Geneva: UNAIDS; 2020 [Available from: <http://aidsinfo.unaids.org>].
3. Prevention Gap Report. Geneva: UNAIDS; 2016.
4. Global AIDS Update: Miles to go: closing gaps, breaking barriers, righting injustices. Geneva: UNAIDS; 2018.
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. *Journal of Acquired Immune Deficiency Syndromes*. 2015;69(3):365-76.
6. UNAIDS Data 2019. Geneva: UNAIDS; 2019.

Appendix tables

Please see country HIV EECA reports for calibrations, cost functions, and model parameters.

Table A1: Estimated new HIV infections and HIV-related deaths averted from 2015-2017 HIV program spending for 11 countries in EECA

Indicator	Actual HIV spending	No spending 2015-2017	Averted	Percentage of infections or deaths averted through 2015-2017 spending over this period
Infections	55,000	148,500	93,500	170%
Deaths	32,600	81,500	48,900	150%

Table A2: HIV programme budgets including targeted and non-targeted HIV program spending for 11 countries in EECA with percent Global Fund contribution and percent non-targeted HIV program spending

Country	Total HIV spending, latest reported	Non-targeted HIV spending, latest reported	% of budget on non-targeted	Global Fund contribution, 2018	% of Global Fund contribution, 2018
Armenia	\$4,212,417	\$2,532,797	60%	\$2,275,164	54%
Azerbaijan	\$8,914,129	\$567,038	6%	\$2,598,214	29%
Belarus	\$24,033,990	\$10,931,130	45%	\$2,096,448	9%
Georgia	\$19,600,865	\$7,467,669	38%	\$2,680,140	14%
Kazakhstan	\$41,537,753	\$11,124,774	27%	\$2,082,043	5%
Kyrgyzstan	\$11,579,905	\$5,108,532	44%	\$7,472,414	65%
Moldova	\$9,142,285	\$2,038,127	22%	\$2,134,885	23%
Romania	\$71,343,377	\$58,159	0.1%	\$70,935	0.1%
Tajikistan	\$5,603,640	\$1,402,813	25%	\$1,918,812	34%
Ukraine	\$99,512,235	\$48,165,611	48%	\$14,041,646	14%
Uzbekistan	\$25,189,241	\$19,645,241	78%	\$2,062,097	8%
Total	\$320,669,837	\$109,041,891	34%	\$39,432,797	12%

*Latest reported values were most commonly for 2018. See country reports for spending by non-targeted HIV program.

These data were collated as part of this study in consultation with national teams. The Global AIDS Monitoring indicator 8.1 data on HIV expenditures were not strictly used.

Table A3: Unit costs for HIV programs for 2018 (unless indicated otherwise) for 11 countries in EECA

HIV program	Armenia	Azerbaijan	Belarus	Georgia	Kazakhstan	Kyrgyzstan	Moldova right bank	Moldova left bank	Romania	Tajikistan	Ukraine	Uzbekistan
Antiretroviral therapy (ART)	\$437.41	\$716.15	\$352.71	\$782.14	\$1,438.22	\$423.88	\$663.21	\$550.47	\$5,893.37	\$364.86	\$276.50	\$166.80
Condoms and SBCC			\$0.06*		\$0.80	\$3.96	\$1.25			\$10.07 (2017/2018)		\$3.84 (2012)
HIV testing services (HTS) (general population)	\$10.00	\$4.20	\$1.37	\$8.01 (2016)	\$1.18	\$1.15	\$3.21	\$2.41	\$0.91	\$21.11 (2017/2018)	\$2.45	\$0.74
HIV testing and prevention programs targeting FSW	\$34.02	\$2.74	\$47.25	\$66.64 (2019)	\$28.10	\$50.79	\$51.27	\$56.10	\$90.00	\$29.81 (2017/2018)	\$42.65	\$6.51
HIV testing and prevention programs targeting migrants	\$11.58									\$10.45 (2017/2018)		
HIV testing and prevention programs targeting MSM	\$34.89	\$8.10	\$25.95	\$57.35 (2019)	\$19.10	\$44.21	\$41.78	\$56.71	\$99.51	\$34.77 (2017/2018)	\$29.24	\$2.22
HIV testing and prevention programs targeting PWID	\$56.53	\$41.03	\$28.66		\$10.40	\$55.74			\$109.46†	\$95.90† (2017/2018)	\$26.00†	\$11.75†
HIV testing and prevention programs targeting prisoners	\$4.79										\$6.89	
Needle-syringe program (NSP)			\$18.21	\$64.72 (2019)	\$8.70	\$11.73	\$54.78	\$41.84				
Opiate substitution therapy (OST)	\$608.39	\$139.43	\$643.27	\$503.73	\$493.40	\$447.88	\$634.53		\$229.81		\$290.52 (2016)	
Prevention of mother-to-child transmission (PMTCT)	\$3,769.11	\$401.97	\$6,441.00	\$2,549.02	\$860.32	\$894.83	\$1,115.22	\$461.18		\$757.91	\$173.93	\$208.80
Pre-exposure prophylaxis (PrEP) for MSM				\$472.56 (2019)	\$105.00 (2019)							

*Excluding condom distribution programs. †Includes needle-syringe programs (NSP). SBCC = social behaviour change communication.