HIV INVESTMENT IN TOGO
OPTIMIZING INVESTMENTS FOR A SUSTAINABLE AND EFFICIENT HIV RESPONSE IN TOGO

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FINDINGS FROM AN HIV ALLOCATIVE EFFICIENCY STUDY

Conseil National de Lutte contre le Sida et les Infections Sexuellement Transmissibles
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ABBREVIATIONS

AIDS	Acquired immune deficiency syndrome
ART	Antiretroviral therapy
ARV	Antiretroviral
ASD	Adaptive stochastic descent
BOD	Burden of disease
Clients	Clients of female sex workers
DALY	Disability-adjusted life year
DU	Drug users
ENV	Enabling environment
Female youth	Females 15–25 years old excluding key population groups in this age group
Females 25–45	Female 25–49 years old excluding key population groups in this age group
FSW	Female Sex Workers
GDP	Gross domestic product
Global Fund	The Global Fund to Fight AIDS, Tuberculosis and Malaria
HIV	Human Immunodeficiency Virus
HR	Human resources
HTS general	HIV testing services for the general population
IBBSS	Integrated bio-behavioral surveillance survey
IDU	Injecting drug use
IEC	Information, education and communication
INFR	Health Infrastructure
Male youth	Male 15–25 years old excluding key population groups in this age group
Males 25–45	Male 25–49 years old excluding key population groups in this age group
MGMT	Management
Military	Military personnel
M&E	Monitoring and evaluation
MSM	Men who have sex with men
NCD	Non-communicable diseases
NHA	National health accounts
NSP	Needle and syringe exchange program
PLHIV	People living with HIV
PMTCT	Prevention of mother-to-child transmission
PNLS-Togo	Programme National de Lutte contre le Sida et les IST
Condoms and SBCC	Condom promotion and distribution and social and behavior change communication
STI	Sexually Transmitted Infection
THE	Total Health Expenditure
WCA	West and Central Africa
WHO	World health Organization
YLL	Years of life lost

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EXECUTIVE SUMMARY

BACKGROUND

This report summarizes the findings of an allocative efficiency analysis to support Togo's national HIV response. The report was prepared while Togo was in the process of drafting a National HIV Strategic Plan for 2016–20 and preparing a concept note for 2018–20 for the Global Fund to Fight AIDS, Tuberculosis and Malaria (the Global Fund). The Government of Togo indicated a desire to mobilize additional resources, including domestic and private resources, for comprehensive HIV services to respond to the goals of the national HIV Strategic Plan. To assure that the resources that have been, or will be, mobilized are used in the most efficient way, and to determine the allocation of resources that brings the greatest health benefit, the Government of Togo asked the World Bank to conduct this allocative efficiency analysis (Section 1) using the Optima HIV mathematical model.

Togo's spending on health is one of the highest in West and Central Africa, but it remains insufficient to cover a very large treatment gap.

Togo is a low-income country with an estimated population of 7.12 million in 2014. At 0.473, Togo's Human Development Index ranks 166 out of 188 countries, similar to Benin, Sudan, and Uganda. The gross domestic product (GDP) per capita was US$625 in 2014, an increase of 11 percent from 2011. The three leading causes of disability-adjusted life years (DALYs) for all age groups in 2013 were malaria (14 percent), lower respiratory tract infections (9 percent), and HIV/AIDS (9 percent)[1]. Of these, HIV/AIDS had the highest increase since 1990 (885 percent). Togo has a mature, mixed HIV epidemic with an estimated prevalence of 2.5 percent among males and females (15–49 years, excluding key populations) in 2014, but with significant disparities between genders, regions, and key populations. Considering the high burden of disease attributable to HIV, the HIV response remains a critical component of health service delivery.

Togo has a very large antiretroviral treatment gap. In 2014 (the last year for which data was available at the time that this study was conducted), it was estimated that only 33 percent of the country's 110,400 people living with HIV (PLHIV) were on antiretroviral therapy (ART). More recent estimates indicate that treatment coverage has increased, but that approximately half of all PLHIV were still not receiving treatment in 2017.[2] Low ART coverage and low proportional spending on ART is characteristic of the HIV responses in West and Central Africa. According to UNAIDS (the Joint United Nations Programme on HIV/AIDS), PLHIV in Eastern and Southern Africa are more likely to obtain treatment services than people in Western and Central Africa.[3] In the West Africa Region, 65 percent of people who were estimated to be eligible for treatment under the

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1 Health Data: Togo (online database), Institute for Heath Metrics and Evaluation (IHME), http://www.healthdata.org/Togo.

2 UNAIDS, 2017. *Ending AIDS: Progress towards the 90–90–90 Targets* (Geneva, UNAIDS).

3 UNAIDS, 2013. *Access to Antiretroviral Therapy in Africa: Status Report on Progress Towards the 2015 Targets.*

2013 World Health Organization (WHO) guidelines were not receiving antiretroviral therapy in 2017, compared to 40 percent in East and Southern Africa.

Togo's spending on health is one of the highest in West and Central Africa. According to WHO estimates for 2013, total health spending as a percentage of GDP in Togo was 9 percent, an increase of more than 60 percent since 2000. In the same year, per capita health expenditure was US$54, a four-fold increase since 2000, and 52 percent of health expenditure was funded from public sources. Government health expenditure has increased by more than 80 percent since 2000, while out-of-pocket spending has decreased from 63 percent to 41 percent of total health expenditure.

The HIV response has remained heavily dependent on donors' contributions. Total HIV spending in Togo increased by nearly 50 percent between 2006 and 2014. During the same period, public funding nearly tripled and international funding has increased by approximately 30 percent. The Global Fund has been the country's major international donor, contributing around 60 percent of all donor funds in 2014. In 2014, the total funding for Togo's HIV response was approximately US$21 million, of which 75 percent was financed from international donors and the remainder was funded by domestic sources. In 2014, 12 percent of domestic funding was financed from private sources, with household contributions through out-of-pocket user-fees representing approximately 80 percent of private spending.

After consultations with key stakeholders and in collaboration with the steering committee of this study, the following specific questions were set for this analysis:

- What would be the expected trends in the HIV epidemic if 2014 spending volume and patterns were maintained into the future?
- What is the expected future impact of different policy or program implementation scenarios, including the impact of reaching the 90/90/90 goals issued by UNAIDS (the Joint United Nations Programme on HIV/AIDS), and attaining 90 percent coverage of prevention of mother-to-child transmission (PMTCT) programs?
- Can the HIV response be improved by optimizing the allocation of funding?
- How much will it cost to achieve proposed National HIV Strategic Plan targets?
- What are the long-term financial commitments to HIV services for PLHIV?

METHODS

The analysis was conducted using Optima HIV, which is an epidemiological and economic model of HIV transmission with a resource optimization feature (see Section 2 and Annex 1). For the analysis, the inputs into the Optima HIV model were gathered through a comprehensive literature review, and key parameters were defined in consultation with key stakeholders. Local demographic, epidemiological, and programmatic data were used to populate the model. Population data for key populations (female sex workers [FSW],men who have sex with men [MSM], people who inject drugs [PWID], and prisoners) were extrapolated based on the available local size estimation. Cost and expenditure estimates were derived from the National AIDS Spending Assessment (NASA).

KEY FINDINGS

- Assuming stable behavior and no increase in the HIV budget from the 2014 levels, **the number of PLHIV is predicted to increase** by 24 percent from 110,400 in 2014 to 136,300 by 2030. **New infections are predicted to increase** 57 percent from 6,300 per year in 2014 to 9,900 per year in 2030. **Deaths are predicted to increase** 31 percent from 4,400 per year in 2014 to 5,700 per year by 2030.

- If the 2014 funding levels are maintained, HIV prevalence is expected to stabilize in all key populations between 2014 and 2030. Among children, and male youth and female youth in the general population, prevalence is estimated to stabilize at low levels between 2014 and 2030. Prevalence is also expected to stabilize among men and women aged 25–49 years in the general population, but at higher levels.

- At the end of 2014 (the last year for which data was available at the time that this study was conducted), there was a large treatment gap in Togo with only 33 percent of PLHIV receiving treatment. More recent estimates indicate that treatment coverage has increased, but that approximately half of all PLHIV were still not receiving treatment in 2017.

- The HIV allocative efficiency analysis using Optima HIV confirmed that the 2014 budget of US$20.8 million was close to being optimally allocated, with limited gains to be made from reallocation among the different interventions and population groups. However, it should be noted that the optimization does not take into account indirect costs which are considered fixed. If all indirect costs were reduced by 25 percent, then 16,900 more PLHIV might be placed onto treatment. This could avert approximately 19,900 new infections and 15,400 deaths by 2030. As management costs make up a large proportion of indirect costs, reducing management costs by 25 percent might enable an extra 10,600 people to be put onto treatment, thus averting 9,900 deaths and 11,000 new infections by 2030.

- **The 2014 annual budget of US$20.8 million would not be enough to reduce incidence and deaths by 50 percent**. In order for Togo to reduce incidence and deaths by 50 percent by 2020, an annual budget envelope of approximately US$39.2 million is required (an 88 percent increase compared to the 2014 budget).

- **Being even more ambitious, meeting UNAIDS goals of 90-90-90 would require additional HIV funding during the 2016 to 2020** HIV strategy period. Achieving the 90-90-90 targets would cost an estimated US$93.7 million between 2016 and 2020 for treatment, and US$3.2 million for testing, at 2014 unit costs, in real terms. **Meeting the 90-90-90 targets could avert an estimated 63,400 (56 percent) new infections by 2030 and 47,900 (68 percent) deaths** compared to baseline coverage.

- **This implies that HIV financing needs to be increased (either through domestic or international sources)** to cover treatment gaps and sustain other

comprehensive, harm reduction oriented prevention services for key populations.

- Reducing indirect costs (e.g., management costs), may be another way to expand the total budget available for the programmatic epidemic response. **Future technical and production efficiency analyses should explore ways to reduce costs without compromising the quality of care.**

- **PMTCT programs also remain critical,** both for preventing new infections among children, and increasing testing and treatment coverage for females aged 15–49 years. If 90 percent coverage for PMTCT was obtained by 2020, this could avert 3,000 (35 percent) of new infections among children.

CONCLUSIONS

1 **The Togolese government has responded effectively to a complex, mixed HIV epidemic.** The government's opportunities to optimize the 2014 HIV spending to further minimize HIV incidence, prevalence and HIV-related deaths are minimal.

2 The findings highlight a significant treatment gap, and argue strongly for additional funding, optimally allocated, to achieve 90-90-90 targets and respond most effectively to this epidemic. **Effective ART scale-up is needed** and **c**overage must be increased if global targets are to be met.

3 **In order to reduce the treatment gap whilst ensuring additional funding for non-ART HIV programs for key populations, in particular FSW, which are a key driver of the epidemic, a series of concomitant actions are required.** These include: reduced spending on general prevention programs targeting low-risk populations; a larger budget envelope; prioritization of spending on core programs; reduced spending on indirect programs where feasible; technical efficiency gains; securing investment from budget components not earmarked for HIV but that benefit from the broader public health impacts of HIV programs that target key populations.

4 In order to reduce incidence and deaths by 50 percent, resources should be shifted from prevention programs targeting the general low risk population to ART, PMTCT, and non-ART prevention programs targeted to key populations.

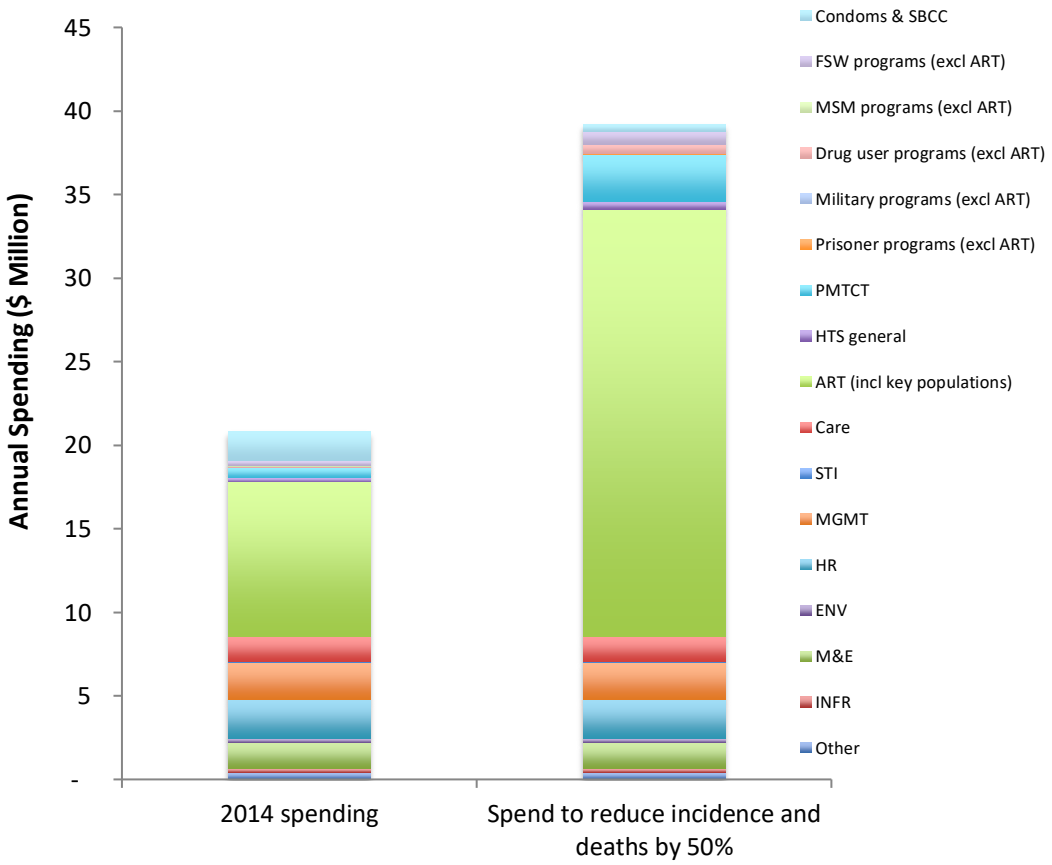
5 **Key population HIV programs would benefit from having ART initiation and adherence initiatives fully integrated into them**.

6 **Additional domestic resources will be needed to sustain the HIV response.** Funding for HIV in Togo has increased since 2007. However, excluding ART, preventive programs and programs targeted at key populations are primarily funded by international donors. As such, any future decreases in international funding without a concurrent increase in domestic resources would have a significant negative impact on the HIV epidemic in Togo.

7 **Greater technical efficiency in spending might be achieved through strategies to reduce the average spending per person reached.** This is particularly true for indirect spending. However, care should be taken to ensure that these strategies do not compromise the quality of prevention or treatment. Further analyses of technical efficiency are also needed before more robust conclusions can be reached.

8 **All of the results from this study point towards the conclusion that Togo currently does not have the appropriate resources to achieve its targets and that optimization gains alone cannot close this gap (Figure E 1).**

Figure E 1 Comparing the allocation of 2014 annual spending against the optimal allocation to reduce deaths and incidence by 50 percent



Note: SBCC = social and behavior change communication; HTS = HIV testing service; STI = sexually transmitted infections programs; MGMT = management; HR = human resources; ENV = enabling environment; M&E = monitoring and evaluation; INFR = infrastructure. Programs are as per NASA definitions.

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1 BACKGROUND: WHY ALLOCATIVE EFFICIENCY ANALYSIS NOW?

1.1 POPULATION, WEALTH AND HUMAN DEVELOPMENT IN TOGO

Togo is a low-income country with an estimated population of 7.12 million in 2014. The population has increased at an average of 2.7 percent per year since 2000,[4] giving Togo the 17th highest population growth in the world.[5]

In 2014, Togo's Human Development Index ranked 166 out of 188 countries, with an index of 0.473, similar to Benin, Sudan, and Uganda. GDP per capita was US$625 in 2014,[6] an increase of 11 percent from 2011.

Togo borders Benin, Burkina Faso, and Ghana, and is situated along the Abidjan-Lagos Transport Corridor, which plays an important role in the HIV epidemic.

1.2 TOGO'S HEALTH AND HEALTH FINANCING CONTEXT

1.2.1. BURDEN OF DISEASE

Life expectancy in 2013 in Togo was 61.1 years for males and 64.7 years for females, an increase from 57.4 years and 59.7 years in 1990 respectively.[7] Togo's overall burden of disease is characterized by a mix of significant causes of morbidity and mortality (**Figure 1.1**). Neonatal and child mortality continue to contribute to the overall number of disability adjusted life years (DALYs). The three leading causes of DALYs for all age groups in 2013 were malaria (14 percent), lower respiratory tract infections (9 percent), and HIV/AIDS (9 percent).[8] Of these, HIV/AIDS had the highest increase since 1990 (885 percent). Considering the high burden of disease attributable to HIV, the HIV response remains a critical component of health service delivery.

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4 World Bank Open Data, online database, World Bank, http://data.worldbank.org/country/togo.

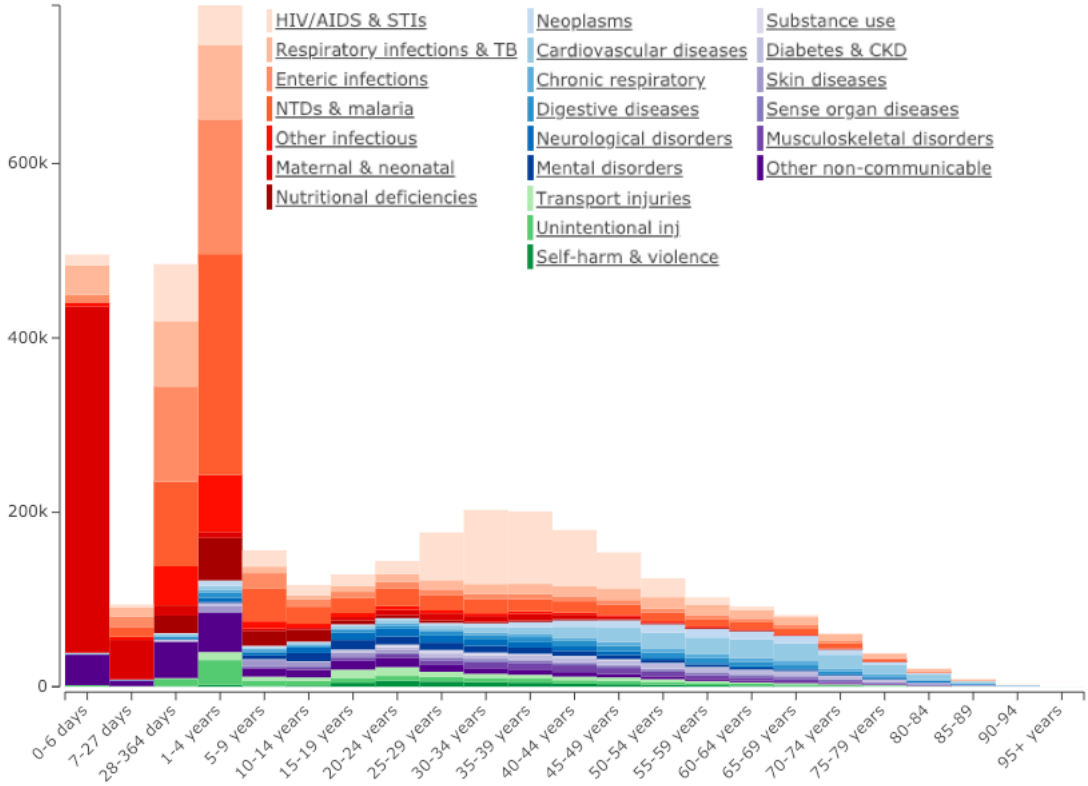
5 The World Factbook (online database), Central Intelligence Agency, https://www.cia.gov/library/publications/the-world-factbook/rankorder/2002rank.html.

6 World Bank Development Indicators (online database), World Bank.

7 Health Data: Togo, IHME, http://www.healthdata.org/Togo.

8 Health Data: Togo, IHME, http://www.healthdata.org/Togo.

Figure 1.1 Cause-specific Disability Adjusted Life Years (DALYs) by age, 2010[9]



Note: LRI = lower respiratory infection; NTD = neglected tropical diseases; inj = injuries; CKD = chronic kidney disease

1.2.2. HEALTH CARE FINANCING AND EXPENDITURE

Togo has a mixed health financing system funded from both public and private sources. The main sources of financing are government contributions, out of pocket payments, compulsory social health insurance (SHI) contributions, and voluntary private insurance contributions. Compulsory social health insurance, introduced in 2012, only covers public sector workers, who account for 10 percent of the population. A number of private health insurance companies similarly cover only a minority of the population, mainly from higher-income groups.[10,11]

At the time this report was prepared, Togo's spending on health was among the highest in West and Central Africa (WCA) (**Figure 1.2**). According to WHO estimates for 2013[12], total health spending as a percentage of GDP in Togo was 9 percent, an increase of more than 60 percent since 2000 (**Table 1.1**). In the same year, per capita health expenditure was US$54, representing a four-fold increase since 2000 (**Table 1.1**), with 52 percent of health expenditure funded from public sources (**Table 1.1**). Government health expenditure has increased by more than 80 percent since 2000, while out-of-pocket

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9 Health Data, IHME, http://vizhub.healthdata.org/gbd-compare/patterns.

10 WHO, Country Cooperation Strategy Brief, Togo, 2014. http://apps.who.int/iris/bitstream/handle/10665/136894/ccsbrief_tgo_en.pdf?sequence=1.

11 International Organization for Migration, Country Fact Sheet, Togo, 2014.

12 National Health Accounts Database, WHO, http://apps.who.int/nha/database/Select/Indicators/en.

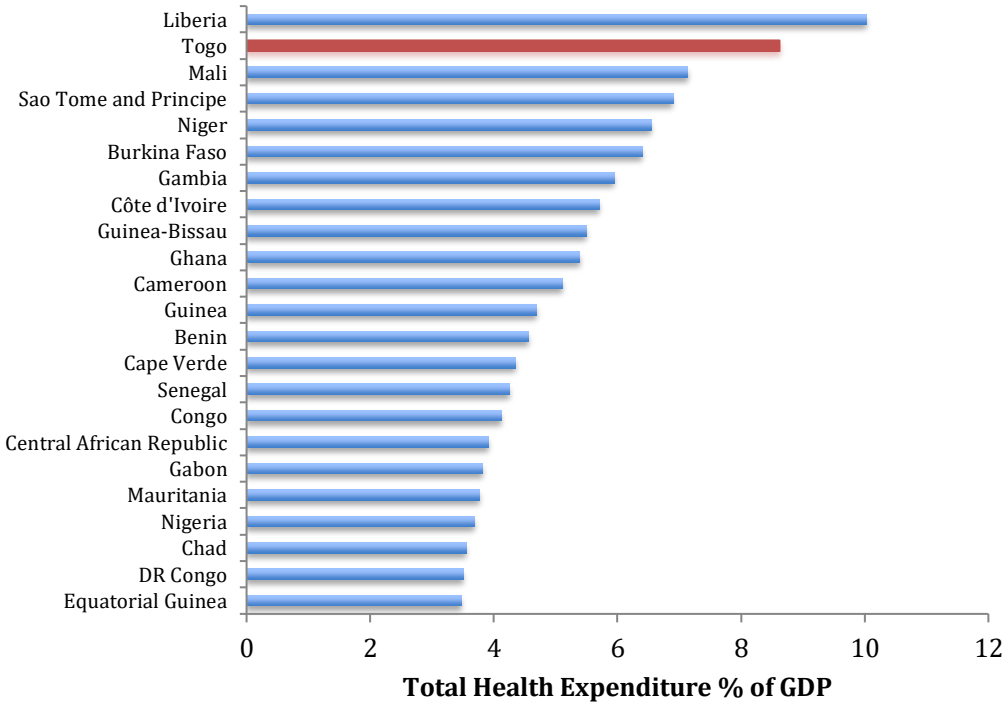
spending has decreased from 63 percent to 41 percent of total health expenditure (**Table 1.1**).

Table 1.1 Trends in health expenditure in Togo, 2000–13

INDICATOR	2000	2005	2010	2011	2012	2013
GDP (current prices, US$, millions)	1,294	2,110	3,193	3,688	3,882	4,306
Total health expenditure (US$, millions)	69	139	251	295	320	371
Total health expenditure (US$ per capita)	14	25	40	46	48	54
Total health expenditure as a percentage of GDP	5	7	8	8	8	9
Government health expenditure as a percentage of total health expenditure	29	29	48	47	51	52
Private health expenditure as a percentage of total health expenditure	71	71	52	53	49	48
Government health expenditure as a percentage of total government expenditure	8	10	15	15	15	15
External resources for health as a percentage of total health expenditure	6	19	17	16	15	6
Social security expenditure on health as a percentage of total government expenditure	12	10	6	6	6	6
Out-of-pocket health expenditure as a percentage of total health expenditure	63	60	44	45	42	41

Source: World Bank data.

Figure 1.2 Total expenditure on health as a percentage of GDP in West and Central African countries, 2013, WHO estimates



Source: WHO National Health Accounts Database, http://apps.who.int/nha/database/Select/Indicators/en, accessed April 20, 2016.

1.3 THE HIV EPIDEMIC IN TOGO

1.3.1. OVERVIEW OF THE HIV EPIDEMIC

Togo has a mature, mixed HIV epidemic with an estimated HIV prevalence of 2.5 percent among males and females (15–49 years) in 2014[13]. Significant disparities amongst genders, regions, and key populations exist. Estimated prevalence is higher amongst women (3.1 percent) than men aged 15–49 (1.7 percent)[14]. Prevalence is also higher in the coastal regions (Lome 3,4 percent, Maritime 3 percent) than the northern regions (Kara 1.8 percent, Savane 0.3 percent), and in urban areas (3.5 percent) compared to rural areas (1.5 percent).[15] Population size and HIV prevalence for key populations at higher risk of HIV exposure are outlined in **Table 1.2**. Prevalence is higher among certain key populations such as FSW (11.7 percent),[16] MSM (13.0 percent),[17] prisoners (4.3 percent),[18] drug users (5.5 percent),[19] and military (3.8 percent).[20] Within the drug user population in Togo, injecting drug users make up 2.8 percent, making sexual transmission a higher risk factor than injecting drug use among this population[21].

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13 National HIV Strategic Plan draft 2016–2020, based on Spectrum/EPP.

14 Programme National de Lutte contre le Sida et les IST (PNLS-Togo). 2015. Rapport d'activité sur la riposte au VIH/Sida au Togo.

15 PNLS-Togo. 2015. Rapport d'activité sur la riposte au VIH/Sida au Togo.

16 FSW biological and behavioral survey (BBS) survey 2015.

17 MSM BBS 2015.

18 PNLS-Togo. 2011. Enquête comportementale et de séroprévalence du VIH chez les prisonniers Togo en 2011.

19 PNLS-Togo. 2011. Enquête comportementale et de séroprévalence du VIH chez les utilisateurs de drogues au Togo en 2011.

20 Enquête de Comportement et de Séroprévalence chez les Militaires 2014.

21 PNLS-Togo, 2011. Enquête comportementale et de séroprévalence du VIH chez les utilisateurs de drogues au Togo en 2011.

Table 1.2 Population size and prevalence among populations

POPULATION	ESTIMATED POPULATION SIZE (MOST RECENT VALUE)	PREVALENCE (MOST RECENT VALUE)
FSW	17,909[22,23]	11.7% (CI 9.9%-13.5%)[24]
FSW Clients	106,847 (estimate)[25]	1.8% (CI 0.8%-2.6%)[26]
MSM	7,649[27]	13.0 (CI 10.1%-16.0)[28]
Drug users	40,800[29]	5.5% (CI 3.2% – 7.8%)[30]
Prisoners	4,349[31]	4.3% (CI 3.2% – 5.5%)[32]
Military	13,800[33]	3.8% (CI 2.9%-4.7%)[34]

Note: CI = confidence interval.

1.3.2. HIV INCIDENCE TRENDS

The Optima HIV model, which will be described in more detail in the next section, estimates that the highest number of new infections transmitted in 2014 were by males aged 25–49 years (39 percent), while the largest number of new infections acquired in 2014 were among females aged 25–49 years (49 percent), followed by males aged 25–49 years (26 percent), and females aged 15–24 years (15 percent) (**Figures 1.3 and 1.4**). These findings are supported by other studies in the region,[35] which suggests that the impact of networks between older men and young females plays an important role in the HIV transmission dynamics.

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22 E. A. Papworth et al. 2014. The proportion of the population who are FSW in Togo is estimated to be 0.82 percent (95 percent CI 0.57–1.07 percent) or 13,771 (95 percent CI 9,634–17,909).

23 Conseil National De Lutte Contre Le SIDA, 2015. Etude sur l'estimation de la taille et cartographie des sites HSH et PS au Togo. According to these estimates, 6,292 (CI 5,234-7,352) or 2.4%, of the female population 15–49 living in cities were FSW. In order to reconcile both these studies, it was decided to use the higher estimate from the national study (Papworth et al. 2014).

24 Université de Lome and Unité de Recherche Démographique. 2015. Enquête comportementale et de séroprévalence du VIH chez les professionnelles du sexe et leurs clients au Togo. PS-TOGO_2015.

25 Estimate derived from raw data from Demographic Health Surveys (DHS) report. Source: Ministère de la Planification, du Développement et de l'Aménagement du Territoire (MPDAT), Ministère de la Santé (MS) et ICF International, 2015. Enquête démographique et de santé au Togo 2013–2014. Rockville, Maryland, USA : MPDAT, MS et ICF International.

26 Université de Lome and Unité de Recherche Démographique. 2015. Enquête comportementale et de séroprévalence du VIH chez les professionnelles du sexe et leurs clients au Togo. PS-TOGO 2015.

27 Conseil National De Lutte Contre Le SIDA, 2015. Etude Sur L'estimation De La Taille Et Cartographie Des Sites HSH et PS au Togo.

28 Enquête comportementale et de séroprévalence du VIH chez les hommes ayant des rapports avec d'autres hommes (HSH) Togo en 2015.

29 Conseil National De Lutte Contre Le Sida et Les Infections Sexuellement Transmissibles, 2014. Rapport De Progrès Sur La Riposte Au VIH et Au Sida Au Togo, GARPR 2014.

30 PNLS-Togo. 2011. Enquête comportementale et de séroprévalence du VIH chez les utilisateurs de drogues au Togo en 2011.

31 Direction General de l'Administration Pénitentiaire.

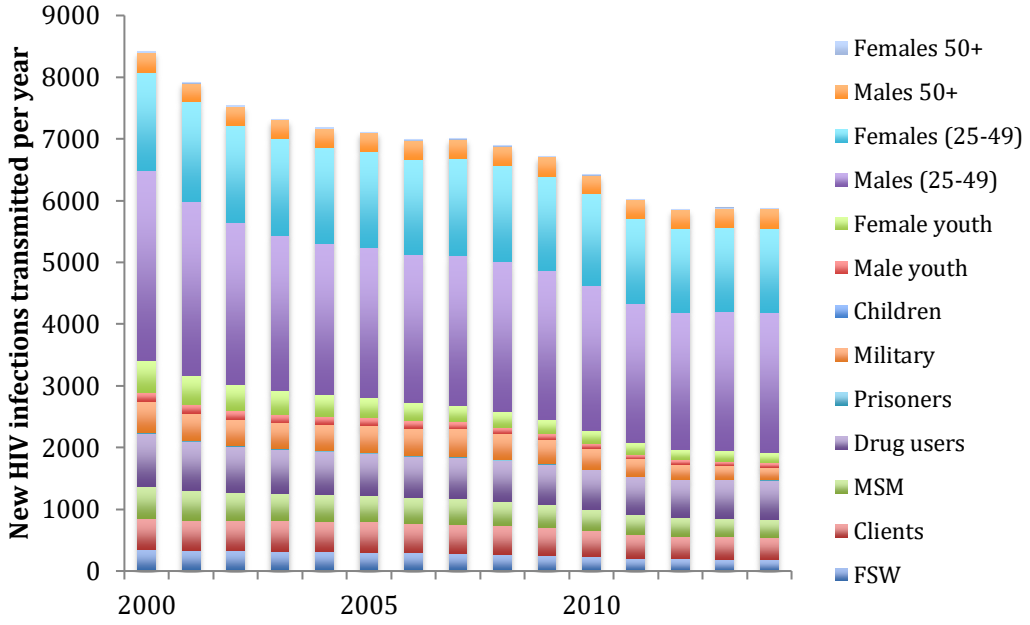
32 PNLS-Togo. 2011. Enquête comportementale et de séroprévalence du VIH chez les prisonniers Togo en 2011.

33 Expert opinion.

34 Enquête de Comportement et de Séroprévalence chez les Militaires 2014.

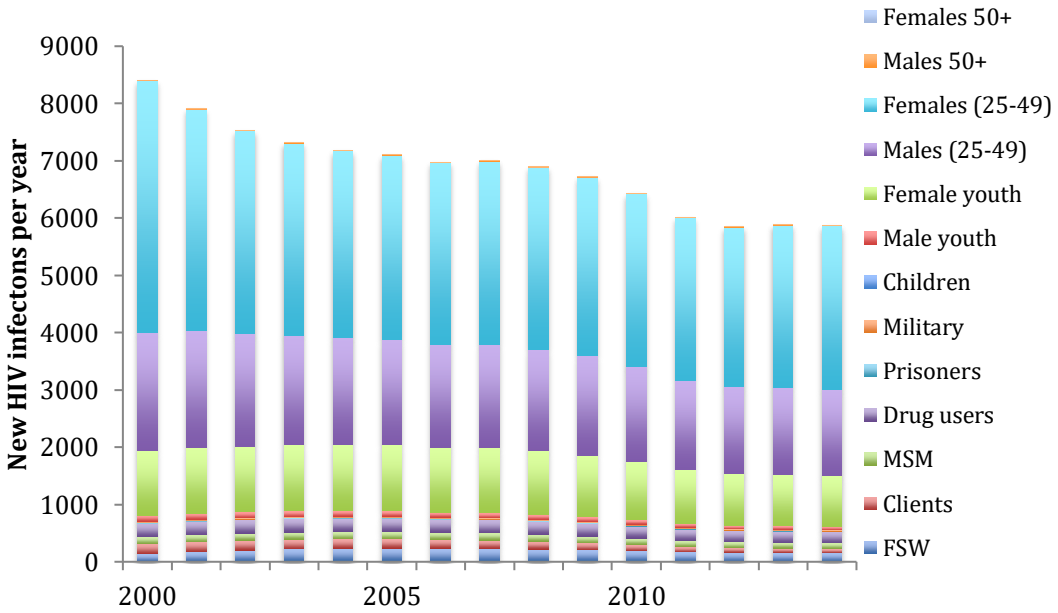
35 H. J. Prudden et al. 2015. "Factors Associated with Variations in Population HIV Prevalence across West Africa: Findings from an Ecological Analysis." *PLoS ONE,* 10(12)**:** e0142601.

Figure 1.3 Estimated number of new HIV infections transmitted, 2000–14



Source: Optima HIV model estimates.

Figure 1.4 Estimated number of new HIV infections acquired, 2000–14



Source: Optima HIV model estimates.

An important characteristic of sexual relationships in this context is the frequency of transactional sex. Following the UNAIDS definition, sex workers in Togo are defined as, "adults or youth who receive goods and/or money in exchange for sex."[36] Some sex workers define themselves as official sex workers, either brothel-based ("les PS

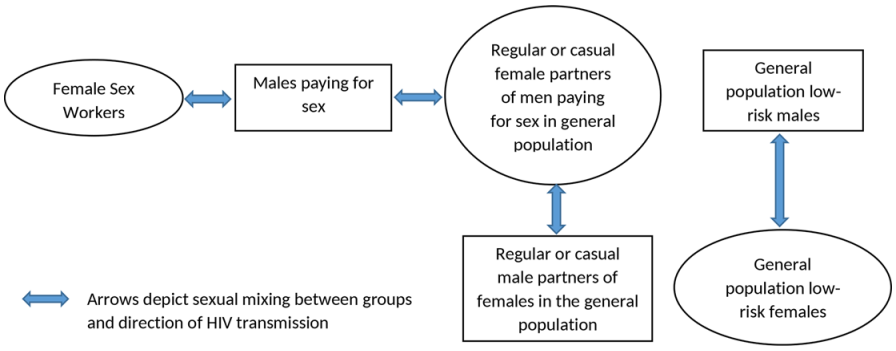
[36] UNAIDS. Guidance Note on HIV and Sex Work. Geneva, UNAIDS, updated 2012.

affichees") or non-brothel based ("les PS ambulantes"). However, a large proportion of sex workers do not identify themselves as sex workers ("les PS clandestines"). In 2009, 6 percent of sex workers were brothel-based, 19 percent were non-brothel based, and the majority (75 percent) did not identify themselves as sex workers.[37] In this report, the highest available size estimate of FSW (17,909 or 1.07 percent of the 15–49 female population) was used in order to take hidden sex workers into account as much as possible.

1.3.3. HIV AMONG FEMALES

The disproportionate burden of HIV among females in Togo is characteristic of the West African epidemiological context and most mixed and generalized HIV epidemics. Analysis conducted by Prudden et al. (2015) highlights the influences of networks between older men and young females (**Figure 1.5, Part A**). In the context of higher prevalence among FSWs and their clients, an increase in HIV infections has been noted when clients and other younger women have sexual relationships, or when either of these groups has multiple partners (**Figure 1.5, Part B**). In Togo, prevalence among young females was estimated to be almost five times that of young males in 2013 (2.4 percent compared to 0.5 percent),[38] indicating that young women and older men have sexual relationships with one another. Female youth are also more likely to have multiple partners (1.3 percent) than older females aged 25–49 years (0.4 percent), and older males aged 25–49 years are more likely to have multiple partners (22.7 percent) than male youth (7.5 percent).[39]

Figure 1.5 Part A: Revised conceptual framework of HIV spread through sexual networks of individuals within the population[40]



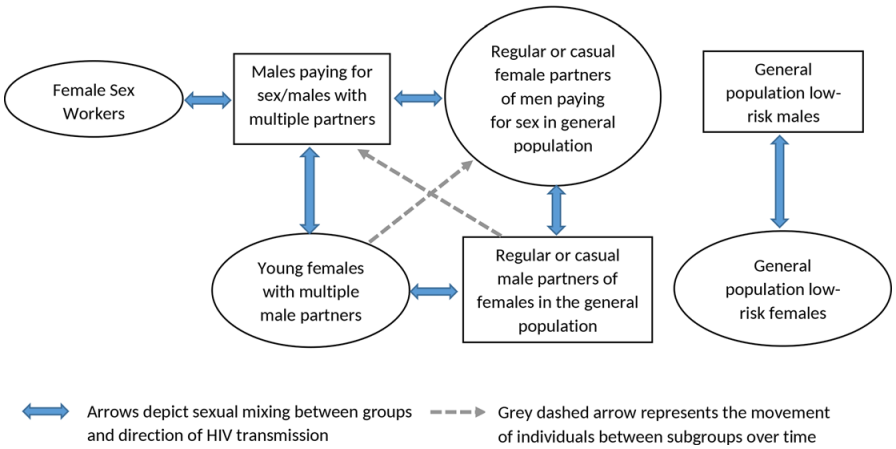
[37] P. Pitché, et al. 2013. "HIV Prevalence and Behavioral Studies in Female Sex Workers in Togo: A Decline in the Prevalence between 2005 and 2011. " *Pan African Medical Journal* 2013; 15:62.

[38] Evaluation du secteur de l'éducation 2015

[39] H. J. Prudden et al. 2015. Factors Associated with Variations in Population HIV Prevalence across West Africa: Findings from an Ecological Analysis. *PLoS ONE,* 10, e0142601.

[40] H. J. Prudden et al. 2015.

Figure 1.5 Part B: Second revised conceptual framework of HIV spread through sexual networks of individuals within the population



1.3.4. CHARACTERISTICS OF HIV RESPONSE IN TOGO

As noted above, HIV prevalence among males and females aged 15–49 years declined between 2000 and 2014. This is attributable in part to the successful use of behavioral interventions to reduce HIV incidence. Self-reported condom use is high for commercial acts with FSW (93 percent in 2014),[41] and is also high for casual acts between MSM, at 86 percent in Lomé and Kara in the same year.[42]

Of the estimated 110,400 PLHIV in 2014, an estimated 52 percent have been diagnosed.[43] The number of women covered under the Option B/B+ approach[44] within the PMTCT program has increased in recent years. In 2014, it was estimated that 87 percent of diagnosed pregnant women received treatment.[45]

ART coverage has steadily increased since 2000 but remained low, at an estimated 33 percent in 2014. This is a major challenge, given the individual clinical benefit and population-level HIV prevention benefit of treatment.

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41 Université de Lome and Unité de Recherche Démographique. 2015. Enquête comportementale et de séroprévalence du VIH chez les professionnelles du sexe et leurs clients au Togo PS-TOGO 2015.

42 E. Papworth et al. 2014. *Examining Risk Factors for HIV and Access to Services among Female Sex Workers (FSW) and Men who have Sex with Men (MSM) in Burkina Faso, Togo, and Cameroon*. Baltimore: USAID | Project Search: Research to Prevention, March. The proportion of the population that is FSW in Togo is estimated to be 0.82 percent (95 percent, confidence index (CI) 0.57-1.07) or 13,771 (95 percent CI 9,634-17,909).

43 Rapport Annuel D'activité de la Réponse Nationale Contre le VIH/SIDA en 2014. In-country experts acknowledge that while this value is the best estimate regarding this indicator, it is still an estimate.

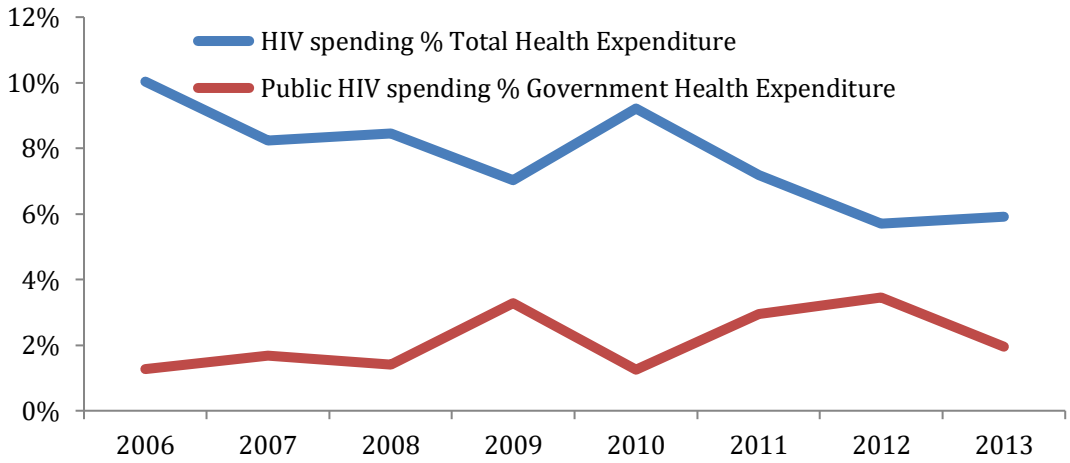
44 In the Option B approach "all pregnant and lactating women with HIV initially are offered ART – beginning in the antenatal period and continuing throughout the duration of breastfeeding. At the end of breastfeeding, those women who do not yet require ART for their own health would discontinue the prophylaxis and continue to monitor their CD4 count, eventually re-starting ART when the CD4 falls below 350 cells/mm3." Option B+ refers to "all pregnant women living with HIV are offered life-long ART, regardless of their CD4 count." Source: Unicef (no date). "Options B and B+ Key Considerations for Countries to Implement an Equity-Focused Approach." Discussion draft. http://www.unicef.org/aids/files/hiv_Key_considerations_options_B.pdf.

45 Togo National HIV Strategic Plan draft 2016–2020.

1.4 FINANCING THE HIV RESPONSE IN TOGO

The HIV response has been heavily dependent on donor contributions. HIV spending in Togo as percentage of total health expenditure has been decreasing since 2006 (**Figure 1.6).** At the same time, public spending on HIV as percentage of general government spending on health increased by around 50 percent between 2006, although it has fluctuated substantially during this period **(Figure 1.6)**.

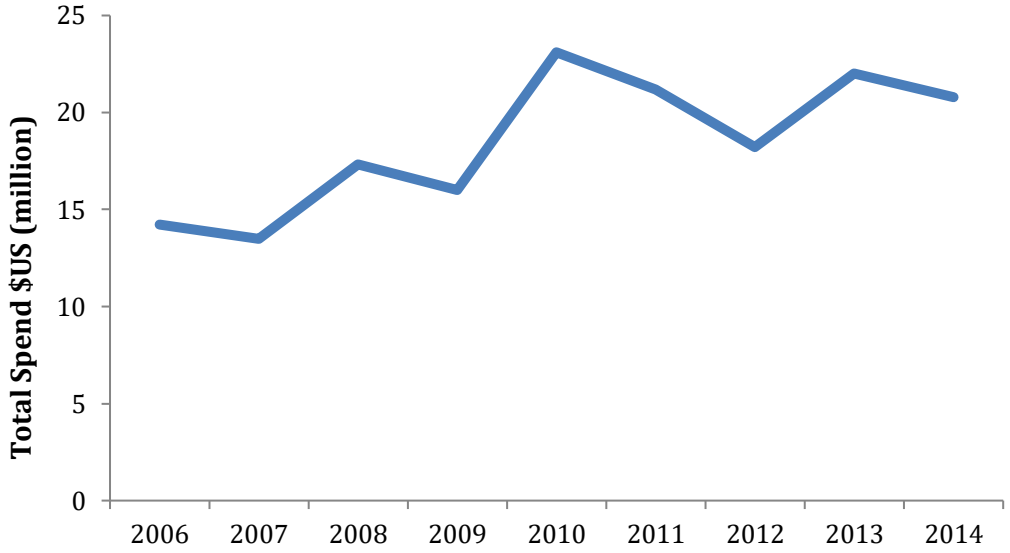
Figure 1.6 HIV/AIDS spending as a percentage of total health expenditure and government expenditure on health in Togo



Source: WHO National Health Accounts Database, http://apps.who.int/nha/database/Select/Indicators/en), accessed April 20, 2016.

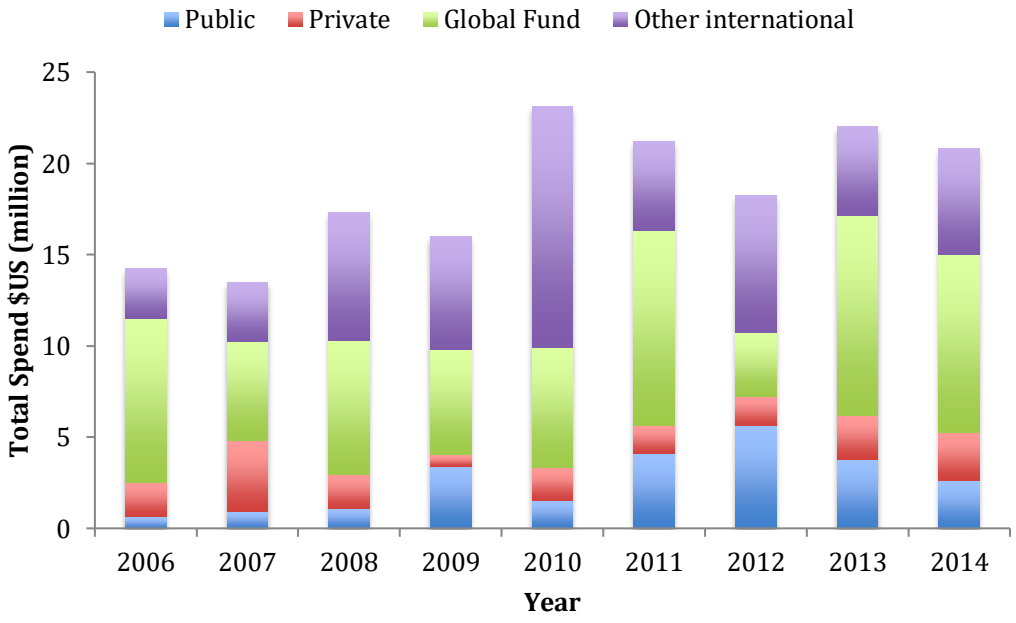
Total HIV spending in Togo increased by nearly 50 percent between 2006–14 (**Figure 1.7**). During the same period, public funding nearly tripled and international funding increased by approximately 30 percent **(Figure 1.8)**. The Global Fund has been the country's major international donor, contributing around 60 percent of all donor funds in 2014.

Figure 1.7 Overall spending on HIV/AIDS in Togo[46]



Source: National HIV/AIDS Spending Report 2006–2014.

Figure 1.8 Funding for HIV in Togo by funding source

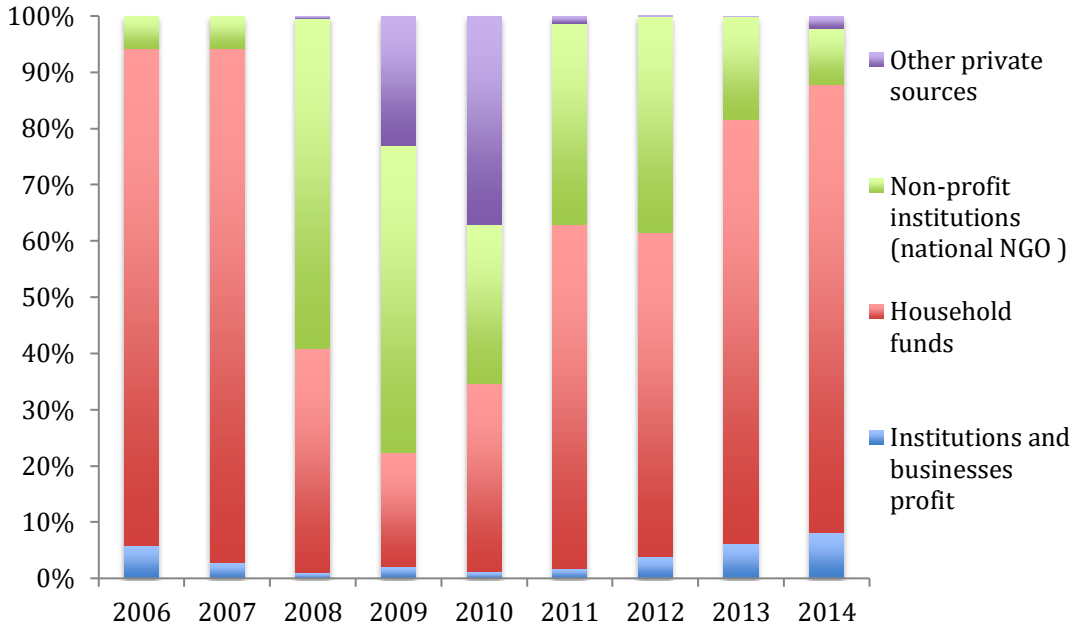


Source: National HIV/AIDS Spending Report 2006–2014.

46

In 2014, the total funding for Togo's HIV response was approximately US$21 million, of which 75 percent was financed by international donors and the remainder was funded with domestic resources. In 2014, 12 percent of domestic funding was financed from private sources. Household contributions through out-of-pocket user-fees constituted approximately 80 percent of private spending in 2014 **(Figure 1.9)**.

Figure 1.9 Private spending on HIV/AIDS in Togo, based on source of funding



Source: National HIV/AIDS Spending Report 2006–2014.

1.5 A NEED FOR IMPROVING ALLOCATIVE EFFICIENCY IN HIV

In the current climate of increasingly limited resources for HIV epidemic responses, focused design and efficiency in service delivery are essential to ensure that programs can do more with less.

A shift towards investment thinking in the design of HIV responses is being promoted by the UNAIDS Secretariat and co-sponsors globally, to maximize the impact of program investment and best realize the long-term health and economic benefits of HIV programs. To this end, many countries are currently developing investment cases in order to better understand HIV epidemics and design, deliver, and sustain effective HIV responses. This report was designed to summarize the results of an allocative efficiency analysis conducted in Togo to support the development of HIV investment cases for the nation as well as the drafting of Togo's National HIV Strategic Plan 2016–20.

This report also summarizes the progress made up until 2014 towards reaching key international HIV commitments. In 2011, the United Nations General Assembly passed a resolution adopting the *Political Declaration on HIV and AIDS*. Under that resolution, countries agreed to reduce sexual and injection-related transmission by 50 percent,

virtually eliminate HIV mother-to-child-transmission, initiate 80 percent of eligible PLHIV on treatment, and end HIV-related discrimination by 2015.[47] The 2014 Gap Report[48] illustrated that substantial additional effort would be required in most countries to achieve these targets. Against this background, UNAIDS defined a global **Fast-Track strategy** in order to achieve the goal of ending the AIDS epidemic by 2030.[49] The strategy includes initiatives such as the 90-90-90 targets, which were set out to ensure that 90 percent of all PLHIV are diagnosed, 90 percent of diagnosed PLHIV are on ART and 90 percent of PLHIV on ART are virally suppressed by 2030.[50] The Fast-Track approach also emphasizes the need to focus on the geographical areas and communities most affected by HIV and recommends that resources be concentrated on programs with the greatest impact.

In the context of this report, the investment case is complemented by a human rights-based approach to health care. As confirmed in the National HIV Strategic Plan draft 2016–20,[51] a universal approach based on upholding human rights and non-discrimination is to be adopted.

The concept of allocative efficiency refers to the maximization of health outcomes within a defined budget envelope. HIV allocative efficiency studies generally try to answer the question: *How can a given HIV funding amount be optimally allocated to the combination of HIV response interventions that will yield the highest impact?*

There is wide consensus that better outcomes could be achieved in many settings with a given amount of HIV funding, or that given outcomes could be achieved with less funding, if resources were distributed optimally or if resources were used in the most efficient ways. Mathematical modeling is one way to determine optimized HIV resource allocation within defined budget envelopes. The HIV allocative efficiency analysis in this study was carried out using Optima HIV. The results can be used to serve the needs of decision makers and health planners seeking to improve the allocative efficiency of their HIV financing.

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[47] United Nations General Assembly, Resolution 65/277, Political Declaration on HIV and AIDS: Intensifying Our Efforts to Eliminate HIV and AIDS, A/65/277 (July 8, 2011).

[48] UNAIDS (2014). *The Gap Report.* Geneva, UNAIDS.

[49] UNAIDS (2014). *Fast-Track — Ending the AIDS Epidemic by 2030*. Geneva, UNAIDS.

[50] UNAIDS (2014). *90-90-90: An Ambitious Treatment Target to Help End the AIDS Epidemic*. Geneva, UNAIDS.

[51] Togo National HIV Strategic Plan draft 2016–2020.

2 HOW WILL THIS REPORT ANSWER KEY POLICY QUESTIONS?

Planning an HIV response can be an extremely time-consuming. To aid with this process, several different tools have been developed and employed in different contexts, including the GOALS resource estimation tool, the Asian Epidemic model, and the Optima HIV tool. All three tools are equipped with a resource requirements estimation feature to help with budgeting. However, a unique feature of the Optima HIV tool is its allocative efficiency optimization algorithm, which can be used to identify the optimal allocation of HIV spending—that is, the allocation that gets the closest to strategic targets.

The findings of this report can assist the government of Togo in further strengthening its HIV investment case, through which it attempts to increase the effectiveness of HIV investments and define corresponding priorities, strategies and impacts of the HIV response.

2.1 THE OPTIMA HIV MODEL

The Optima HIV model and software package was designed and developed by the Optima Consortium for Decision Science (the Optima Consortium) with technical inputs and guidance from the World Bank. The model itself is based on a compartmental model of HIV transmission and disease progression which uses best-practice HIV epidemic modeling techniques and incorporates evidence on biological transmission probabilities, detailed infection progression, sexual mixing patterns, and drug injection behaviors. Optima HIV can be used to produce estimates of epidemic trends, resource needs, and the impact and cost-effectiveness of HIV responses. Furthermore, it allows for an estimation of the allocation of resources across programs that best addresses national HIV targets whilst considering various logistic, political, and ethical constraints. Further details of the Optima HIV model are available elsewhere.[52]

The Optima HIV software package[53] was used to create a specific model for Togo. The Togo was then populated with data from annual reports, bio-behavioral surveys, and clinic registries, as well as published data and information from national registers. The model's parameters were calibrated to HIV prevalence data points available from different subpopulations (e.g., female sex workers [FSW], men who have sex with men [MSM], drug users, females aged 25–49, and males aged 25–49), at specific time points. It was also calibrated to data points on the number of people on ART, and data concerning registered HIV/AIDS cases. Data input and calibration were performed in consultation with experts on the Togo epidemic. The results of the calibration are provided in **Annex 2**.

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[52] See C. C. Kerr et al., 2015. "Optima: A Model for HIV Epidemic Analysis, Program Prioritization, and Resource Optimization." *JAIDS (Journal of Acquired Immune Deficiency Syndrome)* 69(3):365–76.

[53] The version used was v1.0. See hiv.optimamodel.com for further details.

To assess how incremental changes in spending affect HIV epidemics and thus determine the optimized funding allocation, the model parameterizes relationships between the cost of HIV intervention programs, the coverage level attained by these programs, and the resulting outcomes. These relationships are specific to the country, population, and program being considered.

Using the relationships between cost, coverage, and outcome—in combination with the epidemic module—it is possible to calculate how incremental changes in funding allocated to each program will impact overall epidemic outcomes. Furthermore, by using a mathematical optimization algorithm, Optima HIV is able to determine the "optimal" allocation of funding across different HIV programs.

2.2 ANALYTICAL FRAMEWORK

Defining the analytic framework for the Optima HIV modeling analyses required (a) selecting the relevant populations and HIV interventions for inclusion in the analysis; (b) defining the baseline funding scenario; and (c) determining the timeframes for the analysis.

2.2.1. POPULATIONS INCLUDED IN THE ANALYSIS

After consultation with key stakeholders and a review of the evidence on the epidemic dynamics in Togo, it was agreed to include the following populations in the analysis:

1. Female sex workers (assumed to be aged 15–49)
2. Clients of female sex workers (assumed to be aged 15+)
3. Men who have sex with men (assumed to be aged 15+)
4. Drug users (assumed to be aged 15–49, and inclusive of all drug users, not only injecting drug users)
5. Prisoners (assumed to be males aged 15–49)
6. Military personnel (assumed to be males aged 15–49)
7. Children (aged 0–15)
8. Male youth (assumed to be aged 15–24, excluding key populations)
9. Female youth (assumed to be aged 15–24, excluding key populations)
10. Males aged 25–49 (excluding key populations)
11. Females aged 25–49 (excluding key populations)
12. Males aged 50 and above (50+) (excluding key populations)
13. Females 50+ (excluding key populations)

2.2.2. HIV INTERVENTIONS INCLUDED IN THE ANALYSIS

The HIV response was analyzed with the aim of understanding the impact of expenditure on programmatic outcomes. Programs were classified into either *targeted* or *non-targeted* programs. The former category consisted of all programs that directly affect one of the proximal determinants of HIV infection or disease progression (for example, condom distribution programs), while the latter covered all crosscutting programs (including management, infrastructure, monitoring and evaluation, education and empowerment for young women, and other HIV care).

This study did not attempt to establish cost functions for non-targeted programs, since the impact of these programs on HIV incidence and AIDS-related deaths could not be directly quantified in the same way that impact can established be for targeted programs.

The HIV interventions identified in Togo are listed in **Table 2.1**. A more detailed discussion of the funding to these programmatic areas is contained in **Section 3**, and a description of the behaviors and populations targeted by these programs is provided in **Annex 3**.

Table 2.1 HIV interventions identified in Togo

INTERVENTION	DESCRIPTION	TARGETED?
Condoms and social behavior and communication change	Condom promotion and distribution. Also includes mass media programs, behavior change, and HIV education	Yes
Programs for female sex workers and clients	Service package including interpersonal communication and counselling, condom provision, peer education, HIV testing and counselling	Yes
Programs for men who have sex with men	Service package including interpersonal communication and counselling, condom provision, peer education, HIV testing and counselling	Yes
Programs for drug users	Service package including interpersonal communication and counselling, condom provision, peer education, HIV testing and counselling	Yes
Programs for military personnel	Service package including interpersonal communication and counselling, condom provision, peer education, HIV testing and counselling	Yes
HIV testing services (general population)	Provider-initiated and voluntary testing and counselling (delivered outside programs for specific key populations)	Yes
Antiretroviral therapy	Antiretroviral therapy for all population groups	Yes
HIV prevention programs for prisoners	HIV testing and counselling, interpersonal communication and counselling	Yes
PMTCT	Prevention of mother-to-child transmission	Yes
STI programs	Diagnosis and treatment of sexually transmitted infections	No
Health infrastructure	Upgrading and constructing health infrastructure	No
HIV care	Opportunistic infection treatment and other care for PLHIV including psycho-social support	No
Management	Co-ordination and response management	No
Human resources and training	Cross-cutting human resource costs – not specific to individual programs	No

Enabling environment	Advocacy, stigma reduction	No
Monitoring, evaluation, surveillance and research	Research studies, surveys, monitoring evaluation and surveillance activities	No
Other	Includes costs not assigned elsewhere such as blood safety, PEP, male circumcision, social protection, orphans and vulnerable children, and other prevention programs not classified	No

2.2.3. TIMEFRAMES FOR THE ANALYSIS

The epidemic model within Optima HIV was populated with country-specific behavioral, clinical, demographic, and programmatic data covering the period from 2000 until 2014 (the latest year for which data were available). Epidemic trends were calculated under different programmatic assumptions, over varying time horizons: (a) 2016–20 (corresponding to both the government's timeline for achieving the national strategic plan targets and the timeline for achieving the first stage of the international Fast-Track targets); and (b) 2016–30 (corresponding to the timeline for achieving the second stage of the international Fast-Track targets).

2.2.4. BASELINE FUNDING SCENARIO FOR THE ANALYSIS

In 2014, the total funding for Togo's HIV response was approximately US$21 million (see **Sections 1.4** and **3**), allocated across the interventions listed in **Table 2.1** and reported in the 2014 Global AIDS Response Progress Report.[54] The research team constructed a baseline scenario around the assumption that this same amount of funding would be available each year and would be distributed as it was in 2014.

2.3 CALIBRATION

A key stage in the modeling process with Optima HIV is a stage known as "calibration." Calibration represents a model validation process in which the model-projected trends are aligned with the historically observed trends in HIV prevalence in different population groups in a given context. Given the challenges inherent in fitting epidemiological and behavioral data, the calibration for Togo was performed manually (i.e., by varying relevant model parameters in order to attain a best fit between model-projected and historic HIV prevalence across different population cohorts). Where data were limited, these trends were compared with the registered new diagnoses and Spectrum estimates.[55] The results of the calibration are provided in **Annex 3**.

[54] UNAIDS. 2014. *Global AIDS Response Progress Reporting 2014*. Geneva: UNAIDS

[55] For more on Spectrum, see the Spectrum section on the Avenir Health website, http://www.avenirhealth.org/software-spectrum.php.

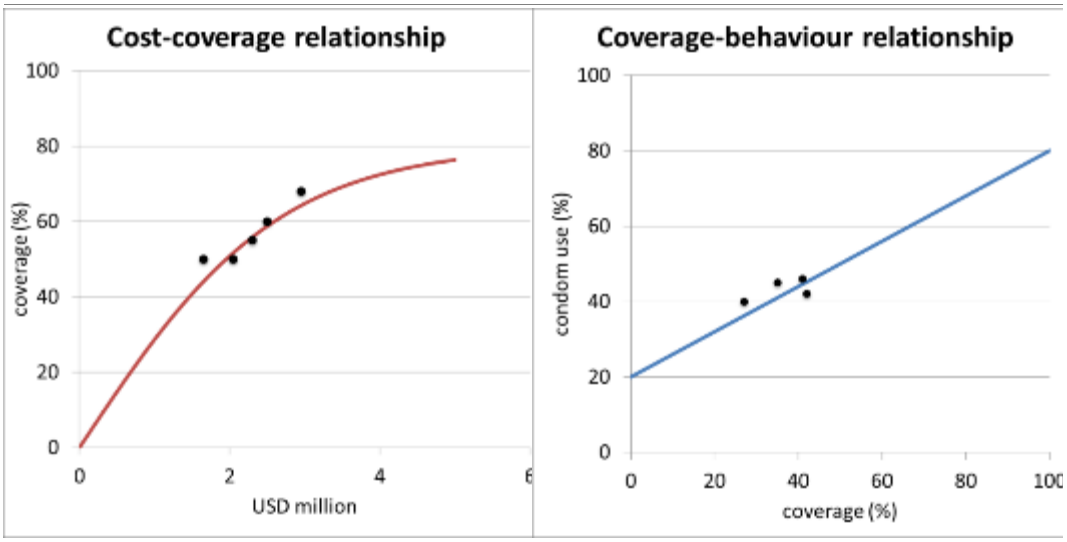
2.4 COST-COVERAGE-OUTCOME RELATIONSHIPS

The next stage of conducting an analysis with Optima HIV consists of establishing relationships between program spending and program coverage. A schematic graph illustrating how this relationship might look is shown in the left panel of **Figure 2.1**. This relationship describes the level of output achieved with a specific level of financial input. In the context of these analyses, output is defined as the availability of a service to a specific proportion of the target population. Coverage refers to the number individuals reached in a given population. For example, this relationship would describe how many MSM can be provided with a standard package of services with an investment of US$0 to US$1 million.

It is also necessary to define relationships between program coverage levels and behavioral outcomes. A schematic illustrating how this relationship might look is shown in the right panel of **Figure 2.1**. This relationship describes the proportion of people who will adopt a specific behavior (such as condom use or consistent use of antiretroviral medicines leading to viral suppression). These analyses were produced in collaboration with Togo on experts and the full set of figures can be seen in the **Annex 3**.

The cost-coverage-outcome relationships are used, together with the calibration projections, to run the optimization and scenario analyses described in **Sections 4-8**.

Figure 2.1 (Left) Illustrative cost-coverage relationship; (right) illustrative coverage-outcome relationship



Note: The black dots represent available spending and coverage data, and associated behaviors. The solid curves are the best fitting or assumed relationships.

2.5 ALLOCATIVE EFFICIENCY ANALYSIS

Efficiency analyses must be informed by local priorities. At the time that this report was prepared, Togo was in the process of drafting a new national HIV strategy for 2016–20. This strategy aims to reduce new infections, provide comprehensive care, and ensure

good governance.[56] This is to be achieved via a universal approach including targeted prevention, treatment, care, and support services—all based on upholding human rights and non-discrimination.

To support these national priorities and assist Togo with sustainability planning, this report answers **five key questions**:

1. What would be the impact of maintaining the latest-reported [2014] spending volume and patterns?
2. What would be the trajectory of the HIV epidemic over 2016–30 under different programmatic assumptions?
3. What can be improved by optimizing the allocation of HIV funding?
4. How much will it cost to achieve the national HIV strategic plan targets?
5. What are the long-term financial commitments to care and treatment for people living with HIV according to different investment options in the short term?

Each of these questions is the subject of an analytical module described in more detail below.

ANALYSIS 1: WHAT WOULD BE THE IMPACT OF MAINTAINING THE 2014 SPENDING VOLUME AND PATTERNS?

For this analysis, the research team estimated the trajectory of the epidemic and key outcomes under the assumption that the 2014 budget envelope will be annually available each year to 2030, and will be allocated as it was in 2014 (this is defined as the baseline scenario in Section 2.2.4). To estimate the impact of this baseline scenario, the team compared it to a zero-funding scenario. The results of this analysis are described in **Section 4**.

ANALYSIS 2: WHAT WOULD BE THE TRAJECTORY OF THE HIV EPIDEMIC OVER 2016–2030 UNDER DIFFERENT PROGRAMMATIC ASSUMPTIONS?

For this analysis, the research team compared the trajectory of the epidemic and key outcomes under different programmatic assumptions. The baseline scenario, as noted in Section 2.2.4, was that the 2014 budget envelope will be annually available each year to 2030, and will be allocated as it was in 2014. The two alternative scenarios are:

1. Attaining 90-90-90 targets: This scenario assumed that by 2020, 90 percent of PLHIV will be aware of their status and 90 percent of diagnosed PLHIV will be on ART.[57]
2. 90 percent PMTCT coverage: This scenario explored the possible impact of achieving 90 percent PMTCT coverage of all pregnant women living with HIV.

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[56] Togo National HIV Strategic Plan draft 2016–2020.

[57] Treatment efficacy in reducing new infections for PLHIV on ART was assumed to be 70 percent.

The analyses described in **Section 5** estimate the epidemic impact if specific outcome levels or targets are achieved, regardless of cost and coverage considerations, except for a basic estimate of the cost required to achieve the 90-90-90 targets.

ANALYSIS 3: WHAT CAN BE IMPROVED BY OPTIMIZING THE ALLOCATION OF HIV FUNDING?

For this analysis, the research team investigated whether it would be possible to obtain epidemic improvements relative to the baseline scenario by re-allocating the baseline HIV budget. Specifically, the team assumed that the 2014 budget envelope will be available each year during the 2016–30 period, and then estimated the allocation of this funding that would minimize cumulative new HIV infections and HIV-related deaths in the entire population over that period, whilst also ensuring that no population would be worse off than they were before. The results of this analysis are described in **Section 6**.

ANALYSIS 4: HOW MUCH WILL IT COST TO ACHIEVE PROPOSED NATIONAL HIV STRATEGIC PLAN TARGETS?

This analysis identified the minimum resource requirements to achieve possible national strategy targets. As the new National HIV Strategic Plan targets had not been fully defined at the time, analyses were run to establish how much funding is required to (a) reduce new infections and deaths by 25 percent, and (b) reduce new infections and deaths by 50 percent. The results of these analyses are presented in **Section 7**.

ANALYSIS 5: WHAT ARE THE LONG-TERM FINANCIAL COMMITMENTS TO CARE AND TREATMENT OF PEOPLE LIVING WITH HIV ACCORDING TO DIFFERENT INVESTMENT OPTIONS IN THE SHORT TERM?

This analysis reviewed the long-term financial impact of achieving National Strategic Plan targets. Specifically, it compared the commitments one would expect to result from the allocation of the 2014 budget against the optimized allocation to reduce new infections and deaths by 50 percent, as described in section 7. The findings from this analysis are presented in **Section 8**.

2.6 LIMITATIONS OF THE ANALYSIS

In this study, care was taken to use the best data available to produce guidance for decision making as the logical implication of available evidence. However, all mathematical modeling exercises have some limitations, and results should therefore be interpreted with the necessary caution. In particular, it is important to note that:

1. All model forecasts are subject to uncertainty. This includes assumptions regarding resources available for all programs, including ART and underlying behavioral changes. Therefore, point estimates are indicative of trends rather than exact figures.
2. The accuracy of model projections depends heavily on the quality of the input data. The country and research teams have done everything possible to ensure the best possible data quality, but it is never possible to have a complete, or completely certain, dataset. Model projections rarely achieve an exact match with historical data, but do closely mirror key trends.

3. Data in Togo are often not collected specifically for 25–49 year-olds, but rather are collected for 15–49 year-olds, resulting in greater uncertainty around the trajectory for 25–49 year-olds as there was limited disaggregated data for this age-group.
4. Surveillance of key populations in this context is complex and may result in the underestimation of the size of these populations, as well as an urban bias in the estimates.
5. There is some uncertainty in the epidemic projections for certain populations where multiple prevalence data points were available. These data sometimes showed very large decreases in HIV prevalence over a short time frame. This may be due to a lack of external validity and consistency across survey rounds. This was accommodated through the use of best fits between observed extreme data points.
6. There is uncertainty surrounding the number of registered PLHIV. In 2014, it was estimated that 57,356 (52 percent) had been diagnosed,[58] but this is subject to uncertainty as HIV-related deaths are not monitored.
7. For some population groups, behavioral data (e.g., condom use at last act) and population size estimates were limited.
8. The modeling approach used to calculate relative cost-effectiveness between programs includes assumptions about the impact of increases or decreases in availability of funding for programs. These assumptions are based on unit costs and observed ecological relationships between outcomes of program coverage or risk behavior and the amount of money spent on programs in the past, assuming that there would be some saturation in the possible effect of programs with increases in spending.
9. The cost-coverage-outcome relationships were derived from actual cost and coverage values for 2014. As unique identifier codes are not routinely used in Togo, coverage estimates were derived using the triangulation of available data for certain programs and from discussions with country experts.
10. The analysis presented in this report does not determine the technical efficiency of programs as this was beyond the scope of the analysis. However, gains in technical efficiency may lead to lower unit costs and would therefore affect the optimized resource allocation described in this report.
11. Modeling the optimization of allocative efficiencies depends critically on the availability of evidence-based parameter estimates of the effectiveness and cost-efficiency of individual interventions. Interventions/programs for which these parameter estimates do not exist—which is the case for many of the critical enablers—are excluded for the mathematical optimization analysis. However, this does not mean that these programs should not receive funding. In addition, there are uncertainties around parameter estimates of some of the critical clinical interventions (e.g., ART and the parameter estimates such as the preventive effect of ART) which may distort the results.
12. Effects of the programs outside the HIV endpoints—including, for example, the wider health and non-health benefits of FSW and MSM programs (beyond those

[58] Rapport Annuel D'activité de la Réponse Nationale Contre le VIH/SIDA en 2014. In-country experts acknowledge that while this value is the best estimate regarding this indicator, it is still an estimate.

directly related to HIV) and the effects of reduced drug use—are not included in this model.

13. The Optima HIV model does not seek to quantify the human rights, stigma and discrimination, ethical, legal, or psychosocial implications of providing or withdrawing care. The authors acknowledge that these are important aspects to consider when allocating funding to health services.

14. Other models may produce different projections than those produced by the Optima HIV model. This is an underlying property when using theoretical mathematical frameworks. Different analytic frameworks may generate different outcome projections. In addition, the analyses presented in this report have made use of the best available country data, experience gained from applying the Optima HIV model in many countries, and comparisons within the West and Central Africa region, for the validation and contextualization of inputs and findings wherever possible.

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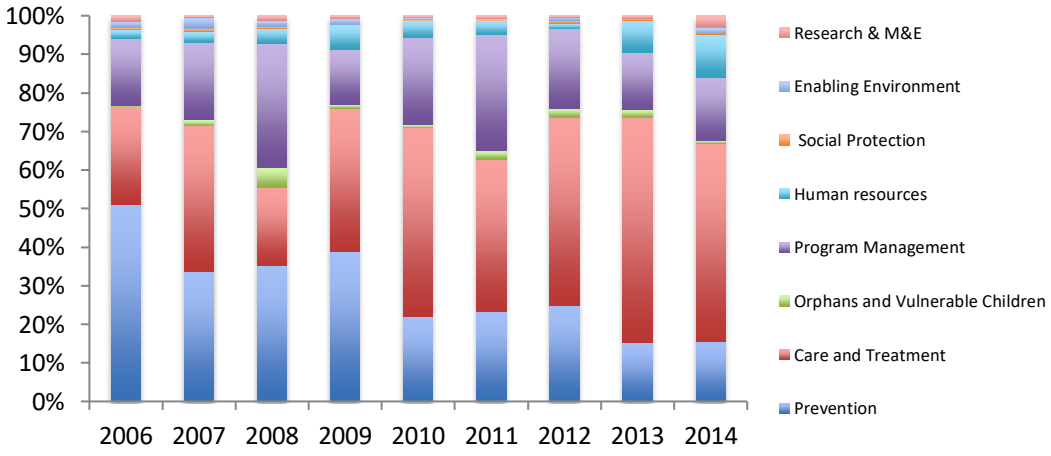
3 CHARACTERIZING THE HIV RESPONSE

HIV care and treatment (including ART) is the largest component of HIV spending in Togo, attracting an average of 40 percent of the total annual HIV budget since 2006 **(Figure 3.1).** In 2014, approximately 50 percent of total HIV spending was allocated to care and treatment, most of which was spent on ART **(Figure 3.1)**. As shown in **Figure 3.2**, the majority of funding for treatment in 2014 was financed from international donors.

By comparison, spending on preventive programs for key and general populations—such as condom promotion and social behavior change communication—constituted around 15 percent of total HIV spending in 2014. Spending on these and other non-ART preventative programs has decreased substantially since 2006, when it represented more than 50 percent of HIV spending. From 2013 to 2014, total spending on the nine targeted interventions identified in **Table 2.1** declined significantly from approximately US$14 million to less than US$12 million (**Figure 3.3)**. In the context of a growing population, this reduction signals a significant contraction in per capita spending on targeted programs.

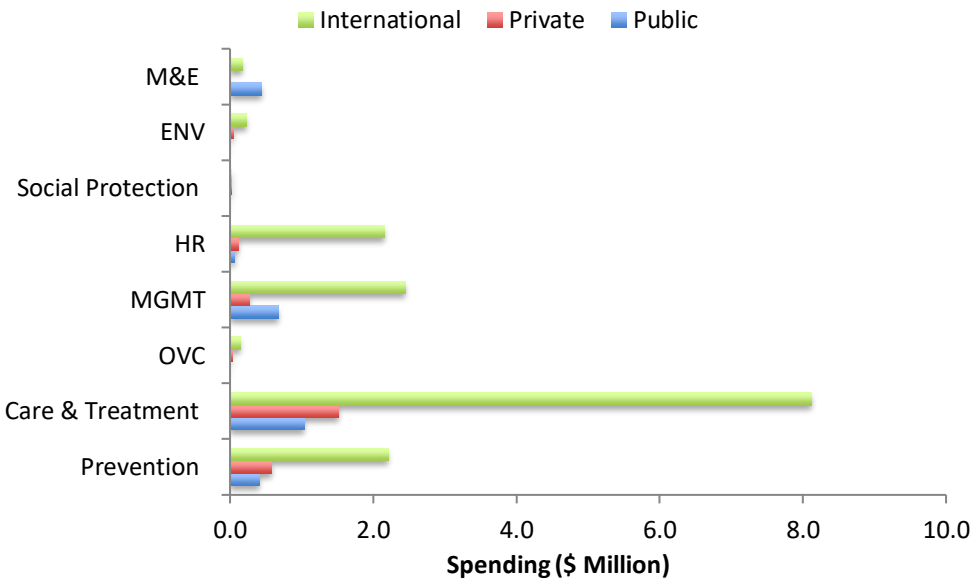
In terms of non-targeted interventions, program management is the main cost category, constituting an average of 21 percent of total annual HIV spending since 2006 **(Figure 3.1)**. Although spending on program management was reduced to 16 percent of total spending in 2014, this proportion remains slightly higher than total spending on preventative programs. Spending on human resources is the second largest non-targeted cost category, making up around 11 percent of total HIV spending in 2014. Technical efficiency analyses may assist with discerning ways in which to decrease these costs.

Figure 3.1 HIV expenditure in Togo by category



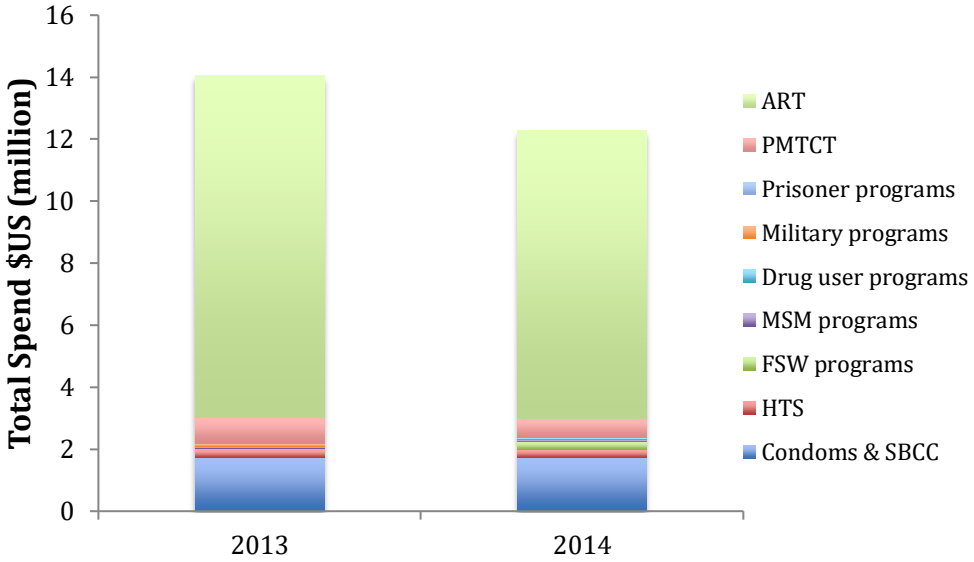
Source: National HIV/AIDS Spending Report 2006–2014.
Note: M&E = monitoring and evaluation.

Figure 3.2 HIV expenditure in Togo by category and funding source for 2014



Source: National HIV/AIDS Spending Report 2014.
Note: HR = human resources; M&E = monitoring and evaluation; MGMT = management; OVC = orphans and vulnerable children.

Figure 3.3 Trends in spending across the nine targeted programs identified in Table 2.1



Note: The HTC program mainly covers people from key population groups in the context of Togo.

4 BASELINE EPIDEMIC PROJECTIONS

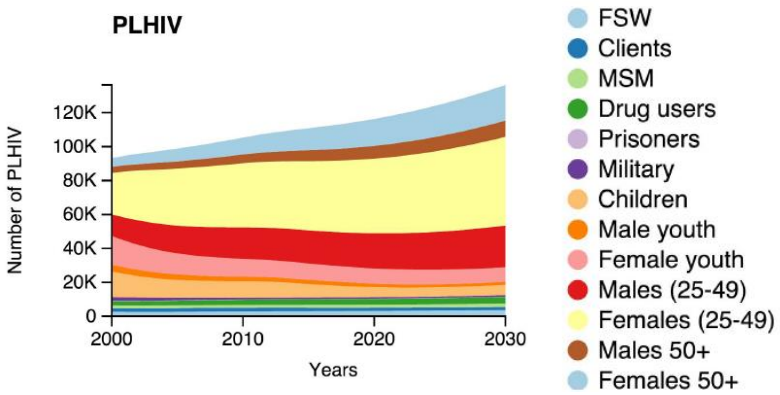
This section presents projections of the HIV epidemic out to 2030 under the assumption that the 2014 budget envelope is annually available and allocated as it was in 2014.

4.1. PEOPLE LIVING WITH HIV

If 2014 levels and patterns of HIV spending were maintained out to 2030, the number of people living with HIV (PLHIV) would be projected to increase from 110,400 in 2014 to 117,318 (6 percent) by 2020 and 136,447 (24 percent) by 2030 (**Figure 4.1**). This increase is due in part to an expected stabilization in HIV incidence and an increase in Togo's population size[59]. **Figure 4.1** shows that in 2014, 60 percent of PLHIV were females aged 15 years or older, whilst males aged 15 or older made up 33 percent of PLHIV.

Projecting forward to 2030, males are expected to continue to comprise around one-third of the expected PLHIV, whilst almost two-thirds of PLHIV are expected to be female. The percentage of children living with HIV is expected to decline over this time period. Amongst both males and females in the general population, the model estimates that by 2030, a larger proportion of PLHIV will be in populations older than 25 years of age. Key populations made up an estimated 10 percent of all PLHIV in 2014, and this is expected to remain roughly constant out to 2030.

Figure 4.1 Projected estimates of PLHIV under the baseline scenario. Source: estimates from the Optima HIV model for Togo



4.2. HIV PREVALENCE

If 2014 levels and patterns of HIV spending were maintained over 2016–30, overall HIV prevalence would be projected to decrease from 1.6 percent in 2014 to 1.5 percent in 2020 and 1.3 percent by 2030 (**Figure A2.2**). Although the estimated HIV prevalence is higher among key populations than in the general population, the epidemic in most key populations is stabilizing.

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[59] The World Factbook (online database), Central Intelligence Agency, https://www.cia.gov/library/publications/the-world-factbook/rankorder/2002rank.html.

Between 2014 and 2030, HIV prevalence is expected to decrease from 16.8 percent to 13.8 percent among female sex workers, and from 2.1 percent to 1.3 percent among their clients. HIV prevalence is also projected to decrease among men who have sex with men (from 16.6 percent to 13.7 percent) and prisoners (from 4.0 percent to 3.2 percent). Among drug users, prevalence is expected to decline from 5.3 percent to 4.5 percent, and for military personnel, it is expected to decrease from 4.9 percent to 3.1 percent over the same time period. However, these prevalence estimates should be treated as indicative only, as projections within small populations such as these will always be more sensitive to small changes in risk factors than projections calculated for larger scale epidemics.

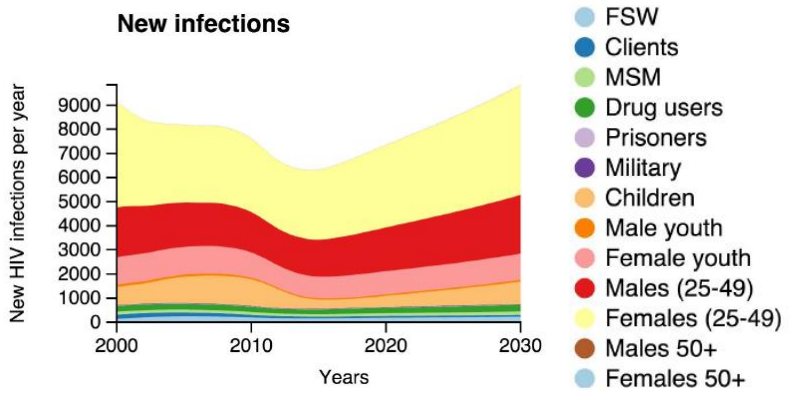
Among some groups in the general population, prevalence is expected to stabilize, with insignificant or very small reductions between 2014 and 2030: from 0.3 percent to 0.1 percent among children; from 0.4 percent to 0.2 percent among male youths (15–24 years); from 1.3 percent to 0.8 percent among female youths; from 2.7 percent to 2.3 percent in men aged 25–49 years; and from 4.4 percent to 3.9 percent for women of the same age group. Among the general population aged 50 years or more, prevalence is expected to increase very slightly between 2014 and 2030: from 2.2 percent to 2.3 percent among men, and from 3.5 percent to 4.0 percent among women. This is partially due to the positive effects of ART and PLHIV living longer.

4.3. HIV INCIDENCE

HIV incidence declined from 2000 to an estimated 0.09 per 100 person-years in 2014. If 2014 levels and patterns of HIV spending were maintained over 2016–30, the model predicts that overall incidence would stabilize: moving from 0.090 in 2014 to 0.097 per 100-person years in 2030. At the same time, new infections would be projected to increase by 20 percent from an estimated 6,300 new infections per year in 2014 to 7,500 per year in 2020, and by 57 percent to an estimated 9,800 per year in 2030 (**Figure 4.2**). The majority of new HIV infections in 2014 were estimated to be among females 25–49 (45 percent), males 25–49 (24 percent), and female youth (14 percent). These three population groups are predicted to still have the highest number of new infections in 2030: females 25–49 will account for 46 percent of new infections, males 25–49 will account for 25 percent, and female youth will account for 11 percent.

If PMTCT coverage is not scaled up, the percentage of new infections among children is expected to increase from 6 percent in 2014 to 9 percent in 2030.

Figure 4.2 Estimated number of new HIV infections per year under the baseline scenario. Source: estimates from the Optima HIV model for Togo

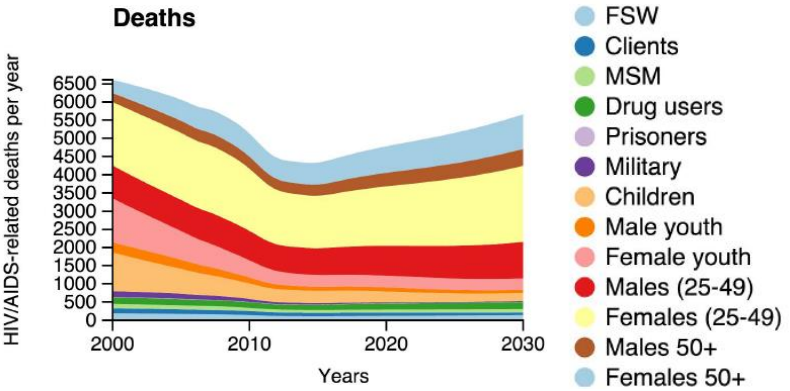


Source: Estimates from the Optima HIV model for Togo.

4.4. HIV-RELATED DEATHS

HIV-related deaths are estimated to have decreased over the decade that ended in 2014, dropping to approximately 4,300 deaths in 2014. However, if the 2014 levels and patterns of HIV spending were maintained over the 2016–30 period, the number of deaths attributable to HIV would be predicted to increase by 12 percent to 4,800 in 2020 and by 31 percent 5,700 (31 percent) by 2030 if PLHIV are not diagnosed promptly and put onto treatment (**Figure 4.3**).

Figure 4.3 Estimated number of AIDS deaths per year under the baseline scenario



Source: Estimates from the Optima HIV model for Togo.
Note: In calibration, the Optima model assumes that the number of PLHIV on ART remains constant.

4.5. DEMAND FOR TREATMENT

At the end of 2014, 33 percent of PLHIV were receiving HIV treatment. However, with the predicted increase in new infections, demand for treatment will rise. If 2014 levels and patterns of HIV spending do not change, this could widen the substantial existing treatment gap. Furthermore, at the time these analyses were conducted (2014), Togo only provided treatment when a person's CD4 count was less than 500cells/mm3. However, WHO guidelines recommend commencing treatment for adults at any CD4

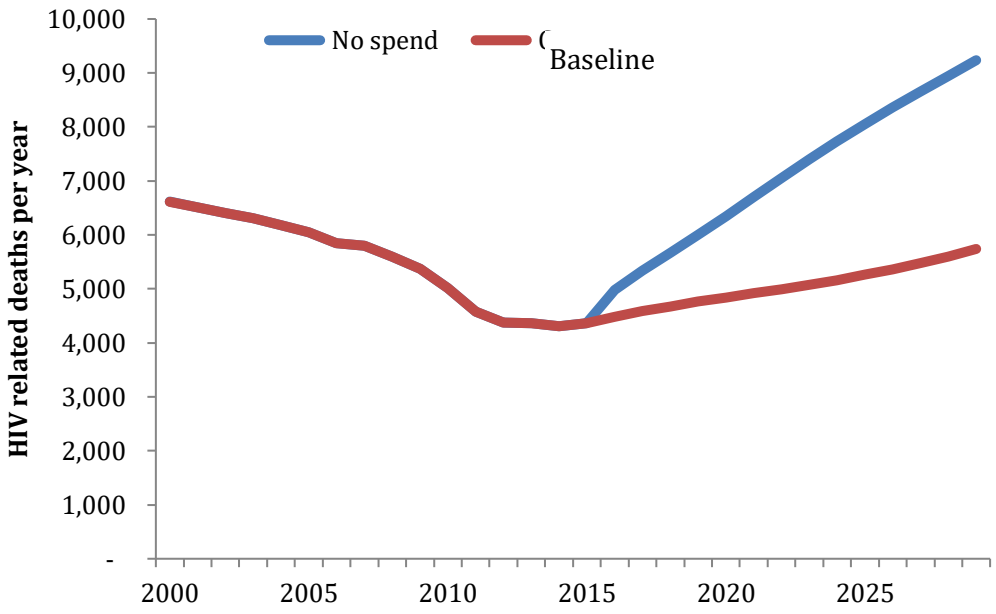
count[60]. If Togo is to adhere to these international guidelines for HIV treatment, additional existing PLHIV will require treatment, as will a greater proportion of all newly diagnosed PLHIV.

4.6. HIV INFECTIONS AND DEATHS AVERTED RELATIVE TO NO SPENDING

Model-based projections of the epidemic indicate that if 2014 levels and patterns of HIV spending were maintained over the 2016–30 period, the HIV response would continue to avert new infections and deaths. In the absence of any spending on the HIV epidemic, the Optima HIV model estimates that 30,000 (42 percent) more deaths would occur and 60,600 (52 percent) more people would be infected by 2030 (**Figure 4.4**). This highlights the need to continue investing in HIV response.

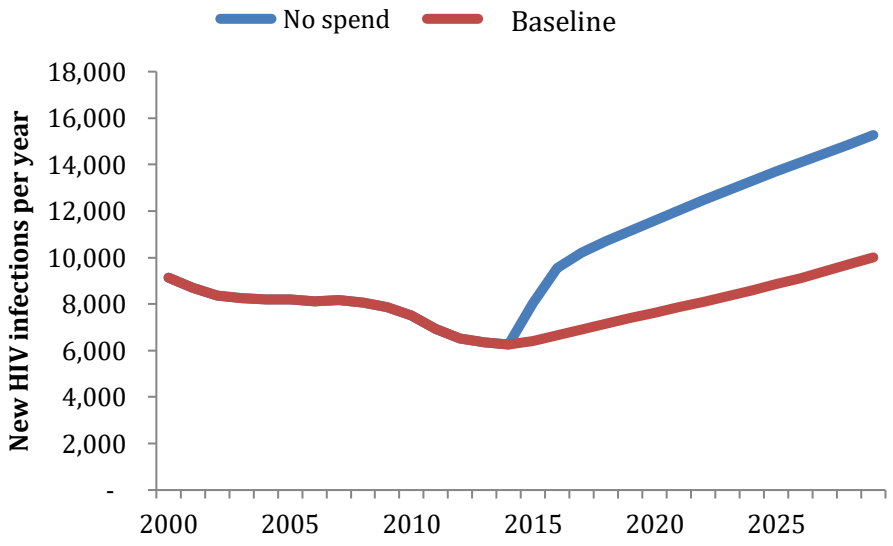
Figure 4.4 Estimated impact of baseline spending compared to no spending on the HIV response, 2016 – 2030 on (a) HIV-related deaths per year and (b) new HIV infections per year)

a. HIV-related deaths per year



60 WHO. 2015. Guideline on When to Start Antiretroviral Therapy and on Pre-exposure Prophylaxis for HIV. Geneva: WHO. http://www.who.int/hiv/pub/guidelines/earlyrelease-arv/en/.

b. New HIV infections per year



Source: Estimates from the Optima HIV model for Togo.

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5 PROJECTING THE EPIDEMIC UNDER DIFFERENT RESPONSE SCENARIOS

5.1 COMPARING HIV RESPONSE SCENARIOS

In the previous section, we compared the epidemic projections under the baseline scenario (i.e., assuming that 2014 levels and patterns of HIV spending are maintained) against a "no spending" scenario. **Figure 4.4** demonstrates that the 2014 response to the epidemic has reduced HIV incidence and HIV-related mortality from the levels one would expect in the absence of any intervention. The Optima HIV model predicts that this positive impact is likely to persist, and even grow, between now and 2030.

This section considers whether reaching predetermined targets could further reduce prevalence, new infections, and mortality. The analysis estimated the trajectory of the HIV epidemic under two alternative response scenarios that are not constrained by a budget but are determined solely by targets. These scenarios were identified through consultation with local stakeholders and a range of experts. The epidemic trajectory was then predicted for each of these two scenarios and compared with the baseline trajectory (i.e., assuming that 2014 levels and patterns of HIV spending are maintained).

The two alternative response scenarios were:

1. Attaining 90-90-90 targets. This scenario assumed that by 2020, 90 percent of PLHIV will be aware of their status and 90 percent of diagnosed PLHIV will be on ART.[61]
2. Attaining 90 percent PMTCT coverage. This scenario assumed that by 2020, 90 percent of all pregnant women living with HIV will be aware of their status, and 90 percent of diagnosed pregnant women living with HIV will be on ART.

Table 5.1 presents detailed information on parameters and targets specified in the alternative scenarios.

[61] Treatment efficacy in reducing new infections for PLHIV on ART was assumed to be 70 percent.

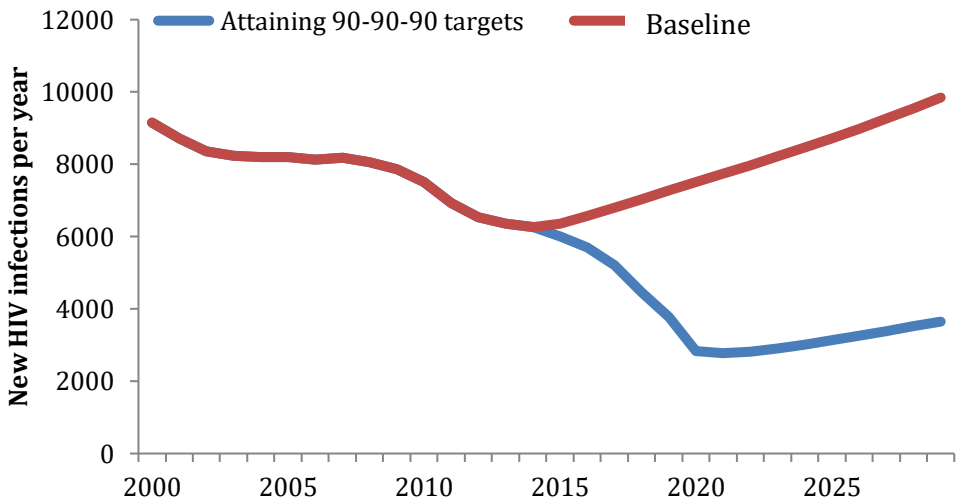
Table 5.1 Parameters and target values used in the alternative scenarios

TARGET POPULATION	PARAMETERS	ALTERNATIVE RESPONSE SCENARIOS*	
		Test and offer treatment (Baseline-2020)	Attaining 90% PMTCT coverage (Baseline – 2020)
FSWs	Proportion of sexual acts in which condoms are used with commercial partners	No change (93%)	N/A
	Proportion of people who are tested for HIV each year	N/A	N/A
Clients of sex workers	Proportion of sexual acts in which condoms are used with commercial partners	No change (61%)	N/A
MSM	Proportion of sexual acts in which condoms are used with casual partners	No change (86%)	N/A
	Proportion of sexual acts in which condoms are used with commercial partners	No change (67%)	N/A
	Proportion of people who are tested for HIV each year	N/A	N/A
Military	Proportion of sexual acts in which condoms are used with casual partners	No change (88%)	N/A
	Proportion of sexual acts in which condoms are used with commercial partners	No change (61%)	N/A
	Proportion of people who are tested for HIV each year	N/A	N/A
Drug users	Proportion of sexual acts in which condoms are used with casual partners	No change (27%)	N/A
	Proportion of people who are tested for HIV each year	N/A	N/A
Prisoners	Proportion of people who are tested for HIV each year	N/A	N/A
Females 15–49	Number of pregnant women receiving Option B or B+	N/A	4,496–5,913 (2016–20)
Number of PLHIV on ART (all populations)		34,955–95,028 (2014–20)	N/A
Proportion of people who are tested for HIV in each year (all populations)		52%–90% (2016–20)	N/A

Note: * Baseline data in each scenario are from different years when the latest data at the time the modelling was conducted was available.

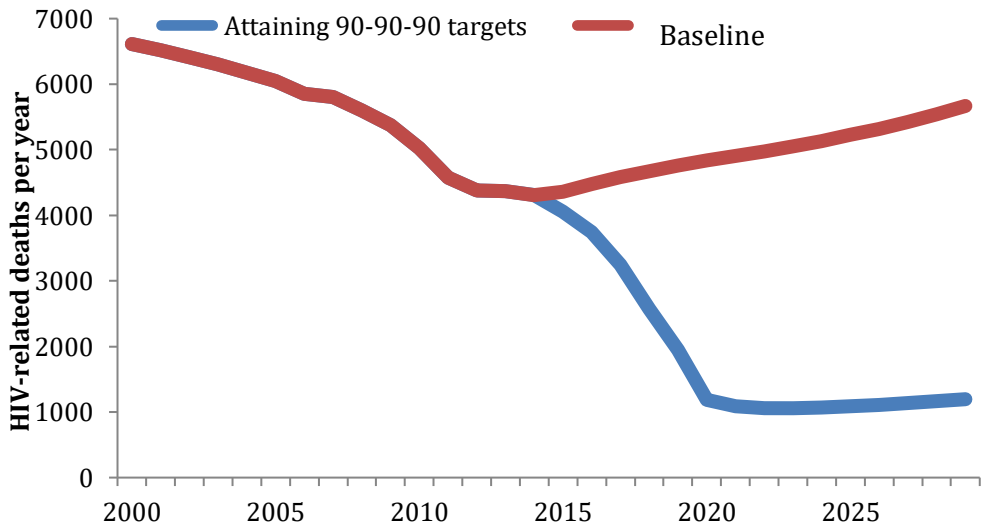
The model-predicted evolution of annual new infections and deaths under these conditions are shown in **Figures 5.1 and 5.2.** For the scenario of attaining 90 percent PMTCT coverage (**Figure 5.3**), expected new infections among children for the same period is shown.

Figure 5.1 Model-predicted evolution of annual new infections comparing baseline coverage with attaining the 90-90-90 targets (2000–30)



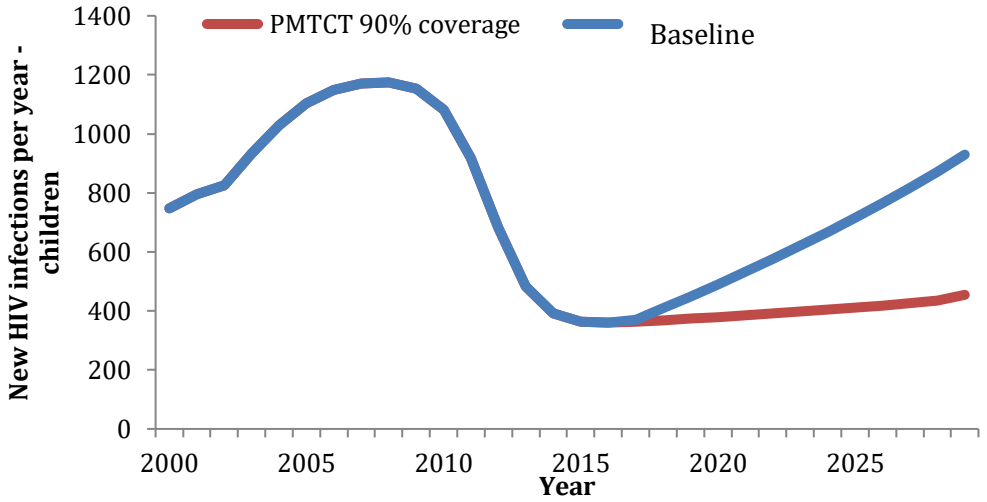
Source: Estimates from the Optima HIV model for Togo.

Figure 5.2 Model-predicted evolution of annual HIV-related deaths comparing baseline coverage with attaining the 90-90-90 targets (2000–30)



Source: Estimates from the Optima HIV model for Togo.

Figure 5.3 Model-predicted new infections for children comparing baseline coverage with attaining the target of 90 percent PMTCT coverage by 2020 (2000–30)



Source: Estimates from the Optima HIV model for Togo.

Overall, if the 2014 funding and coverage levels and allocations are maintained, the number of new HIV infections and HIV-related deaths are expected to increase. The two alternative scenarios are estimated to significantly reduce the number of new HIV infections and HIV-related deaths in comparison with this baseline scenario.

These analyses predict that Scenario 1 (attaining 90-90-90 targets) will substantially reduce new infections and deaths compared with the baseline scenario. Scenario 1 is estimated to result in 56 percent or 63,500 fewer infections, and 68 percent or 47,900 fewer deaths by 2030, compared with the baseline scenario.

These findings also show that attaining 90 percent coverage for PMTCT by 2010 (Scenario 2), could reduce the number of new infections among children by 35 percent, with 3,000 new infections averted compared with the baseline scenario.

5.2 ESTIMATED BUDGET REQUIRED TO ATTAIN THE 90-90-90 TARGETS BY 2020

In reducing the number of deaths and new infections over time, Scenarios 1 and 2 would be significantly more effective than the baseline scenario of maintaining the 2014 level and pattern of HIV spending. This demonstrates the importance of ensuring high testing and treatment coverage for all populations, including key populations. The following discussion provides estimates for the spending levels required to attain the 90-90-90 targets. Deriving these estimates required the application of the following assumptions:

- The estimated 110,400 PLHIV in 2014, was derived from the model calibration which takes multiple parameters into account.
- We assume that investments in all other programs remain are maintained at 2014 levels.

- 2014 unit costs have been applied to all years. For ART, this was US$265.35 per patient, per year[62] and for testing this was US$3.91 per test.[63] Changes in the unit cost over time would affect these estimates.
- It has been assumed that 52 percent of PLHIV, or 57,356 people, were diagnosed in 2014.[64] In-country experts acknowledge that while this value is the best available estimate for this parameter, it remains an estimated figure.
- This analysis constitutes a starting point in understanding the costs of reaching the 90-90-90 targets. However, this estimate is static and does not include all factors that affect the HIV care cascade such as stigma and discrimination. Further work is needed in this area.

5.2.1. COST OF TESTING

Achieving a target of 90 percent of PLHIV tested and diagnosed by 2020, would cost approximately US$3.2 million if 4.9 percent of the tested population were diagnosed with HIV each year. The estimated cost would range between US$5.3 million (for a 3 percent HIV-positive testing rate) and US$1.6 million (for a 10 percent positive testing rate). These are cumulative costs for the 2016–20 period, at 2014 unit costs, in real terms.

5.2.2. COST OF TREATMENT

Achieving a target of 90 percent of diagnosed PLHIV on treatment by 2020 would require investments of approximately US$93.7 million in the treatment program (**Table 5.2**). As with the testing estimates, these are cumulative costs for the period 2016–20, at 2014 unit costs, in real terms. This is a conservative estimate, assuming a static epidemic and stable unit costs, and it would benefit from further analysis.

Table 5.2 Estimated cost required for treatment to reach the 90-90-90 targets by 2020

YEAR	ESTIMATED NUMBER OF PLHIV (OPTIMA HIV ESTIMATES)	% TREATMENT COVERAGE	NUMBER OF PLHIV ON TREATMENT	ANNUAL COST TO PROVIDE TREATMENT IN 2014 REAL TERMS (US$)
2016	112,313	42.4%	47,621	12,636,057
2017	113,381	51.8%	58,731	15,584,256
2018	114,565	61.2%	70,114	18,604,462
2019	115,876	70.6%	81,808	21,707,660
2020	117,318	81.0%	95,028	25,215,395
Total 2016–20				**93,747,830**

[62] National HIV/AIDS Spending Report, 2014.

[63] Coûts unitaires des services de prévention, de traitement et de soutien dans la riposte nationale contre le VIH et le Sida au Togo, Aout 2014.

[64] Rapport Annuel D'activité de la Réponse Nationale Contre le VIH/SIDA en 2014.

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6 CAN EPIDEMIC OUTCOMES BE IMPROVED BY REALLOCATING FUNDS?

The analysis discussed in this section investigated whether it would be possible to obtain epidemic improvements by reallocating the baseline HIV budget. Specifically, it assumed that the 2014 budget envelope for targeted programs of US$20,792,575 (see **Table 2.1**, **Figure 3.3**) would be available each year during the 2016–30 period. The analysis then estimated the allocation of this funding that would minimize cumulative new HIV infections and HIV-related deaths in the entire population over that period, whilst also ensuring that no population would be worse off than they were before.

Findings from the model-based analyses suggested that the actual allocation of the 2014 budget was close to optimal. The baseline allocation of funding differs slightly from the model derived optimized allocation of the 2014 budget, but the gains remain too limited to significantly impact the course of the epidemic.

It should be noted, however, that the model assumes that the indirect cost for management and enablers remain stable and these were therefore fixed as U.S. dollar amounts. However, if all indirect costs were reduced by 25 percent, then 16,900 more PLHIV might be placed onto treatment. This could avert approximately 19,900 new infections and 15,400 deaths by 2030. Beacause management costs make up a large proportion of indirect costs, just reducing management costs by 25 percent might enable an extra 10,600 people to be put onto treatment, thus averting 9,900 deaths and 11,000 new infections by 2030.

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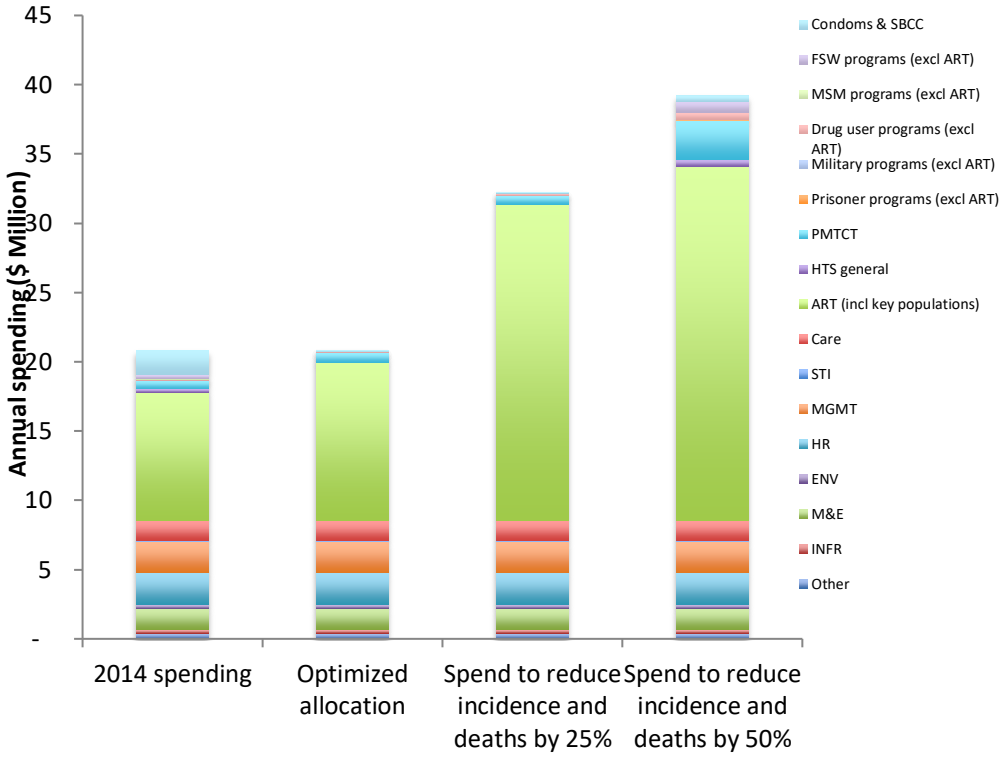
7 HOW MUCH WILL IT COST TO ACHIEVE THE PROPOSED NATIONAL HIV STRATEGIC PLAN TARGETS?

The analysis in this section identifies the minimum annual resource requirements to achieve the National Strategy targets. However, since the targets were not finalized at the time the modelling was conducted, the research team instead estimated the minimum investment required to (a) reduce new infections and deaths by 25 percent; and (b) reduce new infections and deaths by 50 percent.

Figure 7.1 and **Table 7.1** show the 2014 allocation of the HIV budget alongside the minimum spending required to achieve the two targets described above, assuming that the funds are optimally allocated. The model results presented here suggest that US$32.2 million would need to be invested annually to achieve the first target of reducing new infections and deaths by 25 percent. This includes an assumed proportional scale-up of the budget to non-targeted programs (see **Table 2.1**). This total budget is 55 percent more than the 2014 budget of US$20.8 million. Similarly, this analysis estimates that new infections and deaths could be reduced by 50 percent with annual spending of around US$39.2 million, which is 88 percent more than the 2014 spending level. **Table 6** shows the recommended spending across programs in order to reduce new infections and deaths by 50 percent.

In order to reach proposed targets of reducing new infections and deaths by 50 percent, the model recommends increased investments in ART, PMTCT, and non-ART prevention programs, especially those targeted at FSW, drug users, and prisoners as well as HTS programs.

Figure 7.1 Minimum annual spending required to meet selected targets



Source: Estimates from the Optima HIV model for Togo.

Note: SBCC = social and behavior change communication; HTS = HIV testing service; STI = sexually transmitted infections programs; MGMT = management; HR = human resources; ENV = enabling environment; M&E = monitoring and evaluation; INFR = infrastructure. Programs are as per NASA definitions.

Table 7.1 Baseline (2014) and optimized minimum annual spending required to meet the National Strategy target to reduce both new infections and deaths by 50 percent for the 2016–30 period.

PROGRAM	2014 SPENDING (US$)	% OF 2014 BUDGET	ANNUAL SPENDING REQUIRED TO REDUCE DEATHS AND NEW INFECTIONS BY 50% (US$)	% OF ANNUAL SPENDING REQUIRED TO REDUCE DEATHS AND NEW INFECTIONS BY 50%
Condoms & SBCC	1,731,243	8.3%	418,002	1.1%
Drug user programs	45,020	0.2%	546,056	1.4%
Prisoner programs	1,612	0.01%	47,534	0.1%
HTS	251,929	1.2%	472,589	1.2%
FSW programs	255,960	1.2%	755,912	1.9%
MSM programs	77,234	0.4%	3,416	0.01%
Military programs	4,672	0.02%	3,239	0.01%
ART	9,275,229	44.6%	25,578,089	65.3%
PMTCT	624,169	3.0%	2,834,344	7.2%
Management	2,207,263	10.6%	2,207,263	5.6%

PROGRAM	2014 SPENDING (US$)	% OF 2014 BUDGET	ANNUAL SPENDING REQUIRED TO REDUCE DEATHS AND NEW INFECTIONS BY 50% (US$)	% OF ANNUAL SPENDING REQUIRED TO REDUCE DEATHS AND NEW INFECTIONS BY 50%
Human Resources	2,338,274	11.2%	2,338,274	6.0%
Environment	277,017	1.3%	277,017	0.7%
Monitoring and evaluation	1,521,866	7.3%	1,521,866	3.9%
Infrastructure	251,300	1.2%	251,300	0.6%
Sexually Transmitted Infections	69,398	0.3%	70,398	0.2%
Care	1,441,228	6.9%	1,441,228	3.7%
Other	419,162	2.0%	419,162	1.1%
Total	**20,792,576**		**39,185,688**	

Source: Estimates from the Optima HIV model for Togo

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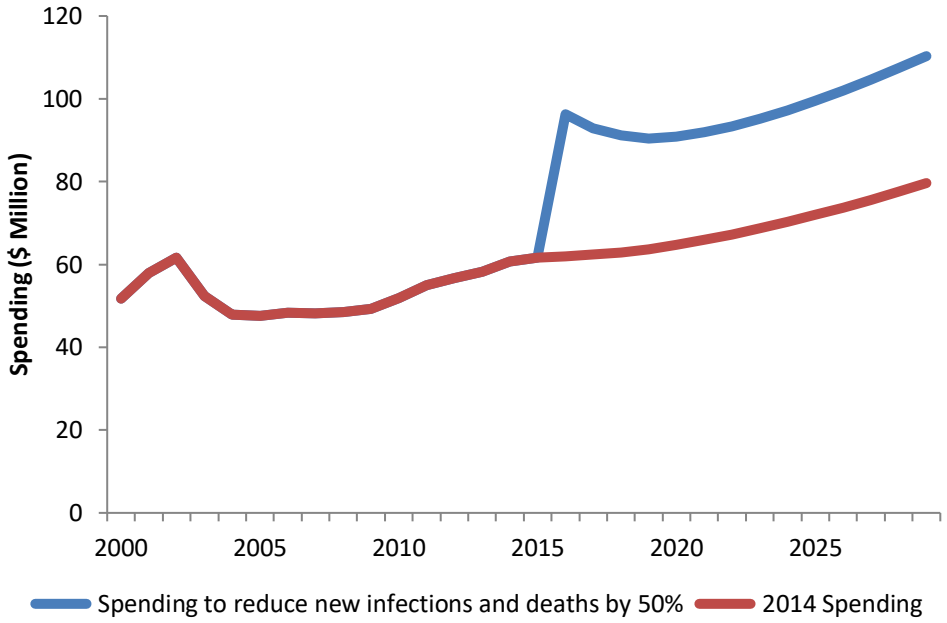
8 WHAT ARE THE LONG-TERM FINANCIAL COMMITMENTS TO HIV SERVICES FOR PLHIV?

This analysis reviews the long-term financial impact of achieving the targets in the National Strategic Plan. Long-term impact refers to all long-term financial liabilities arising from the commitment to provide HIV and related health services to PLHIV in the future. In monetary terms, a financial commitment is the discounted cost of providing HIV services for PLHIV in a particular year. It includes HIV treatment costs, HIV related health care costs, and social mitigation costs.

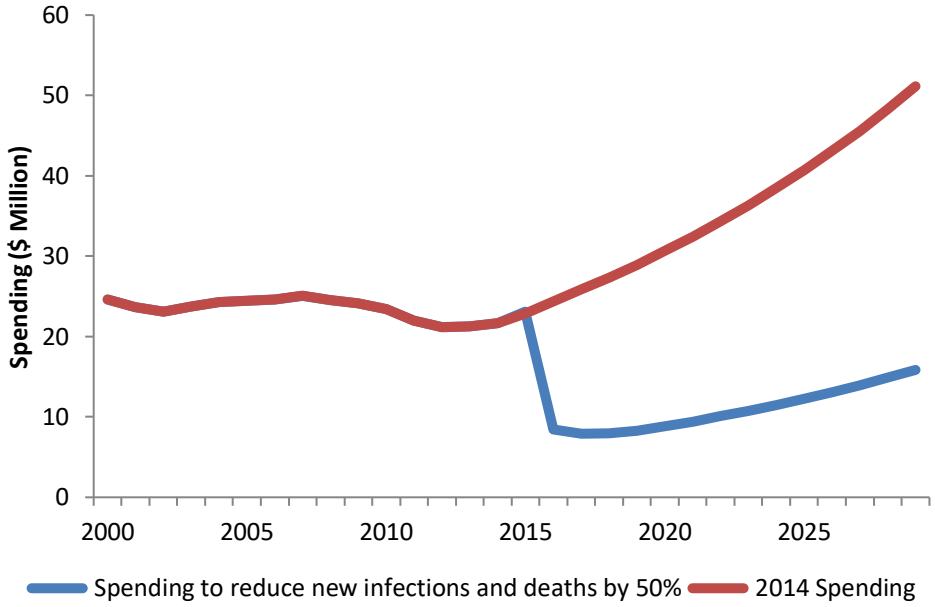
If the National Strategy targets of reducing incidence and deaths by 50 percent are met by 2020, the modelling indicated that annual HIV-related response costs needed to increase by 41 percent between 2016 and 2030 due to the expected increase in the number of people on ART and the concomitant increase in life expectancy (**Figure 8.1**). The long-term costs of expanding ART as described in these analyses ignore the income gains from a virally suppressed and therefore healthier and more productive working-age population. The financial commitments caused by new infections each year (i.e. life-time HIV care costs for newly diagnosed cases) could be reduced by 70 percent between 2016 and 2030 due to the expected reduction in new infections (**Figure 8.2**).

Figure 8.1 Annual HIV related spending for all old and new HIV infections up to 2030



Source: Estimates from the Optima HIV model for Togo.

Figure 8.2 Predicted life-time HIV care costs of new diagnosed cases in each year



Source: Estimates from the Optima HIV model for Togo.

Program management and administration, the main indirect cost category in this context, constituted 9 percent of total HIV spending in 2014. This is lower than some other countries in the region but is higher than HIV care and treatment spending, which constituted 7 percent of total HIV spending in 2013. Although these indirect costs have been fixed in the analyses presented in this report, future work may wish to explore opportunities to rationalize program management and administration costs, with the savings then allocated to the direct costs of the HIV response.

9 CONCLUSIONS

The Togolese government has responded effectively to a complex, mixed HIV epidemic. To assess HIV epidemic trends, the research team for this study used the Optima HIV epidemic module calibrated to HIV prevalence data points available for different subpopulations in Togo. The model was also calibrated to data points on the number of people on ART from available data sources and in consultation with Togolese experts. **Analyses using this model highlight a strong risk that prevalence and incidence will continue to increase overall in Togo if ART coverage is not increased.** Togo's fast-growing population will continue to challenge the HIV response, even in the context of stabilizing prevalence rates in many subpopulations.

The analyses suggest that there is only minimal scope for gains by re-allocating the 2014 HIV budget to further minimize HIV incidence, prevalence and HIV-related deaths. The findings highlight a significant treatment gap, and are testament to the need for additional funding to achieve 90-90-90 targets and to respond most effectively to this epidemic.

Effective ART scale-up is needed. Coverage must be increased if global targets are to be met. In 2014, 33 percent of Togo's estimated 110,400 people living with HIV received treatment, compared with a global target of 81 percent by 2020. More recent estimates (not available at the time these analyses were conducted) indicate that ART coverage has increased, but that around half of the country's PLHIV are not receiving treatment. Reducing AIDS-related deaths and new infections will require increased ART spending.

In order to reduce the treatment gap, whilst ensuring additional funding for non-ART HIV programs for key populations, in particular FSW, which are a key driver of the epidemic, **a series of concomitant actions are required**: reduced spending on general prevention programs targeting low-risk population, a larger budget envelope, prioritization of spending on core programs, reduced spending on indirect programs where feasible, technical efficiency gains, investment from budgets not earmarked for HIV that benefit from the broader public health impacts of key population programs.

The analysis shows indeed that in order to reduce incidence and deaths by 50 percent, **resources should be shifted from prevention programs targeting the general low risk population to non-ART key population programs, ART, and PMTCT**.

Key population HIV programs would benefit from fully integrating ART initiation and adherence. As ART is an effective prevention strategy, it would be beneficial if ART was a central component of the prevention strategy and, as such, integrated into the design and implementation of prevention strategies. The model recommends a proportionately higher increase in spending on treatment for key populations.

Additional domestic resources are needed to sustain the HIV response. Funding for HIV in Togo has increased since 2007. However, excluding ART, prevention programs and programs targeted at key populations are primarily funded by international donors. As such, the withdrawal of international funding without a concurrent increase in domestic resources would have a significant negative impact on the HIV epidemic in Togo.

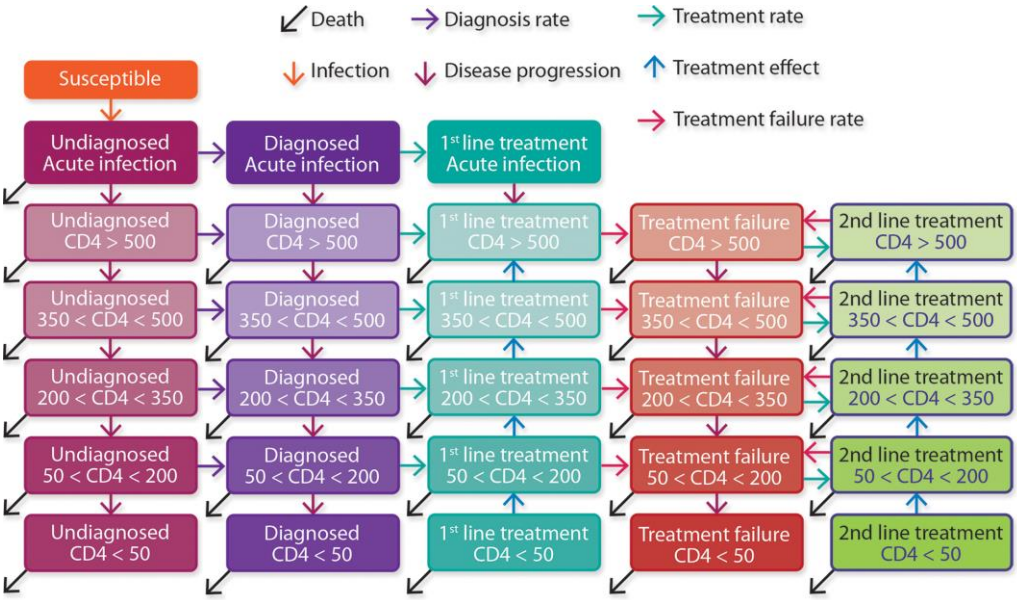
Greater technical efficiency in spending might be achieved through strategies to reduce the average spending per person reached. This is particularly true for indirect spending. However, care should be taken to ensure that these strategies do not compromise the quality of prevention or treatment, and further analyses of technical efficiency are needed before more robust conclusions can be reached.

By modeling the likely trajectories of the HIV epidemic under different conditions, the analysis highlighted the significant gains already achieved with baseline spending in the form of new infections and deaths averted. **However, analyses of what may be needed to achieve the proposed targets of the National Strategy have identified a clear need for increased investment in an optimized HIV response in Togo.** All the results from this study point towards the conclusion that the resources that had been mobilized up to the point at which these modeling analyses were conducted were not sufficient to allow Togo to achieve its targets, and that **optimization gains alone cannot close this gap**.

ANNEX 1: OPTIMA HIV MODEL: TECHNICAL SUMMARY

This Annex provides a brief technical overview of Optima HIV. A more detailed summary of the model and methods is provided elsewhere.[65] Optima HIV is based on a dynamic, population-based HIV model. Optima HIV tracks the entire population of people living with HIV (PLHIV) across five stages of CD4 count. These CD4 count stages are aligned to the progression of World Health Organization (WHO) treatment guidelines: acute HIV infection, >500, 350–500, 200–350, 50–200, and, 50 cells per microliter. Key aspects of the antiretroviral therapy (ART) service delivery cascade are included: from infection to diagnosis; ART initiation on first-line therapy; treatment failure; subsequent lines of therapy; and HIV/AIDS-related or other death (**Figure A1.1**).

Figure A1.1 Schematic diagram of the health state structure of the model



Note: Each compartment represents a single population group with the specified health state, while each arrow represents the movement of individuals between health states. All compartments except for "susceptible" represent individuals living with HIV. Death includes all causes of death.

The model uses a linked system of ordinary differential equations to track the movement of PLHIV between HIV health states; the full set of equations is provided in Kerr et al (2015). The overall population is partitioned in two ways: by population group and by HIV health state. Individuals are assigned to a given population group based on their dominant risk.[66] HIV infections occur through the interaction between different populations by regular, casual, or commercial (including transactional) sexual partnerships, through sharing of injecting equipment, or through mother-to-child

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[65] See C. C. Kerr et al., 2015. "Optima: A Model for HIV Epidemic Analysis, Program Prioritization, and Resource Optimization." *JAIDS (Journal of Acquired Immune Deficiency Syndrome)* 69(3):365–76.

[66] However, to capture important cross-modal types of transmission, relevant behavioral parameters can be set to non-zero values (e.g., males who inject drugs may engage in commercial sex; some men who have sex with men [MSM] may have female sexual partners).

transmission. The force-of-infection is the rate at which uninfected individuals become infected. It depends on the number and type of risk events to which individuals are exposed in a given period (either within their population groups or through interaction with other population groups) and the infection probability of each event. There is one force-of-infection term for each type of interaction (e.g., casual sexual relationships between male sex workers and female sex workers [FSW]); the force-of-infection for a given population will be the sum of all interaction types.[67]

The first step in initiating an Optima HIV analysis is to gather all the relevant epidemiological, demographic, programmatic, and behavioral data; a full set of data requirements is described in the model user guide (http://ocds.co/user-guide). After the data has been uploaded to the model, the model must then be calibrated, which is the process of finding parameter values such that the model generates accurate estimates of HIV prevalence, the number of people on treatment, and any other epidemiological data that are available. The calibration can be performed automatically, manually, or a combination of both. This process of model calibration and validation should normally be performed in consultation with governments and other key stakeholders in the countries in which the model is being applied.

A novel component of Optima HIV is its ability to calculate allocations of resources that optimally address one or more HIV-related objective (e.g., impact-level targets in a country's HIV national strategic plan). Because Optima HIV also calculates the coverage levels required to achieve these targets, it can be used to inform HIV strategic planning and the determination of program coverage levels. The key assumptions of resource optimization are the relationships between (1) the cost of HIV programs for specific

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[67] For sexual transmission, the force-of-infection is determined by:

- The HIV prevalence (weighted by viral load) in partner populations;
- The average number of casual, regular, and commercial homosexual and heterosexual acts per person per year;
- The proportion of these acts in which condoms are used;
- The proportion of men who are circumcised;
- The prevalence of sexually transmissible infections (which can increase HIV transmission probability);
- The proportion of acts that are covered by pre-exposure prophylaxis and post-exposure prophylaxis;
- The proportion of partners on antiretroviral treatment (ART); and
- The efficacies of condoms, male circumcision, post-exposure prophylaxis, pre-exposure prophylaxis, and ART in preventing HIV transmission.

For injecting-related transmission, the force-of-infection is determined by:

- The HIV prevalence (weighted by viral load) in populations
- The number of people who use a syringe and then share it;
- The number of injections per person per year;
- The proportion of injections that use shared equipment; and
- The fraction of people who inject drugs on opioid substitution therapy and its efficacy in reducing injecting behavior.

For mother-to-child transmission, the number of-infections is determined by:

- The birth rate among women living with HIV;
- The proportion of women with HIV who breastfeed;
- The probability of perinatal HIV transmission in the absence of intervention; and
- The proportion of women receiving prevention of mother-to- child transmission (PMTCT) services, including ART.

target populations; (2) the resulting coverage levels of targeted populations with these HIV programs; and (3) how these coverage levels of HIV programs for targeted populations influence behavioral and clinical outcomes. Such relationships are required to understand how incremental changes in spending (marginal costs) affect HIV epidemics.[68] Logistic functions can incorporate initial start-up costs and allow changes in behavior to saturate at high spending levels, thus better reflecting program reality. The logistic function has the form:

$$L(x) = A + \frac{B - A}{1 + e^{-(x-C)/D'}}$$

where L(x) relates spending to coverage, x is the amount of funding for the program, A is the lower asymptote value (adjusted to match the value of L when there is no spending on a program), B is the upper asymptote value (for very high spending), C is the midpoint, and D is the steepness of the transition from A to B. Saturation values of the coverage are typically chosen to match behavioral data in countries with heavily funded HIV responses.[69] To perform the optimization, Optima HIV uses a global parameter search algorithm called adaptive stochastic descent (ASD). ASD is similar to simulated annealing in that it makes stochastic downhill steps in parameter space from an initial starting point. However, unlike simulated annealing, ASD chooses future step sizes and directions based on the outcome of previous steps. For certain classes of optimization problems, we have shown that ASD can determine optimal solutions with fewer function evaluations than traditional optimization methods, including gradient descent and simulated annealing.

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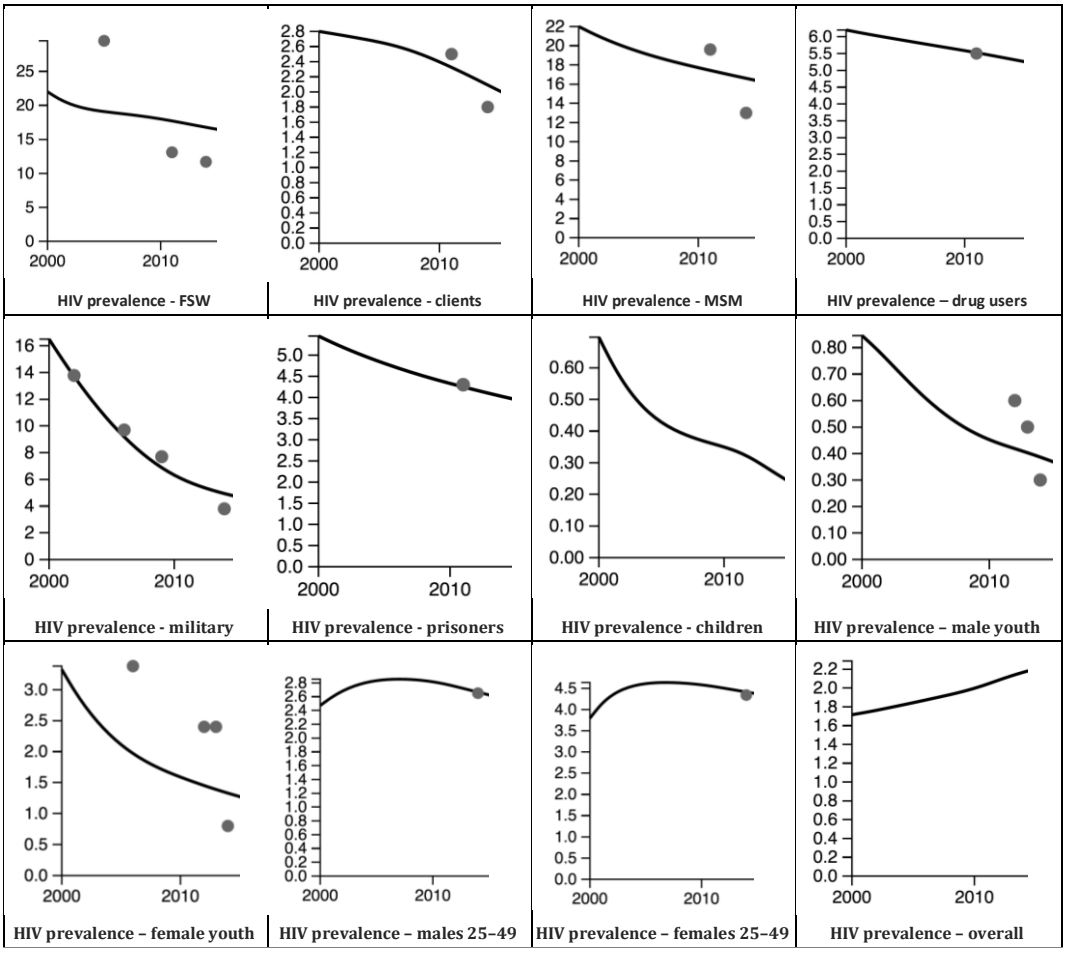
[68] A traditional approach is to apply unit cost values to inform a linear relationship between money spent and coverage attained. This is a reasonable assumption for programs like an established ART program that no longer incurs start-up or initiation costs, but less appropriate for condom promotion and behavior change communication programs. Most HIV programs typically have initial setup costs, followed by a more effective scale-up with increased funding. However, there are saturation effects for very high coverage levels because these require increased incremental costs because of demand generation and related activities for the most difficult-to-reach groups. Optima uses a logistic function fitted to available input data to model cost–coverage curves (See Annex 3).

[69] Program coverage for zero spending, or behavioral outcomes for zero coverage of formal programs, is inferred using data from early on in the epidemic or just before significant investment in HIV programs. Practically, we also discussed the zero and high spending cases with local experts who can advise on private sector HIV service delivery outside the governments' expenditure tracking systems. For each HIV program, we derive one set of logistic curves that relate funding to program coverage levels and another set of curves (generally linear relationships) between coverage levels and clinical or behavioral outcomes (i.e., the impacts that HIV strategies aim to achieve).

ANNEX 2: CALIBRATION FIGURES

Figure A2.1 Calibration of HIV prevalence among key populations and the overall HIV prevalence[70].



Source: estimates from the Optima HIV model for Togo.

In the calibration process, model parameters were varied in order to obtain the most accurate fit from the available data for FSW, clients, MSM, drug users, prisoners, military personnel, male youth, female youth, females 25–49, and males 25–49 populations. Data for children, and the populations of males 50+ and females 50+ were very limited and therefore the model was not calibrated against them. In the case of fitting the prevalence in FSW, clients, MSM, and male and female youth, there were large spreads in the historic data. Therefore, average estimates were used to derive the fitted curves (**Figure A2.1**).

[70] Black dots represent available data for the number of people on ART. The solid curve is the best fitting simulation of total ART patient numbers.

ANNEX 3: COST-COVERAGE OUTCOME FUNCTIONS

Table A3.1 Selected behaviors affected by HIV programs

HIV Program	▪ ***Targeted Behavior (correlating parameter in model)***
Programs for female sex workers (FSW) and clients (package)	▪ Proportion of sexual acts in which condoms are used with commercial partners (FSW) ▪ Proportion of FSW who are tested for HIV each year
Programs for men who have sex with men (MSM) (package)	▪ Proportion of sexual acts in which condoms are used with casual partners (MSM) ▪ Proportion of MSM who are tested for HIV each year
Programs for military personnel (package)	▪ Proportion of sexual acts in which condoms are used with casual partners ▪ Proportion of military personnel who are tested for HIV each year
Programs for drug users (package)	▪ Proportion of sexual acts in which condoms are used with casual partners (drug users) ▪ Proportion of drug users who are tested for HIV each year
Programs for prisoners (package)	▪ Proportion of people tested for HIV each year (prisoners)
Programs for the prevention of mother-to-child transmission (PMTCT)	▪ Number of HIV positive pregnant mothers receiving Option B/B+ (all selected populations)
Condom promotion and distribution and social behavior change communication (SBCC) (package)	▪ Proportion of sexual acts in which condoms are used with casual partners (male youth) ▪ Proportion of sexual acts in which condoms are used with casual partners (female youth) ▪ Proportion of sexual acts in which condoms are used with casual partners (males 25–49) ▪ Proportion of sexual acts in which condoms are used with casual partners (females 25–49)
HIV testing and counseling (general population)	▪ Proportion of male youth who are tested for HIV each year ▪ Proportion of female youth) who are tested for HIV each year ▪ Proportion of males 25–49 who are tested for HIV each year ▪ Proportion of females 25–49 who are tested for HIV each year ▪ Proportion of males 50+) who are tested for HIV each year ▪ Proportion of females 50+ who are tested for HIV each year
Antiretroviral therapy	▪ Number of people on ART (all population groups)

Cost-coverage outcome functions for FSW programs

Figure A3. 1 FSW – number covered by sex worker programs each year,

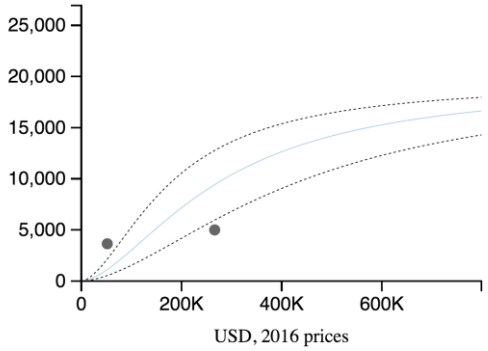


Figure A3. 2 FSW – proportion of people who are tested for HIV each year

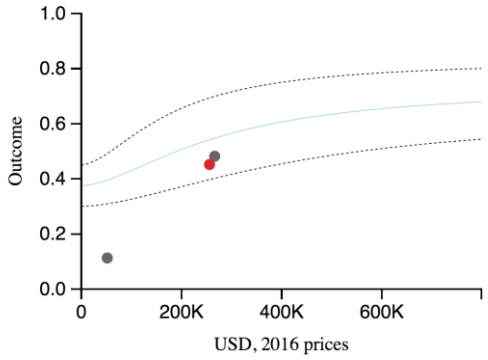
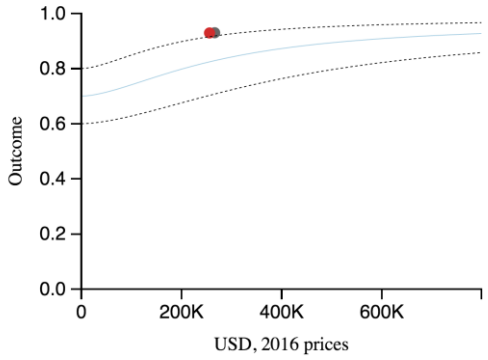


Figure A3. 3 FSW - Proportion of sexual acts in which condoms are used with commercial partners



Cost-coverage outcome functions for MSM programs

Figure A3. 4 MSM – number of people covered by the MSM programs

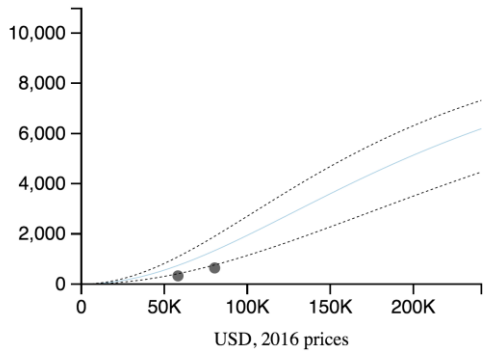


Figure A3. 5 MSM – proportion of sexual acts in which condoms are used with casual partners

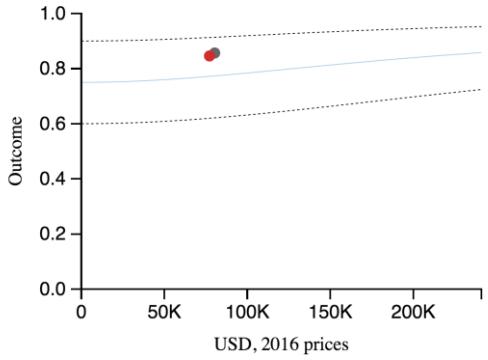
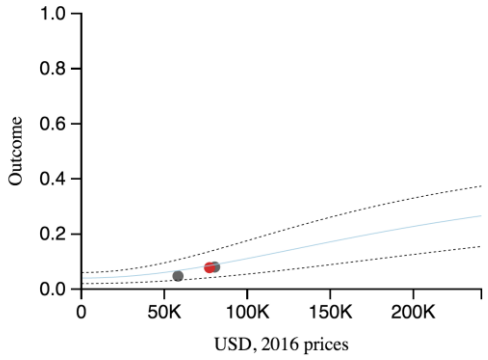


Figure A3. 6 MSM – proportion of people tested for HIV each year



Cost-coverage outcome functions for military personnel programs

Figure A3. 7 Military personnel – number of people covered by the military programs

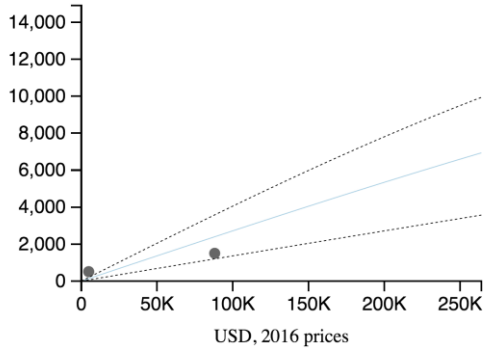


Figure A3. 8 Military personnel – proportion of sexual acts in which condoms are used with casual partners

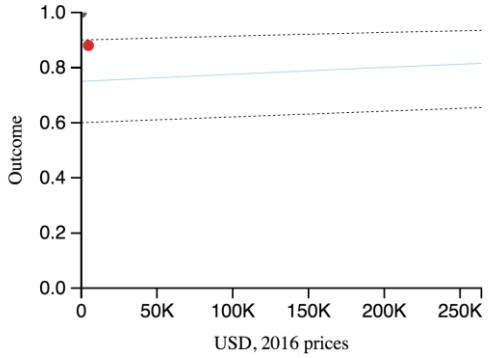
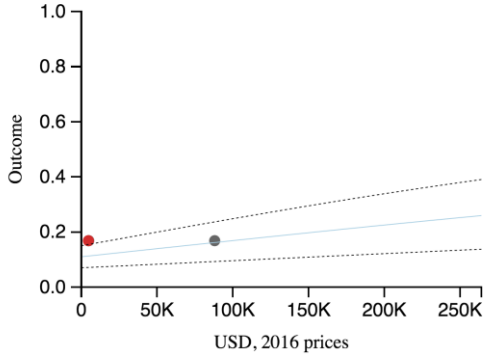
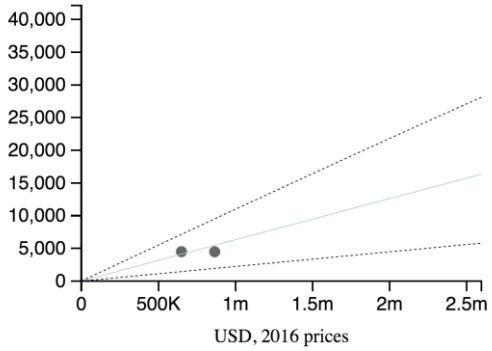


Figure A3. 9 Military personnel – proportion of people tested for HIV each year



Cost-coverage outcome function for PMTCT programs

Figure A3. 10 PMTCT therapy – number of people covered



Cost-coverage outcome functions for drug users' programs

Figure A3. 11 Drug users – proportion of people covered by drug user programs

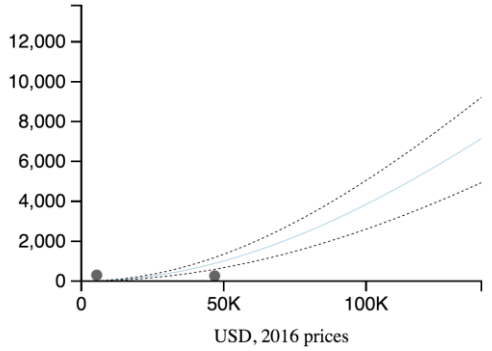


Figure A3. 12 Drug users – proportion of sexual acts in which condoms are used with casual partners

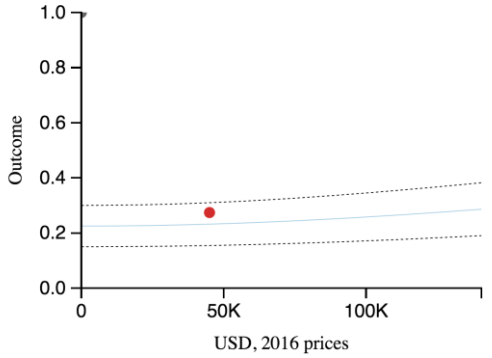
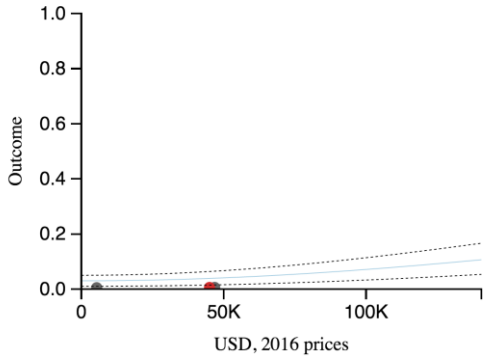


Figure A3. 13 Drug users – proportion of people who are tested for HIV each year



Cost-coverage outcome functions for prisoners' programs

Figure A3. 14 Prisoners – proportion of people covered by prisoner programs

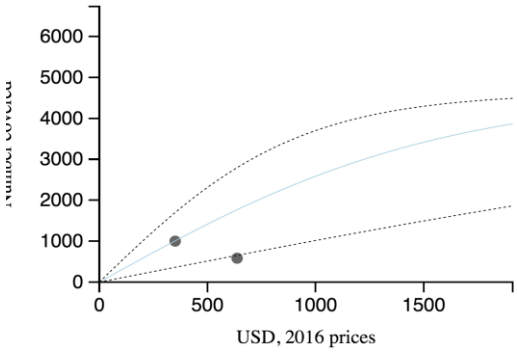
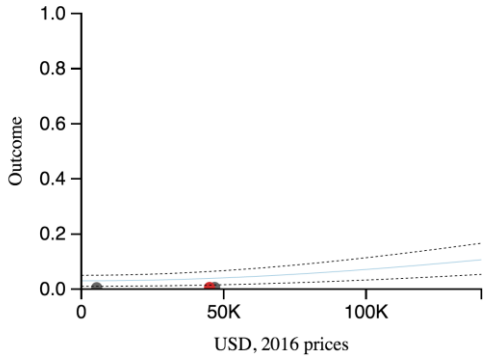


Figure A3. 15 Prisoners– proportion of people who are tested for HIV each year



Cost-coverage outcome functions for general population male and female population groups

Figure A3. 16 General population – proportion of sexual acts in which condoms have been used with casual partners

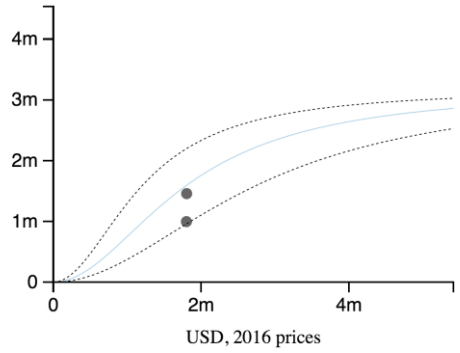


Figure A3. 17 Male youth population – proportion of sexual acts in which condoms have been used with casual partners

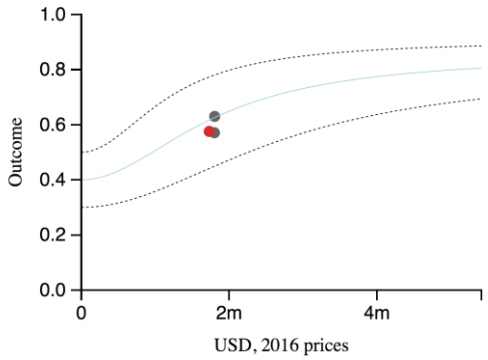


Figure A3. 18 Female youth population – proportion of sexual acts in which condoms have been used with casual partners

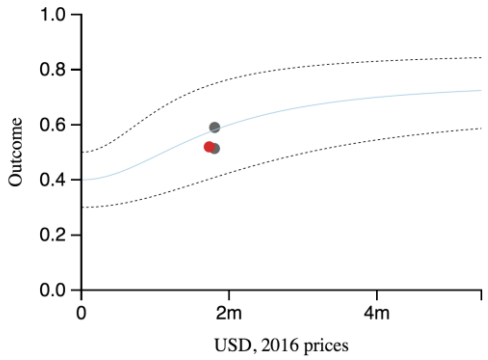


Figure A3. 19 Males 25–49 population – proportion of sexual acts in which condoms have been used with casual partners

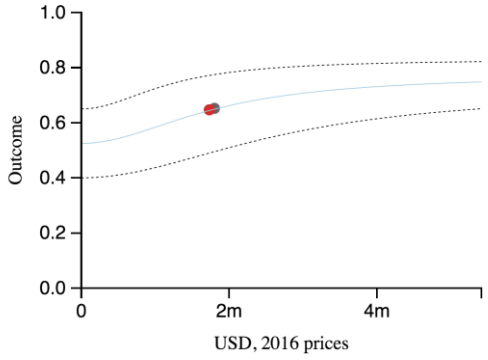


Figure A3. 20 Females 25–49 population – proportion of sexual acts in which condoms have been used with casual partners

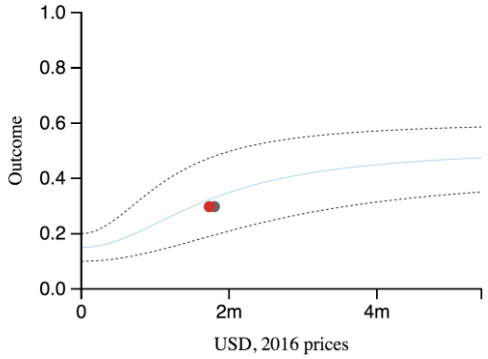


Figure A3. 21 General population – proportion of people tested for HIV

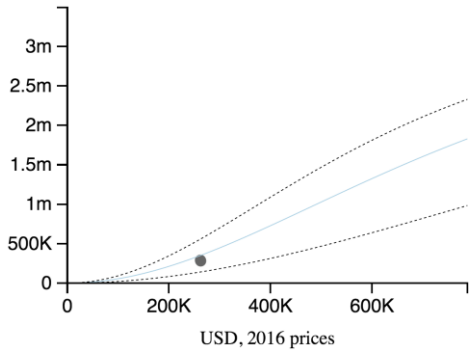


Figure A3. 22 Male youth population – proportion of people tested

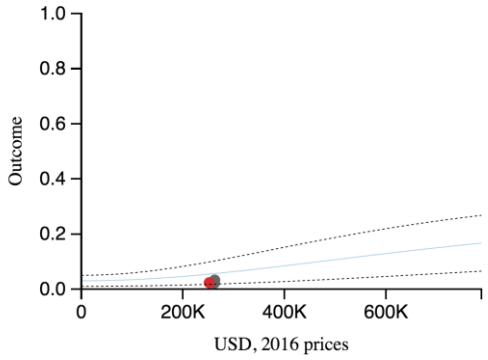


Figure A3. 23 Female youth population – proportion of people tested

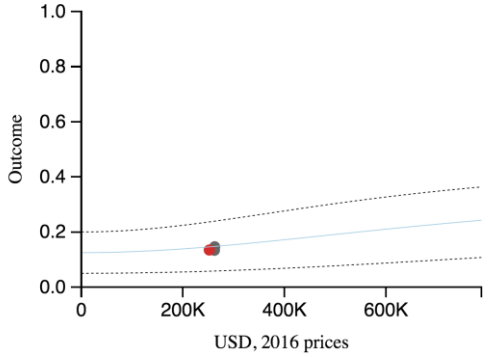


Figure A3. 24 Males 25–49 population – proportion of people tested

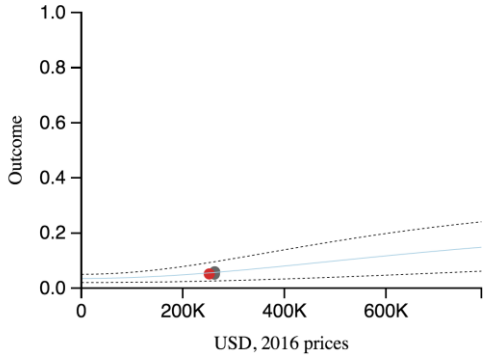


Figure A3. 25 Females 25–49 population – proportion of people tested

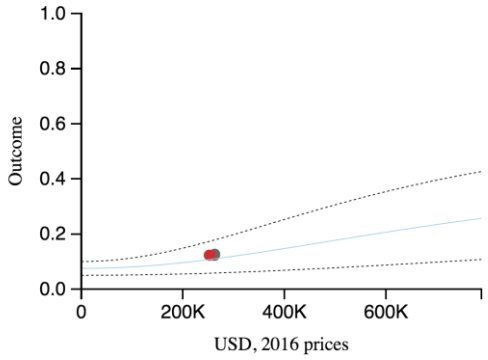


Figure A3. 26 Males 50+ population – proportion of people tested

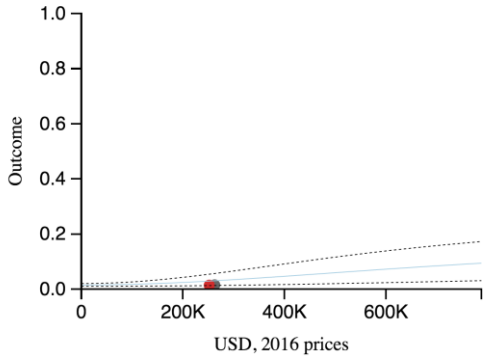
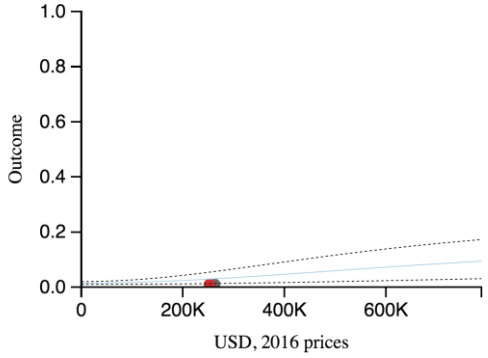


Figure A3. 27 Females 50+ population – proportion of people tested



Cost-coverage outcome function for ART

Figure A3. 28 Antiretroviral therapy – number of people covered (all population groups)