

# Robust Progress in ARV Optimization for Adolescents and Adults in PEPFAR Partner Countries during the First Years of COVID-19

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## Abstract

**Problem:** The United States President's Emergency Plan for AIDS Relief (PEPFAR) partner countries have been directly impacted by multiple waves of COVID-19 since early 2020. The HIV global supply chain in particular experienced drastic manufacturing and logistic disruptions. This public health crisis has tested the resilience of national HIV programs as ministries of health (MoH) and donors worked to maintain HIV programs while implementing COVID-19 readiness and response actions. Our goal was to assess progress in dolutegravir (DTG) transition for adolescent and adult populations during COVID-19.

**Local Setting:** Sixteen countries that receive support from PEPFAR, through the United States Agency for International Development (USAID), met the following inclusion criteria during both six month reporting periods (October 2019 - March 2020 and April 2022 - September 2022):

- PEPFAR/USAID supported HIV treatment to people living with HIV (PLHIV)  $\geq$  15 years,
- PEPFAR/USAID supported a supply chain program, and
- Complete and consistent reporting was available for both programmatic metrics: number of PLHIV on treatment and ARVs dispensed.

**Methods:** Starting in early 2020, PEPFAR published routine guidance for its programs to mitigate commodity disruption and promote HIV treatment continuity while minimizing potential COVID-19 transmission. Person-centered service delivery was promoted through expansion of differentiated service delivery, including the use of telephonic and internet-based support platforms. Clinical and supply plan tools were developed and adapted to meet evolving program needs. Monitoring frameworks tracked program adaptations and solutions, and virtual meetings were convened to disseminate best practices.

**Findings:** Collaboration across stakeholders remained crucial. In all 16 countries, the proportion of first-line DTG-based regimens dispensed increased between March 2020 and September 2022. While the total number of bottles of first-line ARVs dispensed increased in 13 (81%) countries, the total number of bottles of DTG-based regimens dispensed increased in all 16 countries. The reported number of PLHIV  $\geq$  15 years of age receiving ART from USAID-supported facilities increased in 15 (94%) countries

**Conclusion:** Proactive, coordinated service delivery and strategic supply chain adjustments protected high quality HIV treatment and increased uptake of DTG, resulting in millions of PLHIV receiving the benefits of DTG-based treatment during the first years of the COVID-19 pandemic. The introduction and scaling of DTG-based regimens as planned despite COVID-19 demonstrated the ability of PEPFAR and MoH to engage in proactive supply planning and monitoring, while ensuring job aids and training were available to educate providers. The successes and lessons learned will allow the global health community to respond more effectively to inevitable, future disruptions.

**Keywords:** ARV Optimization • PEPFAR • COVID-19 transmission • Dolutegravir

## Introduction

Since 2018, the World Health Organization (WHO) has recommended dolutegravir (DTG)-based antiretroviral therapy (ART) as the preferred first-

line regimen for people living with HIV (PLHIV) [1]. Only PLHIV weighing  $\geq$  20 kg were eligible for DTG until pediatric DTG formulations were approved in late 2020 [1].

Similarly, the United States President's Emergency Plan for AIDS Relief (PEPFAR) and the United States Agency for International Development (USAID) have prioritized the uptake of DTG-based regimens for PLHIV. Since October 2019, PEPFAR has instituted semi-annual monitoring of ARV quantities dispensed [2]. PEPFAR, through USAID (PEPFAR/USAID), supported seven million PLHIV aged  $\geq$  15 years (PLHIV15) in over 50 countries as of September 2022.

PEPFAR partner countries have been directly impacted by multiple waves of the COVID-19 pandemic since early 2020 [3]. The HIV health product global supply chain in particular experienced drastic manufacturing and logistic disruptions. The majority of USAID-procured DTG-containing, fixed-dose combination products are manufactured in India, and predominantly rely on Chinese manufacturers for active pharmaceutical ingredients [4,5]. National

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lockdowns reduced pharmaceutical manufacturing supplies, workforce, and distribution channels, decreasing output by up to 70% and delaying ARV delivery by five weeks on average [6,7]. Logistical activities were significantly constrained due to driver shortages, limited cargo capacity, reduced air travel, cross-border travel requirements, curfews and border closures [7,8].

This public health crisis has tested the resilience of national HIV programs as ministries of health (MoH), USG, and other donors diligently worked to sustain HIV program advancement while implementing COVID-19 readiness and response actions. Our goal was to assess progress in DTG transition for adolescents and adults during COVID-19.

## Methods

### Country setting

Sixteen PEPFAR partner countries met the following inclusion criteria during both six month reporting periods (October 2019 - March 2020 and April 2022 - September 2022):

- PEPFAR/USAID supported HIV treatment to PLHIV15,
- PEPFAR/USAID supported a supply chain program, and
- Complete and consistent reporting was available for both programmatic metrics: number of PLHIV on treatment and ARVs dispensed.

### Approach

Starting in early 2020, PEPFAR published routine guidance for its programs to mitigate commodity disruption and promote HIV treatment continuity while minimizing potential COVID-19 transmission [3]. Monitoring frameworks tracked program adaptations and solutions. PEPFAR/USAID convened virtual meetings with partners to disseminate best practices.

Chemonics International, implementing the USAID Global Health Supply Chain-Procurement Supply Management project, formed a COVID-19 supply chain management task force in February 2020. This task force, guided by MoH and USAID, implemented essential processes and procedures while providing weekly updates and recommendations for global and country-specific challenges. Tools were developed and adapted to meet evolving program needs; these resources included a risk analysis tool, a logistics milestone tracker, and a shipment communication tool. Order pre-emption and consolidation of orders across multiple suppliers and charters were also implemented.

Collaboration across global stakeholders remained crucial to align logistic and supply chain strategies. PEPFAR/USAID closely collaborated with MoH and ARV manufacturers to facilitate timely movement of commodities. Mitigation strategies included forecasting orders covering 12-24 months, introducing larger ARV bottle sizes (e.g., 90-count bottles), expediting import duty waivers, securing safe passages for commodities crossing international borders, and leveraging in-country inventory to compensate for logistical delays.

MoH and healthcare providers expanded differentiated HIV service delivery such as multi-month dispensing (MMD) and decentralized drug distribution (DDD) of ART [9]. USAID partners supported these efforts through training platforms and tools provision. To diversify DDD, programs supported alternative pick-up at community and private pharmacies, 'pop-up' pharmacies, lockers, and community-based pick-up points (post offices, schools, churches, etc.), and through use of peer or private sector home delivery.

Programs made necessary adaptations to protect patients, healthcare workers, and highly burdened health facilities. When appropriate and feasible, HIV service delivery was coupled with broader care, including HIV prevention, reproductive health, tuberculosis and non-communicable disease services. Where in-person HIV treatment services were needed, potential COVID-19 transmission was minimized by adjusting clinic flow to facilitate social distancing and MMD to reduce frequency of in-person facility visits. Individuals with proven or suspected COVID-19 were separated into dedicated

clinic spaces. Moreover, digital platforms were rapidly expanded to support case management and treatment continuity. A modified telemedicine approach supplemented in-person visits, allowing for the assessment of ART adherence and side effects, while also channeling health literacy.

As programs rapidly adapted, routinely collected PEPFAR/USAID data were used to assess the concurrent transition from efavirenz (EFV)-based ART to DTG-based ART for PLHIV15. Facility ARV dispensing data from the beginning of the COVID-19 pandemic (October 2019-March 2020) and from a six-month period two years later (April 2022–September 2022) were compared. Uptake of DTG-based regimens was estimated by comparing the proportion of tenofovir/lamivudine/dolutegravir (TLD) out of all first-line EFV- and DTG-based regimens dispensed. Additionally, the number of PLHIV15 receiving treatment at USAID-supported facilities was compared between the same periods.

## Findings

In all sixteen countries, the proportion of DTG-based first-line regimens dispensed increased between March 2020 and September 2022 (Table 1). All three of the countries with < 10% change between the reporting periods were countries that had already achieved dispensing TLD for > 95% of first-line ARV regimens during the first reporting period (DRC - 99%, Haiti - 98%, Nigeria - 96%) (Figure 1). In eleven (69%) of 16 countries, the proportion increased by > 30% (Figure 1). Countries with the largest increases included Lesotho (85%), South Africa (78%), Zimbabwe (72%), Burundi (59%), and Mozambique (59%) (Figure 1).

In 13 (81%) countries, the total number of bottles of first-line ARVs dispensed increased, whereas the total number of bottles of DTG-based regimens dispensed increased in all 16 countries (Table 1). Haiti, Eswatini and Ethiopia experienced civil unrest disruptions, impacting ARV dispensing efforts during the analytic period.

At the same time, the number of PLHIV15 receiving ART from USAID-supported facilities increased in all countries except South Africa (Figure 2). A major contributor to the decrease of PEPFAR/USAID-supported PLHIV15 in South Africa was a reporting artifact from a shift of support to another PEPFAR Agency starting in October 2020, rather than an actual decline in the number of clients on treatment.

### Lessons learnt

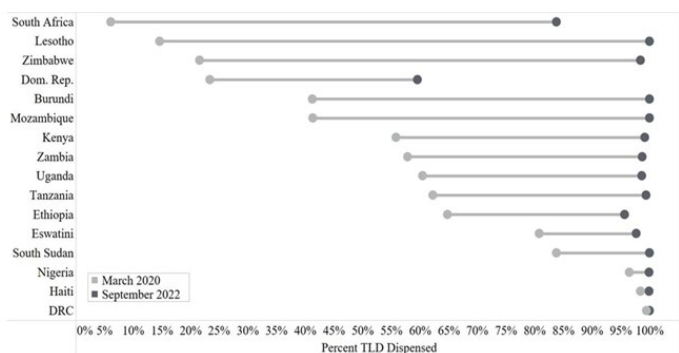
These examples of expansion in and optimization of HIV treatment during COVID-19 demonstrate the effectiveness of intentional clinical and supply chain adaptations, even during an historic and widely disruptive pandemic. Maintenance of adequate ARV stock was supported through coordinated and streamlined ARV orders from manufacturers for limited-use products, decreasing shelf-life requirements for ARV importation, and increasing communication between central warehouse and treatment facility staff. Supply chain experts guided the forecasting and supply planning by national HIV programs to ensure a strategic drawdown of EFV- and nevirapine-based regimens and an informed scale-up of DTG-based regimens, while accounting for simultaneous scale-ups in MMD and DDD. In coordination with national government and stakeholders, ARV supply plans were routinely updated at the country level. These plan updates were informed by existing stock levels, revisions in anticipated commodity demand and patient-level data, and fluctuating ARV funding constraints. To ensure facility stock availability, warehousing and distribution operations remained agile, and preventive measures (e.g., personal protective equipment and virtual platforms) were implemented for workforce safeguarding.

Commodity security of adult first-line DTG-based ART in certain PEPFAR/USAID supported countries was strained early in the COVID-19 pandemic due to lockdowns, port closures, and economic conditions that limited government financing of ARV orders. In some countries, such conditions limited MMD as additional buffer stock was needed to maintain central level minimum stock requirements while dispensing large volumes of ARVs. In Zambia, for example, the transition to DTG-based regimens progressed slowly during this time due

**Table 1.** Cumulative facility-level ARV dispensations and PLHIV receiving ART in 16 PEPFAR/USAID supported countries during October 2019 - March 2020 and April 2022-September 2022.

Country	Bottles of TLD dispensed		Bottles of all first-line ARVs dispensed <sup>†‡</sup>		Proportion of TLD dispensed		PLHIV (≥ 15 years) receiving ART (PEPFAR/ USAID Only)		PLHIV (≥ 15 years) receiving ART	
	(PEPFAR/ USAID Only)		(PEPFAR/ USAID Only)		(PEPFAR/ USAID Only)		(PEPFAR/ USAID Only)		(All PEPFAR agencies)	
	March 2020	September 2022	March 2020	September 2022	March 2020	September 2022	March 2020	September 2022	March 2020	September 2022
Burundi	1,45,761	3,46,774	3,53,580	3,46,780	41%	100%	56,754	62,525	59,500	66,141
Dem. Rep. Congo	5,07,089	11,41,681	5,09,752	11,41,681	99%	100%	60,951	1,21,902	1,31,603	2,54,568
Dominican Republic	10,541	89,354	45,077	1,50,142	23%	60%	13,081	20,508	24,611	38,607
Eswatini	8,62,474	11,04,534	10,68,026	11,30,844	81%	98%	70,829	76,291	1,84,898	2,02,702
Ethiopia	17,22,422	18,90,452	26,58,208	19,76,400	65%	96%	1,705	5,599	4,55,482	4,45,548
Haiti	4,74,331	7,71,637	4,81,848	7,72,275	98%	100%	22,204	30,059	1,06,757	1,27,645
Kenya	10,55,956	20,95,699	18,93,190	21,13,303	56%	99%	3,69,798	4,15,276	10,91,623	12,22,409
Lesotho	2,23,607	13,48,046	15,30,710	13,48,060	15%	100%	1,41,263	1,43,457	2,24,509	2,28,136
Mozambique	2,50,413	85,28,110	6,05,886	85,32,669	41%	100%	2,07,038	3,47,832	10,12,631	14,95,098
Nigeria	16,12,259	35,60,388	16,71,708	35,63,059	96%	100%	3,16,238	6,71,351	9,10,253	19,12,547
South Africa	3,59,470	97,65,384	58,88,251	1,16,55,832	6%	84%	22,07,557	21,16,759	37,59,256	49,96,902
South Sudan	12,486	63,371	14,907	63,371	84%	100%	4,923	9,578	27,815	45,468
Tanzania	45,41,405	1,09,94,575	72,99,757	1,10,63,039	62%	99%	3,77,926	4,44,784	12,37,063	15,02,717
Uganda	9,95,540	23,17,662	16,47,901	23,49,077	60%	99%	4,32,817	4,69,635	11,39,435	12,55,983
Zambia	33,55,727	95,19,798	58,04,197	96,44,488	58%	99%	4,35,151	5,21,755	10,05,705	11,89,984
Zimbabwe	10,18,214	73,15,144	47,28,836	74,33,721	22%	98%	4,98,462	6,09,624	9,02,042	11,66,415

<sup>†</sup>First-line ARVs include tenofovir/lamivudine/dolutegravir (TLD), tenofovir/lamivudine/efavirenz-400 mg and -600mg, and tenofovir/emtricitabine/efavirenz.  
<sup>‡</sup>All ARV bottles have been converted to 30-count equivalents. ART=antiretroviral therapy, ARV=antiretroviral, DRC=Democratic Republic of Congo, DR=Dominican Republic, DTG=Dolutegravir, PEPFAR=United States President’s Emergency Plan for AIDS Relief, PLHIV=People Living with HIV, USAID=United States Agency for International Development



**Figure 1.** Proportion of TLD dispensed compared to all first-line ARVs dispensed at PEPFAR/USAID-supported facilities in 16 PEPFAR partner countries during October 2019-March 2020 compared to April 2022- September 2022.

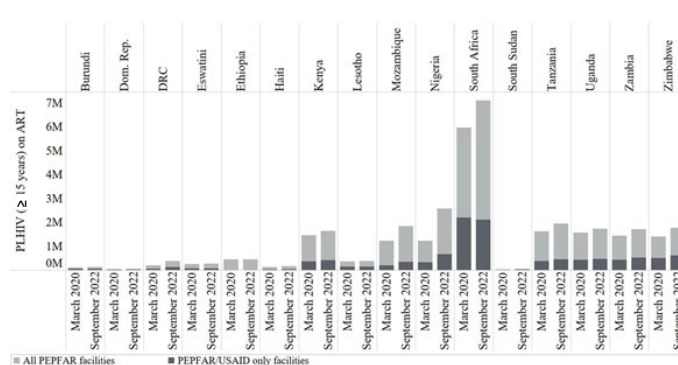
to limited stock requiring the use of other adult first-line ARVs until stocks of DTG-based regimens rebounded to acceptable levels. Periodic efforts to sensitize clinicians to the availability of DTG-based regimen in PEPFAR partner countries ensured that individuals were actively transitioned to optimal DTG formulations.

**Recommendations for sustainable program adaptations**

(1) Clinical programs can continue to intentionally adapt to protect treatment continuity during and after the COVID-19 pandemic through sustainable program adaptations. This includes expansion of MMD and DDD, person-centered adherence support, use of digital technologies and tools, augmenting limited in-person clinical visits with telemedicine services, and providing training and support to healthcare workers and lay cadres through telephonic and internet-based platforms.

(2) Supply chain programs can maximize resilience and minimize interruptions in medication access through:

- Promoting country ownership and timely program adaptation;
- Synchronizing across stakeholders to improve system resilience and commodity security, including improved planning and communications



**Figure 2.** PLHIV (≥15 years) receiving ART at PEPFAR/USAID-supported facilities in 16 PEPFAR partner countries in March 2020 compared to September 2022.

with manufacturers and funders through end-to-end data visibility and ongoing review of plans to inform global order allocations;

- Providing supportive supervision at facilities, through in-person, virtual, or hybrid approaches, to monitor and support supply chain management; and
- Strengthening national electronic logistic management information systems to secure ARV inventories, including tracking product expiry dates.

**Conclusion**

For individual health and HIV epidemic control purposes, HIV treatment continuity is essential. The COVID-19 pandemic has placed unprecedented pressure on health care systems. Proactive, coordinated service delivery and strategic supply chain adjustments protected quality HIV treatment and increased uptake of DTG despite this pressure, resulting in millions of PLHIV receiving the benefits of DTG-based treatment during the first years of the COVID-19 pandemic. The successes and lessons learned position the global health community to respond more effectively to inevitable, future disruptions.

## Role of Authors

The initial concept for this short report was conceived by RG. RG, MH, BRP, JMS, CYM, and GKS contributed to an initial analysis that was presented during IAS 2021. RG, JMS, and CYM drafted the initial outline for the manuscript. MH led the analysis, with technical contributions from RG, JMS, KM, and GKS. All authors (RG, MH, BRP, DT, JMS, CYM, KM, and GKS) contributed to the manuscript content.

All named authors meet the International Committee of Medical Journal Editors (ICMJE) criteria for authorship for this article, take responsibility for the integrity of the work as a whole, and have given their approval for this version to be published.

## Availability of Supporting Data

Raw data were generated at Hospital Foundation of Minas Gerais State - FHEMIG. Derived data supporting the findings of this study are available from the corresponding author on request.

## Competing Interests

The authors declare no competing interests.

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## Disclaimer

The contents in this article are those of the authors and do not necessarily reflect the view of the U.S. President's Emergency Plan for AIDS Relief, the U.S. Agency for International Development, or the U.S. Government.

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