Impacts of US Bilateral Aid Disruptions on HIV Resurgence in Zambia: A Mathematical Modeling Study

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BACKGROUND / INTRODUCTION

Of countries with high HIV prevalence, Zambia had the largest proportion of funding to its HIV program from the United States President's Emergency Plan for AIDS Relief (PEPFAR)—84% at the start of 2025.

Beyond its financial contribution, PEPFAR directly employed thousands of front-line health workers providing HIV treatment and prevention directly to people living with or at risk of HIV, as well as staff supporting healthcare operations such as appointment scheduling, electronic health record- keeping, outreach to clients who missed appointments, mentoring and supervision to clinical staff, logistics and supply chain management, distribution and warehousing of HIV medications and supplies, laboratory specimen transport, and data monitoring and forecasting. Abrupt withdrawal of bilateral aid in January 2025 disrupted HIV services. This study aimed to estimate the health and epidemiological consequences of the disruptions, and to what extent impacts could be mitigated by restoring services.

METHODS

We leveraged a previously developed HIV agent-based network transmission model, Epidemiological MODeling software for HIV, calibrated to Zambian HIV data at the provincial level. Health authorities leading the Zambian HIV program identified data and assumptions regarding impacts of aid disruptions by province and associated uncertainty ranges. We simulated disruptions lasting 3 months, 1 year, 4 years, or unabated, versus a counterfactual of no disruptions, over 2025–2060. Outcomes included additional HIV infections, deaths, and prevalence.

RESULTS

Unabated disruptions added 3.3 million HIV acquisitions (8.8x more than no disruption) and 1.6 million HIV deaths (5.3x), with the largest number among women (1.5 million acquisitions, 790 933 deaths) and the largest proportional increase among children (21.6x acquisitions, 20.8x deaths). Restoring services within 3 months would limit additional acquisitions to 54 863 (+13.1%) and additional deaths to 32 550 (+8.7%). HIV prevalence would increase by 4.5x if disruptions were unabated through 2060, but would not change (0.0x) if services were restored within 3 months.

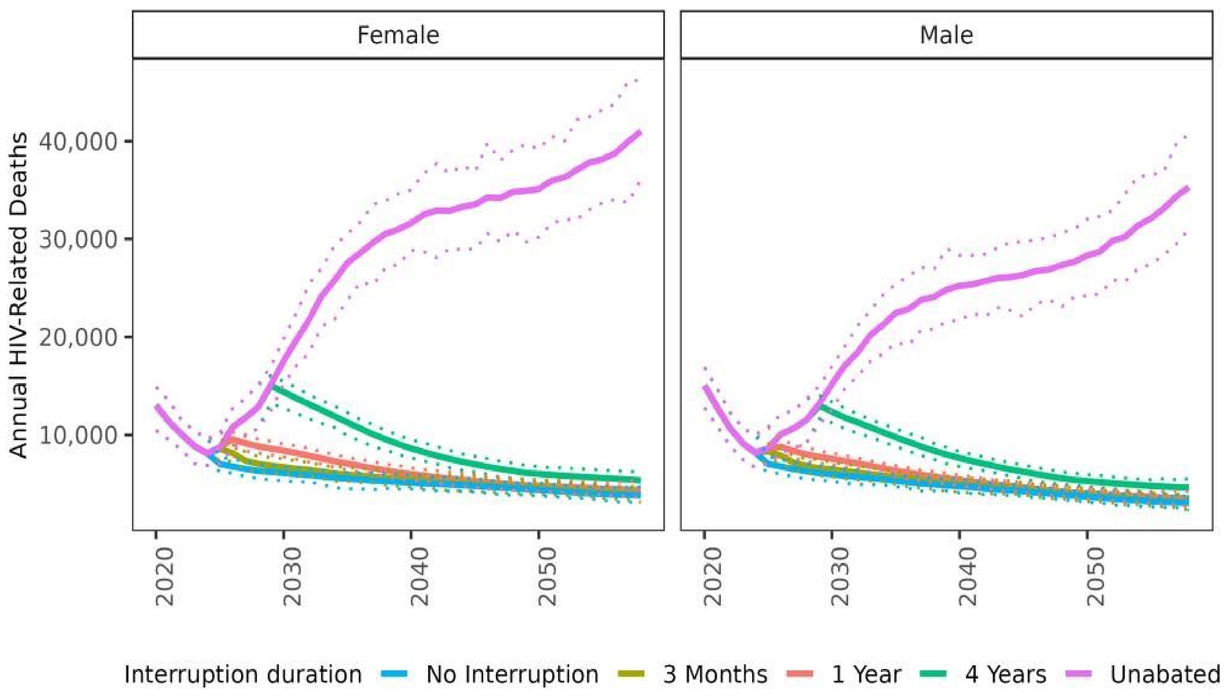

Figure 1. Impact of bilateral aid disruptions lasting different durations (3 m, 1 y, 4 y, or unabated) on annual HIV deaths in Zambia. Disruptions begin in January 2025. The results are reported for all ages and are stratified by sex.

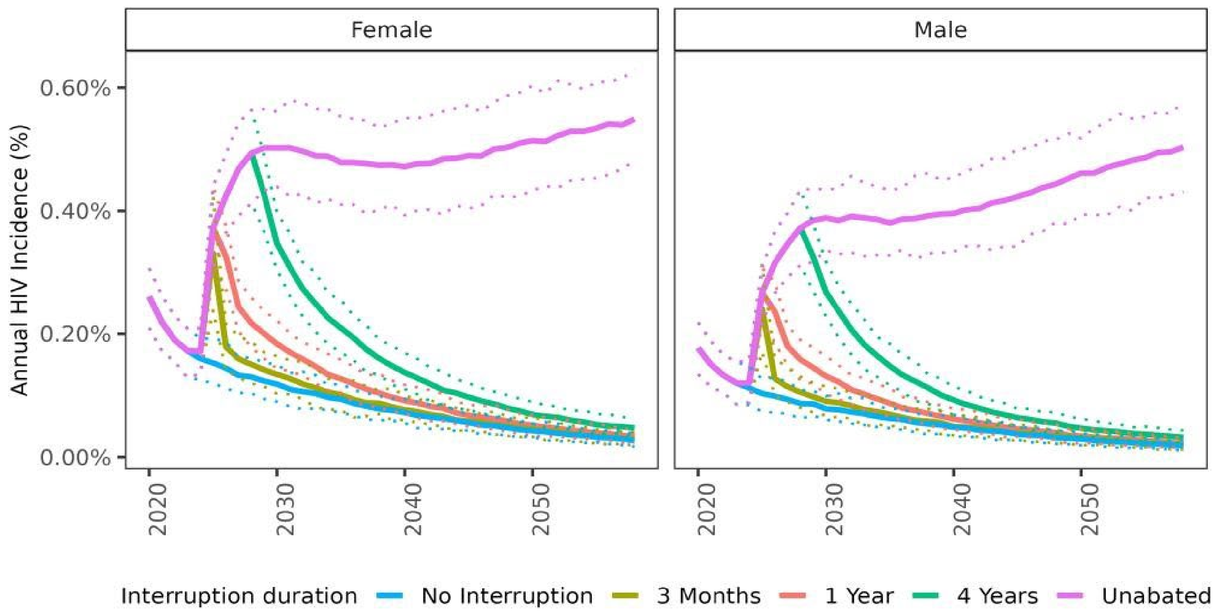

Figure 2. Impact of bilateral aid disruptions lasting different durations (3 m, 1 y, 4 y, or unabated) on annual HIV incidence rate (infections per 100 person-years) among adults ages 15 + in Zambia. Disruptions begin in January 2025. The results are stratified by sex.

DISCUSSION

Our modeling shows that bilateral aid disruptions are causing a resurgence in HIV-related deaths and new HIV infections in Zambia. If disruptions continue unabated, Zambia could experience over 1 million deaths among adults, and nearly a quarter-million deaths among children by 2060 (a 20-fold increase compared with no disruption). New HIV infections would resurge, with over 3 million additional infections by 2060, and HIV prevalence would be more than double, with the largest fold increases among children. HIV mortality could return to baseline if disruptions are limited to 3-month duration, but would take over 2 decades to return to baseline if disruptions last a year or more. However, even a 3-month disruption—which, as of this manuscript's submission, appears to be a best-case scenario—was estimated to cause over 30 000 additional deaths and over 50 000 additional HIV acquisitions in Zambia.

Our findings emphasize the importance of sustaining commitments on HIV epidemic control in low-resource global settings. As a transmissible disease, HIV is prone to resurging when services are disrupted, reversing hard-won gains in HIV epidemic control. Because the largest number of additional HIV infections is estimated to occur among women, mother-to-child HIV transmission will increase, extending the HIV crisis to future generations.

To reduce the impact of aid withdrawal and resulting disruptions to HIV service delivery, the Zambia Ministry of Health, together with cooperating and development partners, explored adaptive strategies to shift the HIV response toward greater domestic ownership and sustainability. This included creating a national sustainability roadmap and updating HIV guidelines to a minimum package of core HIV services considered sustainable and cost-effective within current health financing constraints. Increasing private sector involvement through market strategies and expanding the role of the national health insurance scheme could help diversify HIV financing. Supply chain resilience could be further strengthened by restructuring the Zambia Medicines and Medical Supplies Agency, along with improved stock monitoring in collaboration with UN agencies.

CONCLUSION

Rapid restoration of HIV services disrupted by the 2025 bilateral aid withdrawal could save >1.5 million lives and prevent epidemic resurgence in Zambia.

Ministry of Health