

Estimating the epidemiological impact of reaching the objectives of the Florida integrated HIV prevention and care plan in Miami-Dade County



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Summary

Background The US *Ending the HIV Epidemic* (EHE) initiative aims to reduce national HIV incidence 90% by 2030 and to address the disproportionate burden of HIV among different racial/ethnic populations. Florida's state-wide 2022–2026 Integrated HIV Prevention and Care Plan outlines objectives for reaching EHE goals. In Miami-Dade County, we determined the epidemiological impact of achieving the integrated plan's objectives individually and jointly.

Methods We adapted an HIV transmission model calibrated to Miami-Dade County adjusting access to HIV testing, pre-exposure prophylaxis (PrEP) and antiretroviral treatment to model the effects of each objective between 2022 and 2030. We compared two service scale-up approaches: (a) scale-up proportionally to existing racial/ethnic group access levels, and (b) scale-up according to new diagnoses across racial/ethnic groups (equity-oriented). We estimated reductions in new HIV infections by each objective and approach, compared to the EHE's incidence reduction target.

Findings The single most influential strategy was reducing new HIV diagnoses in Hispanic/Latinx men who have sex with men through increased PrEP uptake, resulting in 907/2444 (37.1%) fewer annual new HIV infections in 2030. Achieving all objectives jointly would result in 1537/2444 (62.9%) and 1553/2444 (63.5%) fewer annual new HIV infections with the proportional and equity-oriented approaches, respectively.

Interpretation Achieving the goals of Florida's integrated care plan would significantly reduce HIV incidence in Miami-Dade County; however, further efforts are required to achieve EHE targets. Structural changes in service delivery and a focus on effective implementation of available interventions to address racial/ethnic disparities will be crucial to ending the HIV epidemic.

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Keywords: Ending the HIV epidemic; HIV/AIDS; Simulation model; Integrated HIV prevention and care plan; Florida; Miami-Dade County; Health equity

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Research in context

Evidence before this study

In the past decade, Florida has seen a general decline in HIV diagnoses; however, Black and Hispanic/Latino populations experience higher rates of new HIV diagnoses. Through the collaborative efforts of the Florida Comprehensive HIV/AIDS Planning Network, the Florida Department of Health (FDOH) released the “State of Florida Integrated HIV Prevention and Care Plan 2017–2021” in 2016 to coordinate the state’s public health response to HIV. In 2020, the FDOH developed Florida’s second 5-year integrated plan for 2022–2026 to synchronize several local, state, and federal initiatives, including an ambitious plan to end the HIV epidemic (reducing new HIV infections by 90%) by 2030, i.e., Ending the HIV Epidemic (EHE) in the United States. We searched PubMed with no date or language restrictions up to April 20, 2023, for any published articles related to Florida’s HIV Prevention and Care Plan using the terms (“HIV Prevention and Care Plan”) AND (“Florida”). We identified 20 records in total. However, none of them provided any evaluation of the integrated plan in Florida nor how it might contribute to the EHE goals. One previous mathematical modeling study examined what combinations of evidence-based interventions for HIV would provide the greatest economic and public health value in reaching the EHE goals for six US cities, including Miami. The study found that the ambitious EHE goals might be approachable for Miami but would require resources and implementation of HIV interventions at unprecedented levels.

Added value of this study

We operationalized each quantifiable objective identified in the draft 2022–2026 integrated plan. Using a previously developed and calibrated dynamic compartmental HIV transmission model for Miami-Dade County, this study is the first to present analysis quantifying the epidemiological impact of achieving the Florida integrated plan’s objectives in comparison to the EHE targets. We determined the level of intervention scale-up required to achieve each objective and compared two approaches for scaling up HIV services, one maintaining existing racial/ethnic disparities, and the other prioritizing expanded services for Hispanic/Latinx and Black populations with higher rates of new HIV diagnoses. We evaluated the overall reduction and racial/ethnic disparities in HIV incidence with achieving the objectives of the integrated plan individually and jointly.

Implications of all the available evidence

This study shows that achieving the objectives of the Florida’s integrated plan through scaling up HIV prevention, diagnosis, and treatment services has the potential to significantly reduce HIV incidence in Miami. However, even if all objectives are reached jointly, it will be insufficient to achieve the EHE targets. To achieve greater health benefits, it is necessary to expand HIV services with an equity-oriented approach. Findings of this study may provide implications for other states and jurisdictions when developing their own integrated HIV prevention and care plans and pathways to reach the EHE goals.

Introduction

In 2019 the US Department of Health and Human Services announced the ‘Ending the HIV Epidemic (EHE) initiative to accelerate action in the nation’s HIV public health response, outlining goals to reduce infections by 75% in 5 years and by 90% in 10 years.¹ Phase 1 of the EHE initiative focuses on 57 priority jurisdictions which include 48 counties, Washington DC and San Juan, Puerto Rico, where more than 50% of new HIV diagnoses were recorded in 2016 and 2017, in addition to seven states with disproportionately high rates of HIV in rural regions.¹

The EHE initiative acknowledges that HIV infections are geographically concentrated in the US within hot-spot counties, which are disproportionately located in the South, where over half of new HIV diagnoses were recorded in 2018.² Florida’s Miami-Fort Lauderdale–Pompano Beach metropolitan statistical area (MSA) continued to have the highest rate of HIV diagnoses across all US MSAs (32.2 per 100,000 population in 2019).^{3,4} Overall, the state’s rate of new HIV diagnoses in 2019 was over five times higher among non-Hispanic Black individuals (57.8 per 100,000) and nearly three times higher for Hispanic/Latinx individuals (28.8/

100,000) compared to non-Hispanic White individuals (9.6 per 100,000), with Black and Hispanic/Latinx people accounting for 74% of new diagnoses.⁵ Furthermore, while the state’s number of new HIV diagnoses decreased among Black and White individuals from 2017 to 2019 by 12.6% and 5.5% respectively, it has increased by 8.1% among Hispanic/Latinx individuals within the same period.⁵ In Miami-Dade County (henceforth referred to as Miami) where Hispanic/Latinx individuals comprise nearly 70% of its residents,⁶ 50% of people living with HIV, and 65% of new HIV diagnoses,⁷ the rate of new HIV diagnoses is substantially higher than the state overall and across racial/ethnic groups (26 per 100,000, 69.6 per 100,000, and 38.5 per 100,000 among non-Hispanic White, non-Hispanic Black and Hispanic/Latinx people, respectively in 2019).⁷

In 2016, through partnership with a statewide HIV planning body known as the Florida Comprehensive Planning Network (FCPN), the Florida Department of Health (FDOH) HIV/AIDS Section released Florida’s first 5-year Integrated HIV Prevention and Care Plan (henceforth referred to as the integrated plan) for 2017–2021. The integrated plan, ultimately aiming to

eliminate HIV transmission and reduce HIV-related deaths,⁸ outlined four key components, including the implementation of routine HIV and STI screening in clinical and community-based settings; rapid access to antiretroviral therapy (ART); improving access to pre-exposure prophylaxis (PrEP) and non-occupational post-exposure prophylaxis; and increasing HIV awareness and community response.⁹ This plan aligned with each of the four pillars of the EHE strategy, announced in 2019 and served as a draft for Florida's unified EHE plan (released in 2020) for the state as well as for each of the state's seven EHE Phase 1 priority counties (Broward, Duval, Hillsborough, Miami-Dade, Orange, Palm Beach and Pinellas).⁸

Building upon the initial integrated plan and Florida's EHE plan, the FDOH and FCPN developed Florida's second 5-year integrated plan for 2022–2026 to coordinate the state's EHE efforts.¹⁰ This new integrated plan identified specific objectives and actionable strategies in alignment with the third National HIV/AIDS Strategy 2022–2025 (NHAS) which provides stakeholders with a framework to reach EHE targets through four goals: (1) prevent new HIV infections; (2) improve HIV related health outcomes; (3) reduce HIV-related disparities and inequities; and (4) achieve integrated coordinated efforts among program partners. The NHAS strategy uses core indicators to measure progress toward reductions in rates of HIV diagnoses and improvements in HIV cascade of care outcomes, with specific health disparity indicators for population subgroups (including men who have sex with men [MSM], Black/African American MSM, Hispanic/Latinx MSM, Black transgender women, and people who inject drugs [PWID]).¹¹ Using the NHAS framework, the FDOH and FCPN, along with other internal and external partners, collaboratively developed localized objectives and supporting activities that integrate findings from internal surveillance data, community needs assessments and provider surveys, in addition to external data for a coordinated approach to addressing the HIV epidemic at the state and local levels. The planning process identified priority areas for intervention across all pillars¹⁰; however, research is needed to examine whether these objectives can meet the EHE goals, and what evidence-based strategies can be employed to satisfy these objectives.

Simulation modeling can serve as a useful tool to support such planning efforts. Our prior simulation modeling studies, focusing on Miami and five other metropolitan areas with a high burden of HIV, demonstrated the breadth of differences across localized HIV epidemics in the US, and underlined the need for tailored strategies to reach EHE targets in each jurisdiction.^{12,13} The epidemiological impact of expanding access to testing, prevention and treatment services in Miami was found to be particularly substantial, given the high rate of new diagnoses, relatively low coverage of HIV services, the anticipated growth in its population,

and rapid changes in its demographics.^{12,13} Compared to maintaining existing service levels, extensive scale-up in HIV testing, treatment and prevention was found to be cost-saving over the long-term.

This simulation model provides an analytical decision tool to directly model the potential impacts of the new integrated plan, understand the relative effects of reaching each objective of the plan, highlight existing implementation and service gaps, and facilitate coordination between regional, state and national goals. Similar modeling efforts have been used to inform national and international strategic goals, such as the UNAIDS 90-90-90 strategy¹⁴; however doing so within localized HIV epidemics provides a basis for more direct inference and tailored guidance. Within this context and building on our modeling framework, our objective was to estimate the potential epidemiological impact of achieving the stated objectives of the Florida state integrated plan both individually and jointly in Miami, accounting for the racial/ethnic inequities in access to care.

Methods

Model description

We adapted a previously published, dynamic, compartmental HIV transmission model calibrated to replicate the HIV microepidemic in Miami.^{13,15} The study population (adults aged 15–64 years) was categorized according to their state of HIV infection: susceptible, infected, diagnosed, and on or off ART, as well as CD4 cell count (CD4 \geq 500, 200–499, and \leq 200 cells/mm³). Miami-specific evidence on the size and distribution of the adult population, risk behaviours related to HIV transmission, and access to HIV testing, treatment and prevention services (including PrEP, syringe services program, and medication for opioid use disorder) were collected from best available sources and stratified where possible by race/ethnicity (Black/African American [Black], Hispanic/Latinx and non-Hispanic White/Others [White]), sex at birth, risk behaviour level (high vs. low-risk), and risk exposure type (MSM, PWID, MSM who inject drugs [MWID] and heterosexuals [HET]), and are described in extensive detail elsewhere.¹⁵ In a previous study, we conducted extensive evidence synthesis to inform 1667 parameters required for the model (of which over 90% were Miami-specific) from various data sources, including primary database analyses, peer-reviewed publications, and public health and surveillance reports.¹⁶ The schematic of the model, parameters, and assumptions have been fully described elsewhere¹⁵ with structural and technical details of the model also provided in [Supplementary Methods A2](#).

Evaluation of integrated plan objectives

We derived the stated objectives (N = 14) from the draft 2022–2026 integrated plan released in April 2022.¹⁷

Whereas most of these objectives defined quantifiable indicator ranges (baseline level in 2019 and target level in 2026), some had baseline or/and target levels that had not yet been finalized, and some were narrative objectives with no quantifiable metrics attached. We extrapolated the objectives with undetermined levels from the 2017–2021 integrated plan,⁹ assuming the same relative change and excluded the unquantifiable objectives in this analysis. In total, we evaluated eight objectives within three overarching goals of the integrated plan, including (1) Objective 1.1: increase HIV serostatus awareness; (2) Objective 1.2: reduce rate of HIV new diagnoses; (3) Objective 1.3: expand prevention interventions; (4) Objective 2.1: increase linkage to HIV care; (5) Objective 2.2: increase re-engagement of HIV care; (6) Objective 2.3: increase retention in HIV care; (7) Objective 3.2: reduce rate of new HIV diagnoses among Black/African Americans; and (8) Objective 3.3: reduce rate of new HIV diagnoses among Hispanic/Latinx population. We first calculated the percentage change between the specified baseline and target level from the integrated plan as the objective target. We identified the health services in the model most pertinent to each objective, drawing from objective descriptions. We then adjusted the corresponding health service scale-up parameters iteratively until reaching the estimated objective target. Details regarding the integrated plan objectives, how we operationalized them in the model, and the baseline levels of scale-up for related HIV care services are described in [Table 1](#) and [Supplementary Methods A1](#).

We defined a “status quo” comparator scenario that holds access to HIV health services constant at the most recently available levels (2019), while allowing for population growth and demographic change projected for Miami. We evaluated the epidemiological impact of reaching each of the eight objectives individually and jointly by estimating the projected number and rate of new HIV infections (total and by race/ethnicity) in 2030 compared to 2020 as well as the status quo scenario. The estimated reduction in HIV incidence were then compared to the EHE 90% incidence reduction target.

We compared two implementation approaches to scale up health services: (1) proportional approach, whereby increased access to services is proportionate to baseline levels of access (2019 levels) by race/ethnicity (i.e., maintaining current social and structural constraints on access to care); and (2) an equity-oriented approach, whereby increased access to services is proportionate to the number of new HIV diagnoses among each racial/ethnic group in 2019. We operationalized the integrated plan objectives within our model by adjusting scale-up of access to corresponding testing, treatment and prevention services (identified as key strategies under each objective) with the proportional approach until reaching the specific target outcomes in 2026. In implementing the integrated plan objectives, we

assumed that the scale-up of corresponding service would take place from January 2022, achieving plan objectives by December 2026, and then sustained through to the end of the EHE timeline in December 2030. We then applied the equity-oriented approach to reach the same overall level of service scale-up (as the proportional approach). This ensured equal increases in the overall level of service delivery but altered the distribution across racial or ethnic groups. Details about the two implementation approaches are available in a previous study.¹⁸ Baseline service levels by race/ethnicity and increases in intervention levels required for the integrated plan objectives are described in [Supplementary Tables S1 and S2](#), respectively. Since Objectives 3.2 and 3.3 explicitly focused on reducing racial/ethnic inequities, the same operationalization was used for both the proportional and equity-oriented scenarios.

Ethics approval

The study was approved by the Simon Fraser University and Providence Health Care research ethics boards [H16-00652].

Role of the funding source

The funders had no role in the study design, data collection, data analysis, interpretation, or in the writing of the report.

Results

Impact of reaching each individual integrated plan objective

In the comparator status quo scenario, we estimated the annual number of HIV new infections in Miami to decrease from 2444 in 2020 to 2103 (–341/2444 [–14.0%]) in 2030 without further intervention.

Achieving Objective 3.3—reducing rate of new HIV diagnoses among Hispanic/Latinx population (operationalized through increasing the uptake of PrEP among high-risk HIV-negative Hispanic/Latinx MSM/MWID) had the largest single impact among all objectives, which reduced annual new infections by 907/2444 (37.1%) in 2030 compared to 2020 ([Fig. 1](#)). Although this objective focused exclusively on Hispanic/Latinx people, we also identified spillover effects where the rate of new HIV infections in 2030 was reduced by 17.3% (from 72.2 to 59.7 per 100,000 people) and 13.8% (from 116.3 to 100.3 per 100,000 people) among White and Black people, respectively, compared to the status quo scenario ([Supplementary Table S3](#)). Conversely, we found that the reduction in new diagnoses within the Black population (11%) exceeded the integrated plan’s Objective 3.2 (reducing rate of new HIV diagnoses among Black populations) target level (9.1%) for 2026 without any further intervention.

Among other objectives of the integrated plan, achieving Objective 2.3 (increase retention in HIV care, operationalized through reducing ART dropout rate)

Goal	Strategy (January 1, 2022–December 31, 2026)	Model implementation
Goal 1. Prevent new HIV infections.	<p>Objective 1.1: Increase the proportion of people with HIV (PWH) who know their serostatus from 86% (2021) to 90% (+4.7%).</p> <p>Strategy 1.1.2: Reduce stigma in communities around HIV testing.</p> <p>Strategy 1.1.3: Reduce stigma among healthcare settings around HIV testing.</p> <p>Strategy 1.1.4: Reduce stigma among correctional settings around HIV testing.</p> <p>Objective 1.2: Reduce the rate per 100,000 population of HIV transmission diagnosed annually in Florida, from 21.4/100,000 (2021) to 18.6/100,000 (-11.4%).</p> <p>Strategy 1.2.1: Expand routine HIV screening in emergency departments as part of medical care.</p> <p>Strategy 1.2.3: Increase awareness among women of childbearing age about HIV testing and perinatal prevention strategies.</p> <p>Objective 1.3: Expand the implementation of prevention interventions in Florida.</p> <p>Strategy 1.3.1: Ensure access to and availability of pre-exposure prophylaxis (PrEP).</p>	<p>Increase the HIV testing rate until the proportion of PWH being diagnosed increases by 4.7%.</p> <p>Increase the HIV testing rate until achieving a 11.4% reduction in the rate of new HIV infections.</p> <p>Increase PrEP coverage among high-risk MSM until achieving a decrease of 13.2% in the rate of new diagnoses among MSM (2017–2021 Objective 3.2 target).</p>
Goal 2. Improve HIV-related health outcomes of people with HIV.	<p>Objective 2.1: Increase the percentage of persons with newly diagnosed HIV linked to care in 7 days from 58.4% (2021) to 70% (+19.9%).</p> <p>Strategy 2.1.1: Provide same-day or rapid start of ART.</p> <p>Strategy 2.1.2: Improve linkage to HIV health care within 30 days for all persons who test positive for HIV</p> <p>Strategy 2.1.3: Work to reduce the average number of days to link persons to HIV care in Florida.</p> <p>Objective 2.2: Increase the percentage of PWH re-engaged in care by 16.3%^a.</p> <p>Strategy 2.2.2: Identify and address barriers for people who have fallen out of care.</p> <p>Objective 2.3: Increase the percentage of PWH retained in care from 73.1% (2021) to 85% (+16.3%).</p> <p>Strategy 2.3.1: Enhance support for medication and treatment adherence.</p> <p>Strategy 2.3.2: Develop and implement effective, evidence-based, or evidence-informed interventions and supportive services that improve retention in care.</p>	<p>Increase rate of immediate ART treatment among newly diagnosed PWH by 19.9%.</p> <p>Increase ART re-engagement rate to achieve 16.3% increase of PWH on treatment.</p> <p>Reduce ART drop-out rate to achieve 16.3% increase of PWH retained on treatment.</p>
Goal 3. Reduce HIV-related disparities and health inequities.	<p>Objective 3.2: Reduce the annual rate of new HIV diagnoses among the Black population from 51.8 (2021) to 47.1 per 100,000 (-9.1%).</p> <p>Strategy 3.2.1: Identify and develop interventions to improve health outcomes among Black women.</p> <p>Strategy 3.2.2: Identify and develop interventions to improve health outcomes among Black men.</p> <p>Strategy 3.2.3: Develop and promote culturally appropriate HIV prevention and care activities.</p> <p>Strategy 3.2.4: Expand community engagement efforts to address service delivery and prevention gaps.</p> <p>Objective 3.3: Reduce the annual rate of new HIV diagnoses among the Hispanic/Latinx population from 31.7 (2021) to 25.9 per 100,000 (-18.3%).</p> <p>Strategy 3.3.1: Identify and develop interventions to improve health outcomes among Hispanic/Latinx men.</p> <p>Strategy 3.3.2: Develop and promote culturally appropriate HIV prevention and care activities.</p> <p>Strategy 3.3.3: Create funding opportunities that specifically address PrEP uptake.</p> <p>Strategy 3.3.4: Expand community engagement efforts to address service delivery and prevention gaps.</p>	<p>Maintain the coverage of PrEP in White and Hispanic/Latinx populations while increasing coverage in the Black population (including high-risk heterosexual Black women) until achieving 9.1% reduction in annual rate of new HIV diagnoses among the Black population.</p> <p>Maintain the coverage of PrEP among the White and Black populations while increasing coverage in the Hispanic/Latinx population until achieving 18.3% reduction in annual rate of new HIV diagnoses among the Hispanic/Latinx population.</p>

^aExtrapolated from Objective 2.3.

Table 1: Evaluated strategies aligned with the State of Florida's Integrated HIV Prevention and Care Plan (2022–2026).

reduced the annual number of new HIV infections (comparing 2030 to 2020) by 573/2444 (23.5%) with the proportional approach and 574/2444 (23.5%) with the equity-oriented approach, respectively (Fig. 1). In contrast, achieving Objective 2.1 (increase linkage to

HIV care, operationalized through increasing immediate ART initiation upon HIV diagnosis) resulted in the lowest reduction in annual new HIV infections under both the proportional approach (344/2444 [14.4%]) and equity-oriented approach (345/2444 [14.4%]).

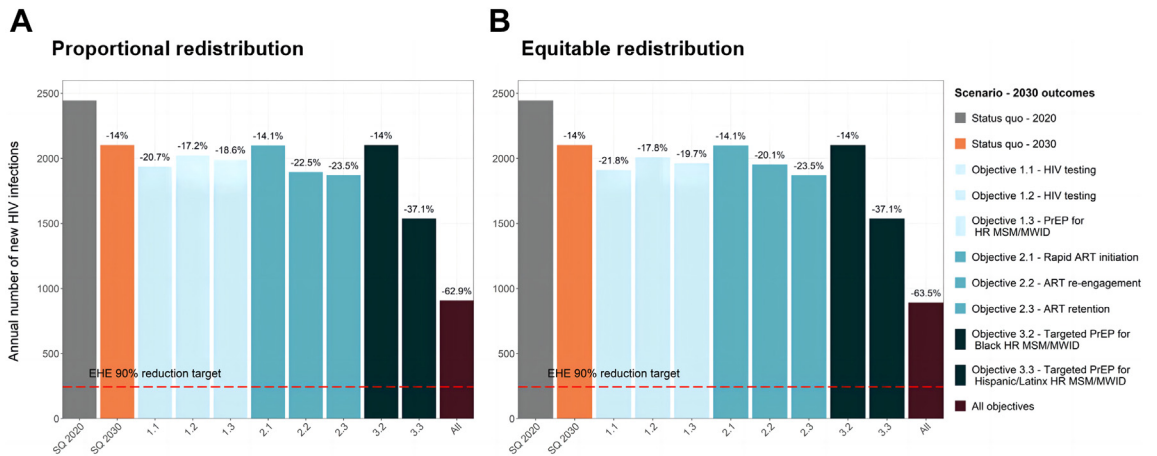


Fig. 1: Comparison of annual number of new HIV infections in 2030 between status quo and reaching Integrated HIV Prevention and Care Plan objectives. Legend: SQ—status quo (no interventions) comparator scenario; EHE—“Ending the HIV Epidemic” initiative; PrEP—pre-exposure prophylaxis; HR MSM/MWID—high risk men who have sex with men and/or inject drugs; ART—antiretroviral therapy. Objectives 3.2 and 3.3 are equity-oriented by definition and are included in both panels.

Impact of reaching all integrated plan objectives jointly

Compared to 2020, achieving all objectives under the proportional approach would result in 1537/2444 (62.9%) fewer annual new infections in the population by 2030 (8212 total averted infections compared to status quo), compared to 1553/2444 (63.5%) under the equity-oriented approach (8288 total averted infections), however both strategies fell short of EHE’s targets of 90% reduction by 2030 (Fig. 1). Fig. 2 and Supplementary Table S3 illustrate the racial/ethnic breakdown of HIV

incidence in Miami comparing the two implementation approaches for achieving all objectives. With the proportional approach, we observed 249/239 (56.8%) and 1137/1765 (64.5%) reduction in annual HIV incidence among Black and Hispanic/Latinx individuals, as compared to the equity-oriented approach which would achieve 247/439 (62.5%) and 1132/1765 (64.1%) reductions, respectively, by 2030. The equity-oriented approach also yielded lower incidence rate ratios for Black (1.51) and Hispanic/Latinx (1.28) populations in comparison to White/other populations, as opposed to

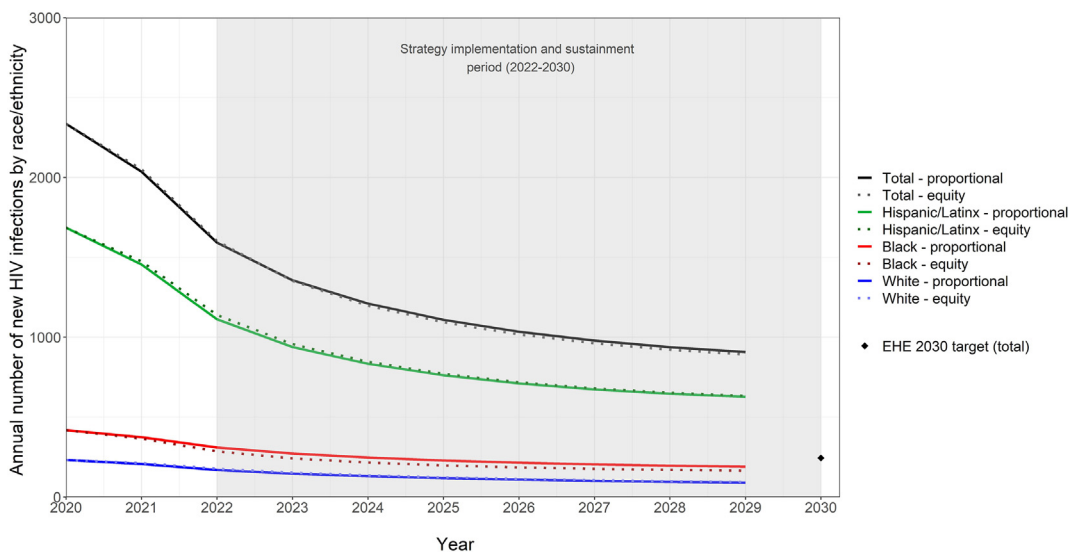


Fig. 2: Projected annual number of new HIV infections through scenarios of implementing all integrated plan objectives jointly with proportional and equity-oriented service scale-up approach, stratified by race/ethnicity.

the proportional approach (1.82 and 1.32, respectively) and the status quo (1.61 and 1.57, respectively) (Supplementary Table S3).

Discussion

This modeling study examined the epidemiological impact of achieving the key objectives in Florida's 2022–2026 integrated plan through scaling up access to HIV testing, treatment and prevention services. We found that the combined impacts of achieving all eight objectives could result in a 64% and 63% HIV incidence reduction by 2030 with an equity-oriented implementation approach and a proportional approach not addressing inequities in service access by race/ethnicity, respectively. Compared to the proportional approach, the equity-oriented approach resulted in greater HIV incidence reduction among the Black population and a reduced incidence rate ratio to the White population, but such incremental benefit was found to be small for the Hispanic/Latinx population. Further efforts to reduce new HIV infections and racial/ethnic disparities are therefore needed to reach the 2030 EHE goals in Miami.

A key finding of this analysis is that the efforts required to fulfill the integrated plan's ART engagement and retention objectives (Objective 2.1, 2.2, 2.3) would have to be far more effective, and achieve greater reach than what has been historically documented in the literature.¹² We have previously reported that interventions for rapid ART initiation and case management strategies for ART retention and re-engagement may provide only modest benefits at the population-level.¹² In order to reach the integrated plan's objectives in Miami, sufficient scale up requires a 20% higher rate of immediate ART initiation, a more than doubling of the base rate of ART re-engagement and tripling of the base rate of ART retention. These additional efforts required to achieve the ART engagement objectives highlight the impact of underlying structural barriers in access to and retention in care in Miami. Notably, the scale of delivery for rapid ART initiation was previously documented as 30% lower among Hispanic/Latinx males in some settings compared to White individuals and is also limited by the proportion of HIV clinics that receive Ryan White HIV/AIDS program funding to scale-up re-engagement interventions.¹² In addition to being a labour-intensive intervention, the scale of delivery of ART re-engagement and re-linkage interventions is limited by patient acceptance and the proportion of out-of-care individuals who are successfully identified and contacted.¹²

Many people newly diagnosed with HIV lack health insurance, have immediate housing, substance use, or mental health care needs and face high levels of stigma. In addition to streamlining protocols to facilitate rapid ART initiation, capacity building for multidisciplinary

staff, and the co-location of services, pharmacy delivery and transportation services as well as mobile care units to address other unmet needs among PWH are recommended strategies to improve outcomes along the continuum of care.^{19,20} Furthermore, historical structural barriers have been previously noted in relation to ART initiation, including state policies requiring visits to the county health department, connection to a case manager and AIDS Drug Assistance Program (ADAP) enrollment prior to initiation of treatment. In addition to restrictive ADAP eligibility rules, clients often have to go to multiple pharmacies to get their complete treatment medications. Other challenges may include a lack of ADAP reassessment grace periods, as well as Florida's decision to not expand Medicaid.^{8,21} In response, the FDOH has initiated the statewide Test and Treat program aiming to reduce the time between testing and initiation of ART through rapid ART initiation or same-day ART. Additionally, the FDOH recently refined the ADAP eligibility and removed the requirement for an ADAP formulary prescription, which helped reduce the delay in enrollment in ADAP and facilitate the establishment of reciprocal eligibility between the Ryan White Part B statewide program and the six Ryan White Part A programs in the state. The FDOH also secured a network of commercial and community pharmacies for uninsured clients in addition to the mail-order option for ART.

Otherwise, although the levels of increases in access to HIV testing and PrEP may be achievable, there are substantial structural barriers that would need to be addressed in order to reach the integrated plan's objectives. Objectives 1.1 and 1.2 required an increase in the baseline rate of HIV testing by 26% and 12% respectively, to increase HIV serostatus awareness and prevent new HIV incidence. In comparison, primary care opt-out HIV testing, electronic medical record reminders for HIV screening in hospitals, and nurse-initiated rapid HIV testing, have been previously documented at comparable scale-up levels of 9%, 32%, and 23% higher than the status quo testing rate, respectively.¹² Objective 1.3 (expand prevention interventions) required a relatively modest 16.5% increase in PrEP coverage, as compared to 118% in a previously documented PrEP expansion intervention.^{12,22} However, because baseline PrEP uptake by the Hispanic/Latinx population was low, reaching Objective 3.3 (reduced rate of new HIV diagnoses among Hispanic/Latinx population) required a nearly four-fold expansion of PrEP coverage to produce the large associated reduction in new diagnoses. This far exceeds the previously documented level of scale-up that was recorded in a shorter time-frame and within service settings where PrEP was covered by the Affordable Care Act (ACA).

Access to PrEP has remained relatively low in Miami. As a non-ACA adopting state, historically the costs of the medications and ongoing monitoring remain substantial hurdles for many people that are uninsured or not

on Medicaid in Florida; however, there is also limited awareness of PrEP among high-risk individuals and medical providers.²³ In response, the State of Florida implemented a statewide PrEP Drug Assistance Program in 2018 that enables PrEP counseling, initial medications, and refills at no cost to clients (Michniewicz M, FDOH, personal communication, April 18, 2023), and created a statewide active referral system for PrEP (PrEPLink).²³ Careful monitoring of these initiatives will be critical to sustain progress towards the EHE goals and reduce racial/ethnic inequities in access to this vital but unevenly, and sub-optimally implemented intervention. Furthermore, while challenges in PrEP access persist in many southern states which have not expanded Medicaid, the US Department of Health and Human Services implemented the “Ready, Set, PrEP” program in 2019 to provide free PrEP and navigation support for qualified individuals. However, uptake of the program has been reportedly low due to persisting challenges in access and retention from limited pharmacy distribution networks, in addition to patient costs for follow-up clinical visits, laboratory services, and travel costs.^{24,25} PrEP programs should therefore address these barriers through strategies that include the procurement of lower cost and alternative forms of PrEP, as well as the expansion of access to lab services and the network of community-based PrEP providers for people who are uninsured.²⁵

Compared with the proportional approach, the incremental benefit of reducing inequities with the equity-oriented approach was found to be relatively modest in Miami, consistent with our prior findings.¹⁸ Disparities in HIV incidence across racial/ethnic groups are largely explained by racial/ethnic inequities in access to care, racially segregated sexual transmission networks, and other direct and indirect effects of structural racism and homophobia.^{26,27} Unlike many other cities in the US, Miami has a predominantly Hispanic/Latinx population (69%) and a smaller non-Hispanic White population (14%).⁶ More importantly, differences in the rate of new HIV diagnoses (38.5 per 100,000 vs. 26 per 100,000)⁷ and the proportion of PWH virally suppressed (68% vs. 65%)²⁸ were relatively modest between Hispanic/Latinx and non-Hispanic White populations in Miami when compared to Florida and national averages. Both factors may have contributed to smaller scales in redistribution in the equity-oriented scenarios. Although the diagnosis rate in Miami among Hispanic/Latinx men was 1.5 times higher compared to White men in 2019, the other six Florida EHE counties reported diagnosis rates for Hispanic/Latinx men ranging from 1.7 to 2.7 times higher compared to White men.⁸ Similarly, differences in the proportion of Hispanic/Latinx PWH virally suppressed compared to White PWH are larger in the other EHE priority counties (ranging from a 5% to 8% difference).⁸ An equity-oriented approach is therefore likely to have a greater

impact on HIV incidence in these jurisdictions. Although the equity-oriented approach yielded a modest incremental benefit at the population level, its effectiveness was particularly pronounced in reducing incidence among Black individuals and in mitigating existing gaps in incidence rates with White individuals. In contrast, we found that adopting the proportional approach could lead to an elevated incidence rate ratio between Black and White individuals. This finding may provide important implications for other jurisdictions with greater racial/ethnic disparities to incorporate targeted measures to address inequalities in health service access when formulating their local HIV response strategies.

This analysis highlighted that the integrated plan’s Objectives 3.2 and 3.3, which aim to reduce the rate of new HIV diagnoses among Black populations by 9.1% and 18.3% among Hispanic/Latinx populations for the State of Florida are conservative targets to reduce racial/ethnic disparities in HIV incidence for the State overall as well as within Florida’s EHE priority jurisdictions. The rate of new HIV diagnoses among White individuals in Florida in 2021 was 8.5 per 100,000 compared to 51.8 and 31.7 per 100,000 among Black and Hispanic/Latinx individuals, respectively. Equitable percentage reduction targets would therefore require up to an 83% and 73% reduction in rates of new diagnoses among Black and Hispanic/Latinx populations respectively for aims that reduce disparities and approach parity to rates observed in the White population, and this should be considered in future planning efforts.⁵ Second, our model did not account for the impact of the COVID-19 pandemic on HIV services, which may have affected the baseline level of HIV incidence and therefore the target level of new diagnoses reduction. Third, despite steady decline in new diagnoses among Black individuals, their infection rate remains the highest among all race/ethnic groups. Furthermore, our analysis underscored the necessity for more comprehensive strategies to attain the 90% incidence reduction objective, a finding that is likely applicable to other jurisdictions. A previous modeling study of all 32 EHE priority metropolitan statistical areas indicated the potential achievability of EHE goals, albeit restricted to specific areas and demanding substantial investments.²⁹ This study demonstrates that simulation models can be leveraged for state and local decision makers to identify, explore, and compare strategies to achieve the national EHE targets.

While we previously outlined limitations related to model structure and underlying data,^{12,15} this study may have several additional limitations. First, not all objectives from the integrated plan were quantifiable (e.g., reducing stigma, stakeholder coordination) and therefore the impact of these excluded objectives was not captured in model results. Second, the delivery of the strategies listed were assumed to take effect in January,

2022 and perfectly sustained for the entire projection period up to December, 2030. Although this may not be feasible in real-world implementation, we illustrate an optimistic scenario illustrating what can be achieved under ideal conditions. Third, changes in access to care that may have arisen as a result of the COVID-19 pandemic were not captured in our analysis; the most recent data available was from 2019. While there is growing evidence that disruptions in access to ART were minimal, the number of HIV tests administered fell across the nation and PrEP utilization also fell temporarily.^{30,31} These disruptions have most likely set back national and global efforts to reduce HIV/AIDS transmission, in part by further exacerbating racial inequities in access to care. Effective response will require careful monitoring as updated evidence emerges. Fourth, while the model accounted for population growth and demographic shifts among the susceptible population, the migration of people living with HIV into and out of Miami was not explicitly modeled due to a lack of supporting evidence. The influence of this population movement on the epidemic greatly hinges on both the direction of migration flow and the demographic composition of the migrants. Finally, given the deterministic presentation of the goals of the FCPN, we have chosen to present a deterministic analysis; as in any modeling study there will be considerable uncertainty in our projected HIV incidence trajectories. Nevertheless, we believe this analysis is illustrative of the expected impacts of reaching the stated goals of the FCPN.

This study evaluated the impact of achieving the objectives set by the Florida integrated plan, comparing two approaches to scaling up HIV prevention, diagnosis, and treatment services for different racial and ethnic groups in Miami. It was estimated that reaching the 90% reduction target in 2030 would be unlikely even if all objectives were reached jointly, we found that an equity-oriented approach. Prioritizing an increase in services for populations with high rates of new HIV diagnoses, had the potential to mitigate the disparities in HIV incidence between Black and White individuals, even if the impact on the population-level incidence reduction appeared modest. Development of the integrated plan represents an opportunity for different departments and stakeholders to collaboratively identify HIV prevention and care needs, existing resources, and implementation barriers and develop local strategies to address them.³² Further efforts to address structural barriers to care and implement equitable policies that aid in increasing PrEP uptake, linking PWH to care, and prevent treatment discontinuation will be necessary to achieve the EHE targets by 2030.

Contributors

XZ and BN conceptualized the study. XZ, MP, and LH wrote the first draft of the article. XZ, LH, BE, and YS executed the analysis and produced the tables and figures. BDLM, WCG, DJF, LRM, PSS, HET, and BN aided in the interpretation of results and provided critical revisions

to the article. BN secured funding for the study. All authors approved the final draft. All authors had full access to all the data in the study and accepted responsibility to submit for publication.

Data sharing statement

All input data for our model is publicly available and has been described in the Supplementary material and published in articles: Krebs E, Enns B, Wang L et al. Developing a dynamic HIV transmission model for 6 U.S. cities: An evidence synthesis. *PLOS ONE* 2019; 14 (5): e0217559; Krebs E, Zang X, Enns B et al. The impact of localized implementation: determining the cost-effectiveness of HIV prevention and care interventions across six US cities. *AIDS* 2020; 34 (3): 447–458; Quan AML, Mah C, Krebs E et al. Improving health equity and ending the HIV epidemic in the USA: a distributional cost-effectiveness analysis in six cities. *The Lancet HIV* 2021; 8 (9): E581–E590. Model code is available at: <https://heru-lem.github.io/LEMHIVpack/>.

Declaration of interests

XZ reports subaward funding from the National Institute on Drug Abuse (R01DA041747) as Co-Investigator. DJF reports consultant payments from R01DA041747. PSS reports grant funding from NIH, CDC, Gilead Sciences, Merck and Viiv Healthcare. BN reports NIDA R01DA041747 funding paid to institution as Principal Investigator. HET reports grant funding from Gilead Sciences and Viiv Healthcare, participation in Data Safety Monitoring Board/Advisory Board for 4UH3DA047720-03, and leadership or fiduciary roles involving HIVMA, PACHA, SAFE project and Florida Harm Reduction Collection.

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Appendix A. Supplementary data

Supplementary data related to this article can be found at <https://doi.org/10.1016/j.lana.2023.100623>.

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