



Published in final edited form as:

*J Acquir Immune Defic Syndr.* 2021 August 15; 87(5): 1145–1153. doi:10.1097/QAI.0000000000002712.

## Reaching those most at risk for HIV acquisition: Evaluating Racial/Ethnic disparities in the PrEP Care Continuum in Baltimore City, Maryland

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### Abstract

**Background**—Reducing HIV incidence requires addressing persistent racial/ethnic disparities in HIV burden. Our goal was to evaluate pre-exposure prophylaxis (PrEP) delivery, overall and relative to community need, among seven clinical sites participating in a health-department led demonstration project to increase PrEP in Baltimore City, Maryland.

**Methods**—PrEP care-continuum stages (screened, indicated, referred, linked, evaluated, prescribed) were examined among HIV-negative individuals receiving services at participating sites between September 30, 2015–September 29, 2019. Community need was defined using information on new HIV diagnoses (2016–2018). Differences in care-continuum progression by demographics/priority population, and comparison of demographic compositions between care-continuum stages and new HIV-diagnoses were examined using modified Poisson regression and Chi-squared tests, respectively.

**Results**—Among 25,886 PrEP-screened individuals, the majority were non-Hispanic(NH) Black(81.1%, n=20,998), cisgender-male(61.1%, n=15,825) and heterosexual(86.7%, n=22,452). Overall, 31.1%(n=8,063) were PrEP-indicated, among whom, 56.8%(n=4,578), 15.6%(n=1,250), 10.8%(n=868), and 9.0%(n=722) were PrEP-referred, linked, evaluated and prescribed, respectively. Among 2,870 MSM, 18.7%(n=538) were PrEP-prescribed. Across all groups, the highest attrition was between PrEP-referred and PrEP-linked. NH-Black race (vs. NH-white) was independently associated with lower likelihood of PrEP-prescription [aPR: 0.89; 95% CI:(0.81–

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**Conflicts of Interest** The authors report no conflicts of interest.

0.98) controlling for age/gender]. Relative to the demographic composition of new HIV-diagnoses, fewer NH-Blacks (80.2% vs. 54.3%) and more NH-whites (10.7% vs. 30.3%) and MSM were PrEP-prescribed (55.2% vs. 74.5%).

**Conclusions**—This project showed promise delivering PrEP referrals and prescriptions overall and to MSM. Substantial improvement is needed to improve linkage overall and to decrease disparities in PrEP-prescriptions among NH-Blacks. Future work should focus on addressing service gaps that hinder PrEP utilization.

### Keywords

Pre-exposure prophylaxis; HIV; health disparities

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### Introduction

Nearly 40 years into the HIV epidemic, approximately 38,000 individuals are newly diagnosed with HIV in the United States (U.S.) annually.<sup>1</sup> Blacks, gay, bisexual and other men who have sex with men (MSM) and young persons (ages 13–34) have disproportionately high HIV diagnosis rates compared to other subgroups. In 2018, though Blacks comprised 13% of the U.S. population, but 43% of new HIV diagnoses.<sup>1, 2</sup> Additionally, 67% were among MSM, and 71% were among young persons.<sup>1</sup> In some local jurisdictions, these disparities are more severe. In Baltimore City, Maryland, in 2018, 81% of new HIV diagnoses were among Blacks (vs. 62% of the total population),<sup>3</sup> 60% were among MSM, and 58% were young persons.<sup>4</sup> Reducing HIV incidence among Blacks, MSM and young persons is critical to reducing systemic racial/ethnic disparities as well as achieving national Ending the HIV Epidemic Plan Goals to reduce overall HIV incidence by 90% by 2030.<sup>5, 6</sup>

HIV pre-exposure prophylaxis (daily antiretroviral use by HIV-negative individuals) (PrEP) may reduce individual-level HIV acquisition risk by up to 99%.<sup>7–9</sup> PrEP uptake in the U.S., however, has been slow. One recent study estimated that less than 10% of those indicated for PrEP, were currently using PrEP.<sup>10</sup> Another major concern is that inequitable PrEP uptake will exacerbate disparities in HIV.<sup>11, 12</sup> Multiple studies have shown lower PrEP care engagement among Black compared to white MSM.<sup>13–18</sup> Available data, though limited, report similar racial/ethnic disparities in PrEP use among other priority populations, [i.e., heterosexual men and women and persons who inject drugs (PWID)].<sup>19–22</sup> Many of these studies were conducted in research settings or among patients receiving care in specific healthcare settings (e.g., sexual health clinics, specialty care clinics). To assess equity in PrEP implementation and delivery, information is needed regarding PrEP care engagement and related racial/ethnic disparities across multiple health care settings, priority populations and within defined jurisdictions. Equitable PrEP usage levels – the levels necessary to reduce observed racial disparities in HIV incidence – remain unknown. At a minimum, PrEP care engagement should be commensurate with the underlying community HIV burden, which can be measured through comparison of characteristics of PrEP users to those of individuals newly diagnosed with HIV. However, evidence on PrEP care engagement relative to community need is limited.

In 2015, in response to these structural challenges, the Baltimore City Health Department (BCHD) launched a city-wide demonstration project to increase PrEP provision throughout the city among multiple clinical settings and priority populations. The goal of this analysis was to identify bright spots and challenges in PrEP care engagement four years after the project was implemented. The objectives were: 1) to describe the PrEP care continuum and compare continuum stages by race/ethnicity, age, gender, and priority population; and 2) to assess whether PrEP care engagement was commensurate with community need.

## Methods

### Overview

The demonstration project was implemented by the BCHD, evaluated by an academic partner and conducted in collaboration with seven private and safety-net clinical sites [publicly-funded sexual health clinics (n=2); a federally qualified health center focused on services for Lesbian, Gay, Bisexual, Transgender and Queer/Questioning patients (n=1); adolescent clinics (n=2), academic PrEP specialty clinics (n=2)] and one community-based organization (CBO) in Baltimore City, Maryland who followed common implementation protocols to leverage existing HIV testing counseling and referral programs, or in the sexual health clinics all patients, to identify, refer and link individuals who may benefit from PrEP to PrEP care. All seven clinical sites provided PrEP evaluations and prescriptions. Increasing PrEP implementation at participating sites was achieved through didactic clinical PrEP skills trainings and establishment of a peer navigation network. Peer navigators engaged in community outreach activities, disseminated PrEP and HIV risk information, provided PrEP referrals, facilitated and supported clients with PrEP initiation/maintenance, and provided referral and linkage to other prevention services (i.e., behavioral health and social services). Same-day linkage occurred when possible. Navigators were then responsible for assisting clients with making appointments for PrEP clinical evaluations. Navigators met monthly for additional trainings, to share successes/lessons learned and troubleshoot challenges. Navigators collaborated at several major outreach events (i.e., Baltimore Pride, World AIDS Day) to increase awareness of and provide referrals to PrEP and other HIV prevention/care services among priority populations.

### Study Population

The analysis included information on HIV-negative individuals receiving HIV prevention services at participating sites between September 30, 2015 and September 29, 2019. Demographics, HIV prevention/clinical services, sexual behavior and substance use information was collected through standardized intake and medical record abstraction forms. As a comparison group, information on Baltimore City residents newly diagnosed with HIV between 2016 and 2018 was obtained using public health surveillance data. Both HIV-negative and newly HIV-diagnosed individuals missing information on race/ethnicity, age, and gender were excluded.

## Measures

**PrEP Care Continuum Stages**—PrEP care continuum stages include: 1) screened; 2) indicated; 3) referred; 4) linked; 4) clinically evaluated (referred to hereafter as evaluated); and 5) prescribed.

PrEP-screened was defined as receipt of HIV screening and risk assessment. Risk assessments were conducted at the time of HIV screening using a common form. At two high-volume sites, these questions were embedded within the electronic medical record. All other clinical sites and the CBO utilized a standard paper form. The CBO did not offer HIV testing, but provided PrEP-referrals to a participating clinical site as appropriate.

Criteria to identify individuals at elevated HIV acquisition risk (i.e., PrEP-indicated individuals) were based on U.S. Centers for Disease Control and Prevention (CDC) PrEP guidelines<sup>23</sup> and local epidemiology. This included MSM (cisgender males who self-identified as gay/bisexual or reported anal sex with males in the past year), transgender persons (Male-to-female or female-to-male), and any individual who reported a syphilis, gonorrhea or rectal chlamydia diagnosis (past three months), or in the past 12 months reported: sharing needles; sex partner living with HIV; buying/selling sex; or 2 episodes of HIV post-exposure prophylaxis (PEP).

PrEP-referred was defined as receipt of an indirect (i.e., provided with information about PrEP/PrEP providers) or direct care referral. PrEP-linked was defined as receipt of PrEP-related navigation or clinical services at a participating site. PrEP-evaluated was defined as 1 clinical visit with a PrEP provider. PrEP-prescribed was defined as 1 documented PrEP prescription in the individual's medical record.

Information on unique individuals is presented; individuals who progressed to a particular stage at any time during the observation period were considered to have reached that care continuum stage.

**Demographics and Priority Populations**—Demographic information included race/ethnicity, age at first PrEP screening, sex assigned at birth, and gender identity. Race/Ethnicity was categorized as non-Hispanic Black (NH-Black), non-Hispanic white (NH-white), Hispanic and non-Hispanic Other (NH-Other). Age was categorized as adolescent/young adult (AYA; aged < 24 years), younger (aged 25–34 years) and older (aged ≥ 35 years) adults. Those with discordant sex assigned at birth and gender identity were classified as transgender. Priority populations were defined using CDC HIV surveillance HIV transmission category definitions, and included MSM, MSM who inject drugs (MSM/PWID), transgender persons, PWID and heterosexual. For comparisons of priority populations between groups, newly HIV diagnosed individuals whose transmission category was listed as “no identified risk” were excluded.

**Statistical Analysis**—Summary statistics were generated to describe individual characteristics at each stage of the PrEP care continuum. Associations of race/ethnicity, age, gender, and priority population with (1) PrEP-referral; (2) PrEP-linkage; (3) PrEP-evaluation; and (4) PrEP-prescription, were examined using Poisson regression with cluster

robust standard errors to account for the nested nature of the data (i.e., individuals within clinics). Due to the collinearity of gender and priority populations, two multivariable models were generated for each outcome. Model 1 included race/ethnicity, age and gender. Model 2 included race/ethnicity, age and priority population. Chi-squared tests were used to assess differences in demographic and priority population composition of individuals at each care continuum stage to those of new HIV diagnoses. All analyses were performed in Stata version 16.1 (Stata Corp., College Station, TX).

Ethical approval was obtained from the Johns Hopkins School of Medicine Institutional Review Board.

## Results

Between September 30, 2015 and September 29, 2019, 26,275 HIV-negative individuals were PrEP-screened at participating sites, 25,886 (98.5%) of whom had complete information on race/ethnicity, age and gender. The majority were NH-Black (81.1%) cisgender male (61.1%) and heterosexual (86.7%). Eleven percent were MSM and 1.3% were transgender persons. The mean and median age was 33.0 years (standard deviation: 12.69) and 29.0 years (Range: 13 – 89), respectively. Thirty percent (29.4%) were AYA, and 35.3% were younger adults.

### PrEP Care Continuum Outcomes

Among the 25,886 PrEP-screened, 31.1% (n=8,063) were PrEP-indicated (Figure 1 and Table 1). Fifty-seven percent (56.8%, n=4,578) of those indicated were PrEP-referred, among whom 27.3% (n=1,250) were PrEP-linked. Among those PrEP-linked, 69.4% (n=868) were PrEP-evaluated, among whom, 83.2% (n=722) were PrEP-prescribed. Overall, among the 8,063 PrEP-indicated individuals, 15.6% (n=1,250) were PrEP-linked, 10.8% (n=868) were PrEP-evaluated and 9.0% (n=722) were PrEP-prescribed.

### PrEP Care Continuum Outcomes by Race, Age, Gender and Priority Population

There were substantial differences in the care continuum by race, age, gender and priority population (Table 1). Smaller proportions of NH-Blacks compared to NH-whites progressed through each care continuum stage. The largest observed differences were during upstream stages, though substantial differences also were observed during downstream stages. Compared to younger adults, fewer AYA were PrEP-prescribed, and fewer older (vs. younger) adults were PrEP-linked and PrEP-evaluated. Compared to cisgender males, fewer cisgender females and transgender individuals progressed through down-stream continuum stages (PrEP-linked, PrEP-evaluated and PrEP-prescribed). By priority population, MSM had the highest proportion of individuals progress through the care continuum and the highest proportion of PrEP-prescribed individuals. Among the 2,870 MSM PrEP-screened and indicated, 18.7% (n=538) were PrEP-prescribed. PWID had smallest proportion of individuals referred and linked, while heterosexuals had the lowest proportion of individuals clinically evaluated and prescribed.

Multivariable regression modeling revealed significant differences in PrEP-referrals and linkage by gender and priority population, and prescriptions by race/ethnicity and priority

population (Table 2). No statistically significant differences were observed by age. NH-Black race/ethnicity (vs. NH-white) was associated with lower likelihood of PrEP prescription in both models [aPR<sub>Prescribed1</sub>: 0.89; 95% CI: (0.81 – 0.98); aPR<sub>Prescribed2</sub>: 0.92 (0.84 – 1.00)], though this association was only borderline significant in Model 2. NH-Blacks also were less likely than non-Hispanic whites to be PrEP-referred, linked, and evaluated, though these associations were not statistically significant. PrEP-linkage, evaluation and prescription was similar among Hispanics and those with NH-Other race/ethnicity compared to NH-Whites. PrEP-referrals were slightly more likely among Hispanics [aPR<sub>Referred1</sub>: 1.09 (0.98–1.21); aPR<sub>Referred2</sub>: 1.14 (2.03–1.26)] and Non-Hispanic other [aPR<sub>Referred1</sub>: 1.12 (1.02–1.23); aPR<sub>Referred2</sub>: 1.16 (1.03–1.31)]. Gender was significantly associated with PrEP-referral and linkage while priority population was associated with PrEP-linkage and prescriptions. Compared to PrEP-indicated cisgender males, PrEP-indicated cisgender females were 49% more likely to be PrEP-referred [aPR<sub>Referred1</sub>: 1.49 (1.09–2.03)]; but 58% less likely to be PrEP-linked (aPR<sub>Linked1</sub>: 0.42 (0.26–0.67)). No differences were observed by gender for PrEP-evaluation and PrEP-prescriptions. Compared to MSM, transgender individuals were 67% less likely to be PrEP-linked [aPR<sub>Linked2</sub>: 0.37; (0.26–0.54)] and 48% less likely to be PrEP-prescribed [aPR<sub>Prescribed2</sub>: 0.52 (0.32–0.85)]. PWID also were less likely to be PrEP-linked [aPR<sub>Linked2</sub>: 0.30 (0.17–0.52)] and PrEP-prescribed [aPR<sub>Prescribed2</sub>: 0.72 (0.56–0.91)].

### PrEP Care Continuum Outcomes Relative to Community Need

Between January 1, 2016 and December 31, 2018, 764 new HIV diagnoses were reported among Baltimore City residents (Table 3). The majority were NH-Black (80.2%) and cisgender male (74.6%). The mean and median age was 36.4 years (standard deviation: 14.02) and 32.0 years (Range: 14–91), respectively. Twenty-one percent were AYA and 34.7% were younger adults. Most had a defined HIV transmission category (n=648, 84.8%), among whom the majority (55.2%) were MSM; 30.7% were heterosexual.

Individual characteristics across the PrEP care continuum significantly differed to those of new HIV diagnoses by race/ethnicity, age, gender and priority population (Table 3). Compared to new HIV diagnoses, NH-Blacks were significantly underrepresented at each care continuum stage (new HIV diagnoses: 80.2%; PrEP-indicated: 72.9%; PrEP-referred: 67.2%; PrEP-linked: 61.3%; PrEP- evaluated: 68.3%; and PrEP-prescribed: 54.3%). NH-whites were overrepresented at each stage; for example, 10.7% of new HIV diagnoses were NH-white compared to 31.3% PrEP prescribed individuals.

Individuals at each PrEP care continuum stage were significantly younger than those newly HIV diagnosed ( $p < 0.001$ , all stages). AYA comprised 21.2% of new HIV diagnoses, but were 29.4% of those PrEP-screened, 28.5% of those PrEP-eligible, 29.6% of those PrEP-referred, 30.5% of those PrEP-linked, 29.8% of those PrEP- evaluated and 26.9% of those PrEP-prescribed. Similarly, 34.7% of those newly diagnosed were younger adults, compared to 41.0% of those PrEP-linked, 43.2% of those PrEP-evaluated and 45.6% of those PrEP-prescribed.

Gender composition differed significantly between HIV diagnoses and each continuum stage ( $p < 0.001$ , all stages). Seventy-five percent (74.6%) of new HIV diagnoses were cisgender



male compared to 61.1% of those PrEP-screened, and 69.3% of those PrEP-referred, but greater proportions were PrEP-linked (76.6%), PrEP-evaluated (79.7%) and PrEP-prescribed (83.9%). A greater proportion of cisgender females (vs. new HIV diagnoses) were PrEP-referred (34.3% vs. 23.4%) but smaller proportions were PrEP-linked (17.2% vs. 23.4%), PrEP-evaluated (16.5% vs. 23.4%) and PrEP-prescribed (12.5% vs. 23.4%).

Relative to new HIV diagnoses, MSM were underrepresented during upstream stages (new HIV diagnoses: 55.2%; PrEP-screened: 11.1%; PrEP-indicated: 35.6%; PrEP-referred: 36.8%) and overrepresented during downstream stages (PrEP-linked: 63.0%; PrEP-evaluated: 68.0%; PrEP-prescribed: 74.5%,  $p < 0.001$  all stages). Except for the screening stage, transgender persons were overrepresented during all stages. In contrast, compared to HIV diagnoses, heterosexual individuals were overrepresented during upstream but underrepresented during downstream stages (new HIV diagnoses: 30.7%, PrEP-screened 86.7%; PrEP-indicated: 57.4%; PrEP-referred: 57.4%, PrEP-linked; 51.0%; PrEP-evaluated: 26.6%; and PrEP-prescribed 20.8%,  $p < 0.001$  all stages). MSM/PWID and PWID were underrepresented at each stage of the PrEP care continuum.

## Discussion

Increasing PrEP provision among individuals at highest HIV acquisition risk is critical to reducing population-level HIV incidence. This examination of PrEP care engagement in Baltimore City reveals substantial attrition through PrEP care continuum stages. Fewer than one-in-ten (9.0%) PrEP-indicated individuals were PrEP-prescribed. Attrition was highest during upstream care continuum stages (PrEP-referred and PrEP-linked). A majority (69.7%) of those PrEP-linked were PrEP-evaluated, and most (83.2%) of those PrEP-evaluated were PrEP-prescribed. We found significant differences in PrEP implementation and delivery by race/ethnicity, gender, and priority populations. NH-Blacks had the lowest care continuum progression rates, were significantly less likely than NH-whites to be PrEP-prescribed, and were underrepresented at each stage relative to the racial/ethnic composition of new HIV diagnoses. MSM had the highest levels of care continuum progression. Nearly one-in-five (18.7%) MSM in the program were PrEP-prescribed.

Our results corroborate existing evidence that achieving Ending the HIV Epidemic goals for reducing HIV incidence may require significant improvement in PrEP care engagement.<sup>24–27</sup> Our findings that fewer than one-in-ten PrEP-indicated individuals and one-in-five MSM were PrEP-prescribed are similar to a recent studies estimating PrEP use among PrEP-indicated U.S. adults (6%),<sup>10</sup> and among MSM in Seattle,<sup>28</sup> Australia,<sup>29</sup> Chicago,<sup>30</sup> New York City,<sup>31</sup> and Tennessee (Range: 11–28%).<sup>18</sup> Other studies have found similarly low PrEP prescription levels among transgender, PWID and heterosexual populations.<sup>18, 20–22, 32</sup> Encouragingly, a large volume of individuals received HIV prevention services through the project, one-third of whom were identified as being at elevated HIV acquisition risk, and therefore, PrEP-indicated. Also encouraging is the large volume of individuals who were PrEP-referred. These results suggest that important HIV priority populations can be accessed for HIV prevention and delivered information about PrEP, though much work remains to improve PrEP uptake among these individuals.

One bright spot was that when controlling for age and gender or for age and priority population, race/ethnicity was not significantly associated with PrEP-referral, linkage or evaluation. However, observed racial/ethnic disparities in PrEP-prescription corroborates previous work,<sup>19–22</sup> Observed stark differences in the racial/ethnic composition of individuals across the care continuum compared to that of new HIV diagnoses are especially concerning. Other studies have identified complex reasons for these disparities, which include social and structural barriers such as poverty, systemic racism, stigma and medical mistrust.<sup>33–37</sup> If these observed disparities continue, we may inadvertently exacerbate existing local disparities in HIV incidence.<sup>5</sup> Notably, a disproportionately low number of NH-Blacks were identified as PrEP-indicated. Most of these individuals were heterosexual. Given increased focus of PrEP uptake among MSM, It is possible that among heterosexual individuals, providers did not assess for PrEP indication and/or these individuals were more reluctant to disclose risk information. It is also possible that, given the extent of new HIV diagnoses among heterosexuals locally, common criteria used to identify heterosexual PrEP candidates may be too stringent, and therefore, may also exacerbate existing disparities. Future work should focus on exploring expanded criteria to identify additional individuals who may benefit from PrEP.

Another bright spot was that the project may be meeting local PrEP needs among AYA and younger adults. Multivariable regression modeling showed no differences by age in care continuum progression. Also, relative to the age composition of new HIV diagnoses, AYA and younger adults were overrepresented at each care continuum stage with some differences among AYA; however, this also suggests that older adults were underrepresented throughout the care continuum. Care should be taken to ensure PrEP is promoted among older adults who may be at risk for HIV acquisition.

A third bright spot was that the majority of PrEP-linked individuals were PrEP-evaluated, of whom most were PrEP-prescribed. Across all demographic groups and priority populations, the highest attrition occurred between the referral and linkage stages. Consistent with our findings, other settings have reported larger attrition rates during upstream compared to downstream care continuum stages.<sup>18, 31, 38, 39</sup> Though some individuals may not be interested in PrEP as a prevention measure, the magnitude of our observed attrition rate at this stage suggests substantial barriers to PrEP-linkage remain. These barriers may be related to behavioral or psychosocial factors that need to be addressed to improve PrEP linkage. Increased engagement with clients, perhaps through navigators, to address potential concerns about PrEP at the time of HIV testing or PrEP referral also could be explored. A third possible solution could be implementation of PrEP on-demand. Future work should focus on identifying and addressing reasons for attrition during pre-linkage stages.

Our observed levels of documented PrEP referrals were lower than expected. An ad hoc analysis showed that the lower than expected referral rate was driven by lower referral rates at the two high volume clinical sites. This could be partially explained by differences in data collection tools between sites. At all but these two sites, a specific paper “intake” form was used which flagged PrEP-indicated individuals to remind the provider or testing counselor that an individual should be referred for PrEP. In the two high-volume clinics where the “intake form” was incorporated directly into the electronic medical record



system, did not include the “PrEP-indicated” flag. The extent to which differences in referral rates can be attributed to this structural difference is unknown; however, it may be something interesting to pursue to improve PrEP referral rates. Our findings also suggest that, relative to community need, the project also underperformed with respect to heterosexual men and women and PWID. Barriers and facilitators to PrEP care engagement among heterosexual populations, particularly women and PWID remains understudied. Black women, in particular, suffer disproportionately high HIV burdens.<sup>1</sup> Much attention has been paid to increasing PrEP use among MSM. However, increased focus on barriers and facilitators to PrEP care engagement among women at elevated HIV risk are urgently needed to prevent exacerbating disparities among NH-Black women.

There are several important limitations to this analysis. Demographic, sexual behavior and substance use information was self-reported and subject to social desirability bias. There was also more complete data among individuals who progressed to downstream stages (PrEP-linked, PrEP-evaluated and PrEP-prescribed), and our analysis may underestimate the proportion of PrEP-indicated and overestimate the proportion of PrEP-prescribed individuals. Two sites required client consent before abstracting information for project evaluation, with PrEP-prescribed individuals most likely to provide consent; this may lead to overestimation of true care continuum progression rates. Information on individuals newly HIV-diagnosed was used as a proxy for unmeasurable incident HIV. In particular, transgender status in HIV surveillance data may be underestimated. Compositional differences between those with incident HIV and those newly HIV-diagnosed may have led to erroneous conclusions. It is possible our results reflect differences in the underlying clinical populations compared to those newly HIV-diagnosed. Comparison of individuals newly HIV-diagnosed at participating sites were younger and more likely to be MSM and transgender than those diagnosed at other clinics. However, sensitivity analyses restricting the comparison group to those newly HIV-diagnosed in participating clinics revealed similar trends to our overall analyses. Finally, participating sites were experienced in providing HIV care and prevention services and our results may not be generalizable to other healthcare settings.

Reducing population-level HIV incidence depends on increasing PrEP use among those at highest HIV acquisition risk. This analysis of a large city-wide demonstration project in one city with a severe HIV epidemic showed promise in meeting this goal. It also identified substantial gaps in PrEP delivery and implementation, particularly at the point between PrEP referral and linkage, and significant disparities in PrEP care engagement, among NH-Blacks, women, and PWID. Future work should focus on identifying individual- and provider-level barriers and facilitators to inform interventions to address these service gaps and ultimately, reduce population level HIV incidence.

## Acknowledgements

The IMPACT Partner Collaborative (Kathleen Page M.D., Baltimore City Health Department, Baltimore, MD; Maisha Davis LCSW-C, Chase Brexton Health Services, Baltimore, MD; Patrick Ryscavage, M.D., Department of Medicine, University of Maryland School of Medicine, Baltimore, MD; Joyce Leitch Jones M.D., M.S., Department of Medicine, Johns Hopkins School of Medicine, Baltimore, MD; Jason Farley Ph.D., M.P.H., ANP-BC, FAAN, AACRN, Department of Community Public Health, Johns Hopkins School of Nursing, Baltimore,

MD; Renata Arrington-Sanders M.D., M.P.H., Sc.M., Department of Pediatrics, Johns Hopkins School of Medicine, Baltimore, MD; Vicki Tepper Ph.D., Department of Pediatrics, University of Maryland, Baltimore, MD)

#### Sources of Support:

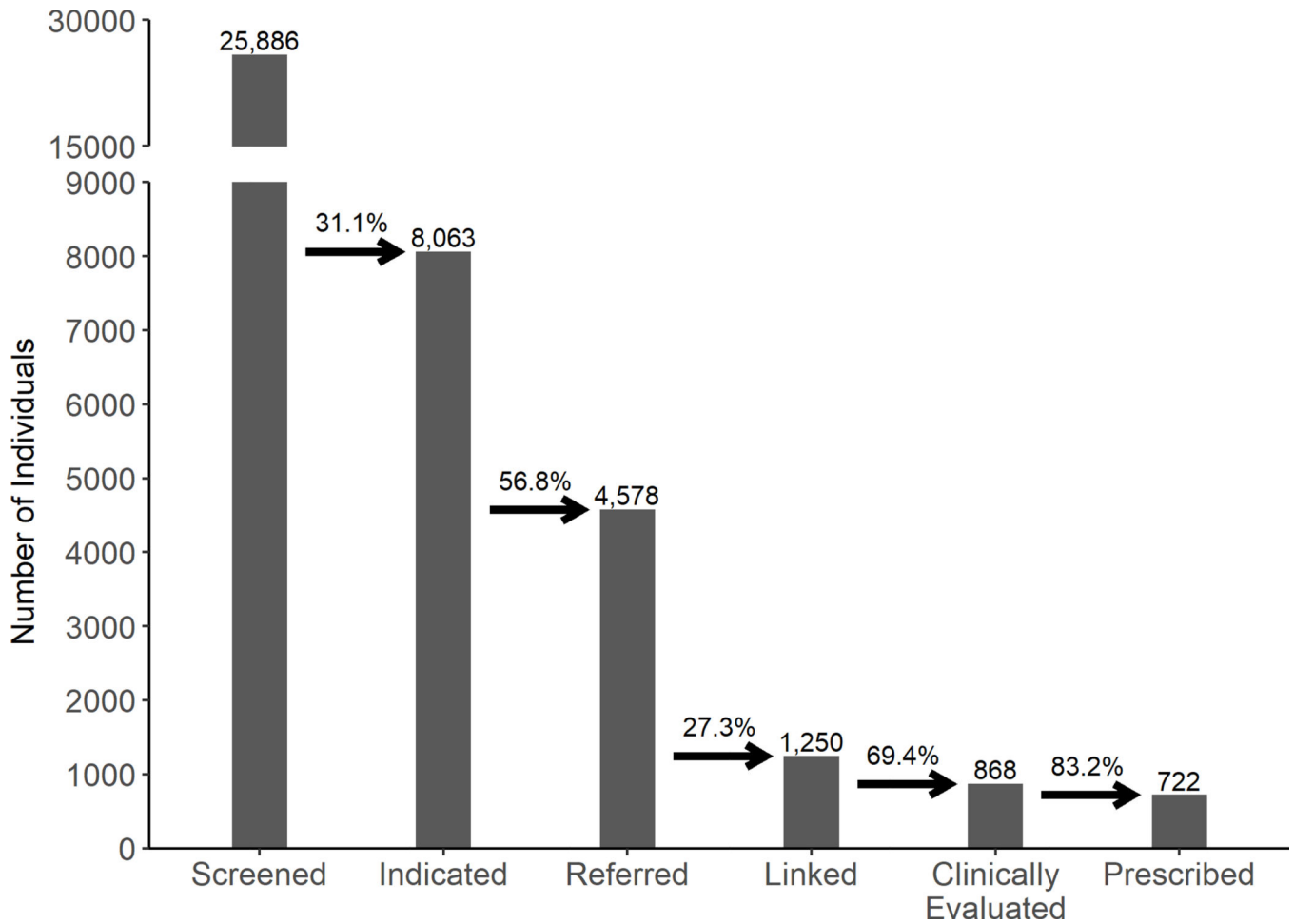
This study was supported by the Centers for Disease Control and Prevention grants entitled Understanding Syphilis Transmission in the United States (1U01PS005171-01; CMS, EF, AG, JMJ), Health Department Demonstration Projects for Comprehensive Prevention, Care, Behavioral Health, and Social Services for Men Who Have Sex with Men of Color at Risk for and Living with HIV Infection (PS15-1509, CMS, XT, AC, EF, AP, AG, JJ, KP, MD, PR, JLJ, JF, RAS, VT), Health Department Demonstration Projects to Reduce HIV Infections and Improve Health Outcomes for Men Who Have Sex with Men of Color at Risk for and Living with HIV Infection (PS15-1506, CMS, XT, AC, EF, AP, AG, JJ, KP, MD, PR, JLJ, JF, RAS, VT), and the STD Surveillance Network (PS13-1306, CMS, AG).

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**Figure 1. HIV Pre-Exposure Prophylaxis (PrEP) Care Continuum Outcomes,<sup>1</sup> Baltimore City Maryland, September 30, 2015 – September 29, 2019.**

<sup>1</sup>PrEP care continuum outcome definitions:

Screened: received HIV screening and/or assessed for HIV acquisition risk.

Indicated: based on U.S. Centers for Disease Control PrEP guidelines and local epidemiology and includes individuals who: were cisgender gay, bisexual or other man who has sex with men (MSM); were transgender; or reported needle sharing (past 12m), a sex partner living with HIV (past 12m), buying or selling sex (past 12m), 2 episodes of HIV post-exposure prophylaxis (past 12m), previous syphilis, gonorrhea or rectal chlamydia diagnosis (past 3m).

Referred: received information on how to obtain PrEP and/or direct referral to a PrEP provider.

Linked: received navigation and/or clinical services related to PrEP at a participating site.

Clinically evaluated: received a clinical exam for PrEP at a participating site.

Prescribed: PrEP prescription documented.

Percentages represent proportion in each stage progressing to the next stage. For example, 56.8% of PrEP indicated individuals were PrEP referred.

Table 1.

HIV Pre-Exposure Prophylaxis (PrEP) Care Continuum Outcomes<sup>1</sup> among HIV-negative Individuals by Demographics and HIV Priority Population, Baltimore City, Maryland, September 30, 2015 – September 29, 2019

	Screened		Indicated		Referred		Linked		Clinically Evaluated		Prescribed	
	N	n	% screened	n	% indicated	n	% referred	n	% linked	n	% evaluated	
<b>Overall</b>	25,886	8,063	31.1	4,578	56.8	1,250	27.3	868	69.4	722	83.2	
<b>Race/Ethnicity</b>												
Non-Hispanic Black	20,998	5,875	28.0	3,080	52.4	766	24.9	503	65.7	392	77.9	
Non-Hispanic White	2,708	1,436	53.0	996	69.4	330	33.1	254	77.0	226	89.0	
Hispanic	1,464	446	30.5	281	63.0	81	28.8	60	74.1	55	91.7	
Non-Hispanic Other	716	306	42.7	221	72.2	73	32.9	51	69.9	49	96.1	
<b>Age</b>												
13–24 years	7,600	2,302	30.3	1,355	58.9	381	28.1	259	68.0	194	74.9	
25–34 years	9,141	2,857	31.2	1,602	56.1	512	32.0	375	73.2	355	87.7	
35 years	9,145	2,907	31.8	1,621	55.8	357	22.0	234	65.5	201	85.0	
<b>Gender</b>												
Cisgender males	15,825	5,587	35.3	2,820	50.5	958	34.0	692	72.2	606	87.6	
Cisgender females	9,713	2,128	21.9	1,572	73.9	215	13.7	137	63.7	87	63.5	
Transgender <sup>2</sup>	348	348	100.0	186	53.4	77	41.4	39	50.6	29	74.4	
<b>Priority Populations</b>												
MSM <sup>2</sup>	2,870	2,870	100.0	1,684	58.7	787	46.7	590	75.0	538	91.2	
MSM PWID <sup>2</sup>	20	20	100.0	15	75.0	7	46.7	<5 <sup>4</sup>	<71.4	<5 <sup>4</sup>	100.0	
Transgender <sup>2</sup>	348	348	100.0	186	53.4	77	41.4	39	50.6	29	74.4	
PWID <sup>2</sup>	196	196	100.0	66	33.7	11	16.7	6	54.5	<5 <sup>4</sup>	<83.3	
Heterosexual	22,452	4,629	20.6	2,627	56.8	638	24.3	231	36.2	150	64.9	

<sup>1</sup> PrEP care continuum outcome definitions:

Screened: received HIV screening and/or assessed for HIV acquisition risk.

Indicated: based on U.S. Centers for Disease Control PrEP guidelines and local epidemiology and includes individuals who: were cisgender gay, bisexual or other man who has sex with men (MSM); were transgender; or reported needle sharing (past 12m), a sex partner living with HIV (past 12m), buying or selling sex (past 12m), 2 episodes of HIV post-exposure prophylaxis (past 12m), previous syphilis, gonorrhea or rectal chlamydia diagnosis (past 3m).



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Referred: received information on how to obtain PrEP and/or direct referral to a PrEP provider.

Linked: received navigation and/or clinical services related to PrEP at a participating site.

Clinically Evaluated: received a clinical exam for PrEP at a participating site.

Prescribed: PrEP prescription documented.

<sup>2</sup> Transgender: individuals whose gender identity differs from their sex assigned at birth; MSM: gay, bisexual or other man who has sex with men; PWID: persons who inject drugs

<sup>3</sup> In this demonstration project, all individuals who were transgender, MSM or PWID were PrEP indicated. Statistical testing was not performed for this step of the continuum for Gender and HIV Acquisition Risk.

<sup>4</sup> Data suppressed

<sup>#</sup> p < 0.001

Table 2.

Factors associated with HIV Pre-Exposure Prophylaxis (PrEP) Referral, Linkage, Clinical Evaluation and Prescriptions<sup>1</sup> among HIV-negative individuals, Baltimore City, Maryland September 30, 2015 – September 29, 2019

	PrEP Referred (among those indicated) N = 8,063				PrEP Linked (among those referred) N = 4,578							
	Bivariate	Model 1	Model 2	Bivariate	Model 1	Model 2	Bivariate	Model 1	Model 2			
Race/Ethnicity	PR	95% CI	aPR	95% CI	PR	95% CI	aPR	95% CI	aPR	95% CI		
Non-Hispanic Black	0.76	(0.55 – 1.03)	0.80	(0.63 – 1.02)	0.82	(0.66 – 1.02)	0.75	(0.60 – 0.94)*	1.00	(0.72 – 1.40)	1.20	(0.85 – 1.68)
Non-Hispanic White	REF		REF		REF		REF		REF		REF	
Hispanic	0.91	(0.83 – 1.00)*	1.09	(0.98 – 1.21)	1.14	(1.03 – 1.26)*	0.87	(0.58 – 1.30)	1.18	(0.81 – 1.72)	1.10	(0.78 – 1.54)
Non-Hispanic Other	1.04	(0.93 – 1.17)	1.12	(1.02 – 1.23)*	1.16	(1.03 – 1.31)*	1.00	(0.81 – 1.22)	1.20	(0.92 – 1.58)	1.24	(0.94 – 1.63)
<b>Age</b>												
13–24 years	REF		REF		REF		REF		REF		REF	
25–34 years	0.95	(0.75 – 1.21)	0.96	(0.81 – 1.15)	0.94	(0.77 – 1.15)	1.14	(0.77 – 1.68)	1.06	(0.76 – 1.48)	1.02	(0.75 – 1.39)
35 years	0.95	(0.73 – 1.23)	0.96	(0.78 – 1.17)	0.96	(0.75 – 1.22)	0.78	(0.46 – 1.33)	0.79	(0.50 – 1.25)	0.90	(0.58 – 1.38)
<b>Gender</b>												
Cisgender males												
Cisgender females	1.46	(1.02 – 2.10)*	1.49	(1.09 – 2.03)*			0.40	(0.25 – 0.64)*	0.42	(0.26 – 0.67)*		
Transgender <sup>2</sup>	1.06	(0.83 – 1.35)	1.04	(0.80 – 1.36)			1.22	(0.71 – 2.10)	1.19	(0.70 – 2.02)		
<b>Priority Populations</b>												
MSM <sup>2</sup>	REF											
MSM PWID <sup>2</sup>	1.28	(0.82 – 2.00)			1.34	(0.82 – 2.20)	1.00	(0.52 – 1.90)			1.01	(0.54 – 1.88)
Transgender <sup>2</sup>	0.57	(0.33 – 1.01)			0.54	(0.30 – 1.00)*	0.36	(0.25 – 0.51)*			0.37	(0.26 – 0.54)*
PWID <sup>2</sup>	0.97	(0.71 – 1.32)			1.05	(0.82 – 1.34)	0.30	(0.17 – 0.51)*			0.30	(0.17 – 0.52)*
Heterosexual	0.91	(0.71 – 1.16)			0.94	(0.73 – 1.21)	0.89	(0.54 – 1.44)			0.87	(0.54 – 1.41)
<b>Race/Ethnicity</b>												
Non-Hispanic Black	0.85	(0.64 – 1.14)	0.90	(0.71 – 1.15)	0.92	(0.73 – 1.17)	0.88	(0.76 – 1.01)	0.89	(0.81 – 0.98)*	0.92	(0.84 – 1.00)
Non-Hispanic White												
Hispanic	1.08	(0.87 – 1.33)	1.03	(0.86 – 1.24)	1.03	(0.86 – 1.25)	1.17	(0.96 – 1.43)	1.10	(0.97 – 1.25)	1.10	(0.97 – 1.23)

	PrEP Referred (among those indicated) N = 8,063				PrEP Linked (among those referred) N = 4,578							
	Bivariate		Model 1		Model 2		Bivariate		Model 1		Model 2	
	PR	95% CI	aPR	95% CI	aPR	95% CI	PR	95% CI	aPR	95% CI	aPR	95% CI
<b>Age</b>												
13–24 years	0.96	(0.79 – 1.17)	0.94	(0.76 – 1.15)	0.96	(0.76 – 1.20)	1.14	(0.92 – 1.40)	1.12	(0.95 – 1.32)	1.17	(0.98 – 1.40)
25–34 years	1.08	(0.87 – 1.33)	1.03	(0.86 – 1.24)	1.03	(0.86 – 1.25)	1.17	(0.96 – 1.43)	1.10	(0.97 – 1.25)	1.10	(0.97 – 1.23)
35 years	0.96	(0.79 – 1.17)	0.94	(0.76 – 1.15)	0.96	(0.76 – 1.20)	1.14	(0.92 – 1.40)	1.12	(0.95 – 1.32)	1.17	(0.98 – 1.40)
<b>Gender</b>												
Cisgender males												
Cisgender females	0.88	(0.67 – 1.16)	0.92	(0.75 – 1.13)			0.73	(0.48 – 1.11)	0.75	(0.52 – 1.09)		
Transgender <sup>2</sup>	0.70	(0.28 – 1.78)	0.70	(0.27 – 1.85)			0.85	(0.71 – 1.02)	0.87	(0.70 – 1.09)		
<b>Priority Populations</b>												
MSM <sup>2</sup>												
MSM/PWID <sup>2</sup>	0.38	(0.13 – 1.08)			0.38	(0.14 – 1.04)	1.10	(1.05 – 1.15)*			1.04	(0.98 – 1.11)
Transgender <sup>2</sup>	0.73	(0.30 – 1.77)			0.74	(0.29 – 1.86)	0.55	(0.34 – 0.87)*			0.52	(0.32 – 0.85)*
PWID <sup>2</sup>	0.84	(0.62 – 1.12)			0.88	(0.69 – 1.12)	0.71	(0.54 – 0.94)*			0.72	(0.56 – 0.91)*
Heterosexual	0.68	(0.27 – 1.69)			0.69	(0.27 – 1.76)	0.82	(0.69 – 0.96)*			0.84	(0.68 – 1.03)

<sup>1</sup> PrEP care continuum outcomes

Indicated: based on U.S. Centers for Disease Control PrEP guidelines and local epidemiology and includes individuals who: were cisgender gay, bisexual or other man who has sex with men (MSM); were transgender; or reported needle sharing (past 12m), a sex partner living with HIV (past 12m), buying or selling sex (past 12m), 2 episodes of HIV post-exposure prophylaxis (past 12m), previous syphilis, gonorrhea or rectal chlamydia diagnosis (past 3m).

Referred: received information on how to obtain PrEP and/or direct referral to a PrEP provider.

Linked: received navigation and/or clinical services related to PrEP at a participating site.

Clinically Evaluated: received a clinical exam for PrEP at a participating site.

Prescribed: PrEP prescription documented.

<sup>2</sup> Transgender: individuals whose gender identity differs from their sex assigned at birth; MSM: gay, bisexual or other man who has sex with men; PWID: persons who inject drugs

\* p < 0.05

Table 3.

Characteristics of HIV-Negative Individuals at Each Stage of the HIV Pre-Exposure Prophylaxis (PrEP) Care Continuum<sup>1</sup> Compared to Individuals Newly Diagnosed with HIV, Baltimore, Maryland September 30, 2015 – September 29, 2019

	Reported New HIV Diagnoses 2016–2018 <sup>2</sup>			PrEP Care Continuum Outcomes					
	n	%	N = 764	Screened N = 25,886	Indicated N = 8,063	Referred N = 4,578	Linked N = 1,250	Clinically Evaluated N = 868	Prescribed N = 722
<b>Race/Ethnicity</b>									
Non-Hispanic Black	613	80.2		20,998	5,875	3,080	766	593	392
Non-Hispanic White	82	10.7		2,708	1,436	996	339	254	226
Hispanic	48	6.3		1,464	446	281	81	69	55
Non-Hispanic Other	21	2.8		716	306	221	73	51	49
<b>Age</b>									
13–24 years	162	21.2		7,600	2,302	1,355	381	259	46
25–34 years	265	34.7		9,141	2,857	1,602	512	375	355
35 years	337	44.1		9,145	2,904	1,621	357	234	201
<b>Gender</b>									
Cisgender males	570	74.6		15,825	5,587	2,820	958	692	606
Cisgender females	179	23.4		9,713	2,128	1,572	215	137	87
Transgender <sup>4</sup>	15	2.0		348	348	186	77	39	29
<b>Priority Populations</b> <sup>3</sup>									
MSM <sup>4</sup>	358	55.2		2,870	2,870	1,684	787	590	538
MSM PWID <sup>4</sup>	12	1.8		20	20	15	7	<5 <sup>5</sup>	<5 <sup>5</sup>
Transgender <sup>4</sup>	15	2.3		348	348	186	77	39	29
PWID <sup>4</sup>	65	10.0		196	196	66	11	6	<5 <sup>5</sup>
Heterosexual	199	30.7		22,452	4,629	2,627	638	231	150

<sup>1</sup> PrEP care continuum outcome definitions:

Screened: received HIV screening and/or assessed for HIV acquisition risk.

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Indicated: based on U.S. Centers for Disease Control PrEP guidelines and local epidemiology and includes individuals who: were cisgender gay, bisexual or other man who has sex with men (MSM); were transgender; or reported needle sharing (past 12m), a sex partner living with HIV (past 12m), buying or selling sex (past 12m), 2 episodes of HIV post-exposure prophylaxis (past 12m), previous syphilis, gonorrhea or rectal chlamydia diagnosis (past 3m).

Referred: received information on how to obtain PrEP and/or direct referral to a PrEP provider.

Linked: received navigation and/or clinical services related to PrEP at a participating site.

Clinically Evaluated: received a clinical exam for PrEP at a participating site.

Prescribed: PrEP prescription documented.

<sup>2</sup>Baltimore City residents with a new HIV diagnosis reported between January 1, 2016 and December 31, 2018

<sup>3</sup>Excludes 116 individuals newly diagnosed with HIV with no priority population identified. The total number of individuals newly diagnosed with HIV with assigned priority population is 648.

<sup>4</sup>Transgender: individuals whose gender identity differs from their sex assigned at birth; MSM: gay, bisexual or other man who has sex with men; PWID: persons who inject drugs

<sup>5</sup>Data suppressed

<sup>†</sup>p < 0.001