

Positive Charge: Filling the Gaps in the U.S. HIV Continuum of Care

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Abstract Adequate engagement in HIV care is necessary for the achievement of optimal health outcomes and for the reduction of HIV transmission. Positive Charge (PC) was a national HIV linkage and re-engagement in care program implemented by AIDS United. This study describes three PC programs, the characteristics of their participants, and the continuum of engagement in care for their participants. Eighty-eight percent of participants were engaged in care post PC enrollment. Sixty-nine percent were retained in care, and 46 % were virally suppressed at follow-up. Older participants were more likely to be engaged, retained, and virally suppressed. Differences by race and gender in HIV care and treatment varied across PC programs, reflecting the diverse target populations, locations, and strategies employed by the PC grantees. There is an urgent need for programs that promote HIV care and treatment among vulnerable populations, including young people living with HIV. There is also an urgent need for additional research to test the effectiveness of promising linkage and retention in care strategies, such as peer navigation.

Keywords HIV linkage to care · HIV retention in care · Program evaluation · Continuum of care · Spectrum of engagement in care · HIV cascade

The members of the PC Intervention Team are listed in Appendix.

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Introduction

HIV continues to be a disease of significant public health importance with more than 1.1 million people living with HIV (PLWH) in the United States [1]. Substantial portions of PLWH are not adequately engaged in medical care. Estimates from the Center for Disease Control and Prevention (CDC) suggest that 66 % of PLWH are linked to care, 37 % are retained in care, 33 % are prescribed highly active antiretroviral therapy (HAART), and only 25 % are virally suppressed [2]. Similarly, an analysis by Gardner found that 59 % of PLWH were linked to care, 40 % were retained in care, 24 % were on antiretroviral therapy (ART), and 19 % had an undetectable viral load [3]. Disparities exist along each stage of the continuum of care [2] and barriers to sustained engagement in care are greatest for vulnerable populations, including subpopulations of men who have sex with men (e.g. MSM of color), homeless individuals, and individuals who face mental health and substance abuse challenges [4–6].

Adequate engagement in care is vital for two reasons: achievement of optimal HIV treatment outcomes and a reduction in HIV transmission. HAART significantly reduces incidence of opportunistic infections and mortality [7], transforming HIV from a terminal illness into a chronic disease [8]. In addition, studies suggest that ART can reduce the risk of HIV transmission among heterosexual serodiscordant couples from 92 to 98 % [9–12]. Community viral load research suggests that HIV incidence might be decreasing in geographical locations with increased ART uptake, availability of more potent and tolerable ART, and virologic suppression [13].

There is a dearth of studies that test the efficacy of HIV linkage and retention in care interventions. At the time this article was written, only one randomized control trial, the

ARTAS study, had assessed the impact of an HIV linkage to care intervention. ARTAS found that strengths-based case management increased linkage and retention in care over a 1 year period [14]. In addition, a variety of intervention models have been assessed using non-randomized designs. Recent reviews of HIV linkage and retention in care interventions found that successful interventions shared common components, including strength-based counseling, health navigation, peer navigation, and a reduction of individual-level and systems-level barriers to HIV care [15, 16].

In response to the pressing need to optimize the potential treatment, and hence prevention benefits of HAART, AIDS United, a national grantmaking, capacity building, and advocacy organization, launched Positive Charge (PC) in 2010 with support from Bristol Myers Squibb. PC was a national multi-site HIV linkage and re-engagement in care program. At the time PC was launched, there were few published studies of linkage to care programs and published studies focused primarily on the newly diagnosed [14, 17–19]. To fill this gap, PC supported demonstration projects that reached out to PLWH who had never engaged in care or were out of care and PLWH who faced significant barriers to HIV care such as substance abuse, mental health, and homelessness.

The aim of this study is to describe the stages of care for PC participants after program exposure. This paper (a) describes the linkage strategies implemented by PC projects (b) describes the characteristics of program participants (c) assesses the continuum of engagement in care for vulnerable PLWH following exposure to the PC linkage to care program and (d) assesses the continuum of engagement in care by demographic characteristics.

Methods

Research Context

Participants were enrolled at five sites participating in PC. The sites were located in Chicago, New York City (NYC), San Francisco/Bay Area, and multiple cities in Louisiana and North Carolina. Each PC program was designed to meet the needs of the most underserved populations given the local context. This resulted in varied program models across the PC cohort. However, each PC program shared common evidence-based strategies, such as peer or patient navigation, case management, and efforts to address system-level barriers.

The current study only includes data from Chicago, Louisiana, and NYC. San Francisco/Bay Area and North Carolina were not included in this analysis because they lacked access to clinical data necessary to describe the full

continuum of engagement in care. In Chicago, project IN-CARE linked men who have sex with men into care using a peer health navigation approach. The components of project IN-CARE were to Identify and enroll PLWH; provide short-term peer health navigation; facilitate access to primary care, lab services and medication through existing medical and social services; and to enhance retention in care through peer-led group-based education. Louisiana used a variety of linkage to care strategies including, pre- and post-release case management for incarcerated individuals, as well as peer/patient navigation, intensive case management, and case finding with disease intervention specialists for the general population of PLWH who were previously diagnosed or newly diagnosed. To identify potential participants Louisiana's PC project relied on out-of-care client lists from clinics within the state hospital system, referrals from other community based organizations, and HIV-specific disease intervention specialists working in STD clinics and public testing sites. To link and retain clients, the program used a mix of strategies including brief strength-based case management, health education and health navigation located within hospitals, post-release case management with former inmates, and a community-based peer health navigator. In NYC, Amida Care, a Medicaid managed care insurance plan for PLWH (in partnership with the New York Community Trust) linked PLWH to care using both client level and systems level approaches through their project ACCESS NY. Client-level approaches included outreach and health navigation, while systems level provider focused collaborative learning approaches included improving patient flow through flexible scheduling and reduced visit time (Table 1). At the client level, community health outreach workers (CHOWs) and health navigators were assigned to PC clients out of care for more than 6 months to promoted return to care link. CHOWs were peers who played an intensive, short-term role that conducted outreach and linked participants to resources and health navigators. Health navigators filled a more long-term role, connecting clients to medical care and social support.

From August 1, 2010 to July 31, 2013, PC enrolled participants who were not in care (defined as failing to have two visits at least 2 months apart in the past year [20]) or at risk for falling out of care. Participants were considered at risk for falling out of care if they exhibited behaviors such as a 6 month gap in care or a recent history of missed visits or if they demonstrated a significant barrier to care such as homelessness, substance abuse, or mental health challenges. Participants were purposively sampled at each site using recruitment mechanisms such as outreach, in-reach, and referrals from partner organizations. Eligibility criteria for participants were developed to meet the site-specific program goals and to reach the population determined to be

Table 1 Characteristics of Positive Charge Projects

Geographical location	Intervention name	Target audience	Recruitment method	Intervention model	Intervention duration	Continuum of care data source
Chicago	IN-CARE	Men who have sex with men	Referrals, outreach	Peer health navigation	6–9 months	Administrative records, surveillance databases, lab records
New Orleans, Baton Rouge, Lake Charles, Shreveport	Louisiana Positive Charge (LA PC)	Incarcerated, newly diagnosed, and out of care	Referrals, outreach, in-reach	Pre/post release case management, peer/patient navigation, intensive case management, HIV disease intervention specialist	3–6 months	State surveillance
New York City	ACCESS NY	Members of a Medicaid managed care plan	In-reach	Multi-level intervention: Client centered outreach, peer health navigation; clinic system change	Open ended	Managed care plan claims database

at greatest risk for being out of care at each location. All data collection activities were subject to Institutional Review Board (IRB) review at pertinent institutions. Data collection activities for LA PC, IN-CARE, and ACCESS NY were approved by Louisiana Department of Health and Hospital, CORE Center IRB Committee, and Columbia University, respectively. National evaluation activities conducted by Johns Hopkins Bloomberg School of Public Health (JHBSPH) were found by JHBSPH's IRB to be non-human subjects research.

Research Design, Data Collection and Definitions

Faculty at JHBSPH were contracted to design and implement a cross-cutting national evaluation for all five PC programs. The details of this evaluation design have been described elsewhere [21]. The national evaluation used a single-group longitudinal evaluation design to monitor social determinants and participant health status over time. Participant data on descriptive statistics, medical visits, CD4 cell counts and viral loads were collected at baseline, as well as 6 and 12 months post baseline. For baseline CD4 and viral load, we used the lab value closest to baseline. If retrospective data were not available, we used the lab values obtained during each participant's first visit for HIV medical care following enrollment as a proxy. Data sources varied across the three program sites. In Chicago, medical visit history, CD4 and viral load data were gathered from administrative records (ClientTrack), the Chicago Department of Health's surveillance database, and lab records. Peer supervisors abstracted data from lab records using a standardized spreadsheet. In Louisiana, data on each participant's CD4 cell counts and viral loads were from eHARS (Enhanced HIV/AIDS Reporting System) and

matched with CAREWare data for additional participant data regarding health history and linkage to care. Here, surveillance data on CD4 cell counts and viral loads were used as proxy measures for medical visits [22]. In NYC, data on medical visit history came from Amida Care's electronic insurance claims dataset maintained by Amida Care's Information Systems Department. CD4 cell counts and viral loads were abstracted from the lab records of medical providers in the Amida Care network (Table 1).

Demographic data was also collected on participant's gender, race/ethnicity and age. In Chicago and Louisiana, demographic data were collected by an interviewer-administered survey during PC enrollment. In NYC, demographic data on gender and age were collected at the time of enrollment into Amida Care's health plan. Data were gathered and cleaned at each program location and then sent in aggregate to JHBSPH in standardized Microsoft Excel tables. At this juncture, JHBSPH conducted a second round of data cleaning and further analysis.

The primary outcome for this paper was a description of participants' progression through the continuum of engagement in care using standardized definitions. Throughout this paper, the term engagement in care has been used to describe both initial linkage to care (for participants who were never linked to care or who were newly diagnosed) and re-engagement in care (for participants who had dropped out of care). Engagement in care was defined as a medical visit with a health care professional with prescribing privileges [23] in a health care setting with the purpose of receiving HIV care. Retention in care was defined as having two medical visits at least 60 days apart in the past year [20], and viral suppression was defined as having a viral load less than or equal to 200 copies/mL [24].

Continuum of Care Analysis

We assessed participants' positions along the HIV continuum of care using two different methods. The first (Continuum of Care A) includes all participants enrolled in the PC program. The engaged bar includes all participants who had a medical visit following enrollment, the retained in care bar includes all participants who met our definition of retained in care at either 6 or 12 months follow-up, and the viral suppression bar included data on any participant who was virally suppressed at either 6 or 12 months follow-up.

In addition, we conducted a second sub-analysis (Continuum of Care B) that includes only participants who were enrolled in PC one year prior to the close of the program. For example, if a program stopped enrollment on July 31, 2013, the denominator for Continuum of Care B excluded individuals enrolled after July 31, 2012. This allowed us to assess retention and viral suppression for the 12 month period following program enrollment. This method excluded individuals whose exposure to PC may not have been of sufficient duration to move beyond linked to care or re-engaged in care. For the Continuum of Care B methodology, the engaged bar includes all individuals who had a medical visit following enrollment, the retained in care bar includes participants who met the definition of retention in care during the 12 months following enrollment, and the suppressed viral load bar includes individuals who were virally suppressed at least once during the year following enrollment [25]. In developing both continuums of care, engagement in one step of the continuum of care was not predicated on inclusion in the previous step. For example, someone who was linked to care could have skipped the step of retention and still be virally suppressed.

It is important to note that a substantial amount of baseline data for the NYC project is missing. This is because NYC enrolled participants with at least a 6 month gap in claims data for medical care visits and retrospective data beyond 6 months was not available. However, the claims data NYC was able to collect prospectively was complete and fully consistent with continuum of care methodologies described above and, therefore, was included in this analysis.

Univariate statistics were used to describe study participants and to create continuums of care for PC programs. We calculated unadjusted prevalence ratios and corresponding 95 % confidence intervals to assess differences in suppressed viral load by various demographic characteristics. We used prevalence ratios rather than odds ratios because the frequency of our outcome was greater than 10 % [26, 27]. Prevalence ratios and confidence limits were calculated using either SAS proc freq with a RELRISK option or Microsoft Excel. Both methods use a

nonmodeled approach, as opposed to a modeled approach such as a log-linked binomial model or a modified Poisson model [28]. To assess the hypothesis that our prevalence ratios were equal to one, we used Pearson's χ^2 [29], Fisher's exact test was employed if expected frequencies fell below 5.

Results

In Chicago, Louisiana, and NYC, the PC program enrolled a total of 2,615 participants. The majority of PC participants were male (74 %) and over the age of 35 (60 %). In Chicago and Louisiana, participants were primarily African American/Black (54 and 82 % respectively) (Table 2). Although a precise percentage breakdown of the ethnic composition was not obtained for NYC because of incomplete data, the large majority of Amida Care members are African American/black.

Data were collected on participants' clinic visit history and health status at baseline to allow for comparisons over time. For project IN-CARE (Chicago) no participants were in care at baseline and the median CD4 cell count and viral load for participants at baseline were 374 and 230 copies per mL respectively. Forty-four percent of participants had a suppressed viral load at baseline. In Louisiana, 77 % of participants were out of care at baseline, the remaining 23 % of participants were at risk for falling out of care. The median CD4 at baseline for Louisiana participants was 296, and the median viral load was 26,230 copies per mL. Fifteen percent of participants in Louisiana had a suppressed viral load at baseline. Data on retention in care, viral load, and CD4 were not available for the majority of ACCESS NY participants at baseline, however all participants were either existing Amida Care members who had a 6 months gap in care prior to enrollment or were newly enrolled Amida Care members who had not had a visit with an Amida Care HIV medical care provider.

Figure 1 outlines stages of care for PC participants following program enrollment. Of the total 2,615 participants, 2,303 (88 %) were linked to care, 1,803 (69 %) were retained in care, and 1,215 (46 %) were virally suppressed. To explore further participants' progression through the stages of care, we created a second version of the continuum (Continuum of Care B) which was limited to individuals who were enrolled at least one year prior to the end of the program ($n = 1,938$). Using this method, 1,806 (93 %) of participants were linked to care, 1,423 (73 %) were retained in care, and 1,024 (53 %) were virally suppressed (figure not shown).

Table 3 displays the continuum of care by site stratified by gender, race/ethnicity, and age. Data from Chicago's IN-CARE program depicts the continuum of care for MSM

Table 2 Characteristics of Positive Charge participants at baseline

	Chicago n (%)	Louisiana n (%)	New York n (%)
Total	564 (100)	998 (100)	1,053 (100)
Demographics			
Gender			
Male	562 (99.6)	661 (66.2)	703 (66.8)
Female	0	306 (30.7)	331 (31.4)
Transgender	2 (0.4)	31 (3.1)	19 (1.8)
Missing	0	0	0 (0)
Race/ethnicity			
African American/Black	306 (54.3)	814 (81.6)	284 (27.0)
Hispanic/Latino	132 (23.4)	21 (2.1)	128 (12.1)
White	106 (18.8)	122 (12.2)	45 (4.3)
Not African American/Black, Hispanic/Latino or White	17 (3.0)	11 (1.1)	318 (30.2)
Missing	3 (0.5)	30 (3.0)	278 (26.4)
Education			
Less than high school	56 (9.9)	419 (42.0)	60 (5.7)
High school diploma or equivalent	133 (23.6)	329 (33.0)	128 (12.2)
Some college or technical school	211 (37.4)	191 (19.1)	53 (5.0)
College or higher education	104 (18.4)	34 (3.4)	33 (3.1)
Missing	60 (10.6)	25 (2.5)	779 (74.0)
Mean number of days from first seropositive diagnosis [n: mean (SD)]	551: 1,905 (2,478)	993: 1,899 (2,273)	410: 4,372 (2,728)
Visit history and health status			
Care status (two visits 60 days apart in the past 12 months)			
Yes	0 (0)	234 (23.4)	303 (28.8)
No	564 (100)	764 (76.6)	207 (19.7)
Missing	0 (0)	0 (0)	542 (51.5)
Mean CD4 at baseline [n: mean (SD)] ^a	515: 407 (262)	879: 335.9 (264.9)	276: 481 (310)
Median CD4 at baseline ^a	374	296	443
Mean viral load at baseline [n: mean (SD)] ^a	512: 49,170 (188,948)	860: 185,230 (557,936)	368: 34,216 (132,617)
Median viral load at baseline ^a	230	26,230	65
Suppressed viral load at baseline			
Yes	249 (44.1)	152 (15.2)	206 (19.6)
No	263 (46.6)	708 (70.9)	162 (15.4)
Missing	52 (9.2)	138 (13.8)	685 (65.1)

^a If CD4 and viral load baseline data were not available data from first doctors visit was used as a proxy. In Louisiana, 94 CD4 and 99 viral load baseline values were from first visit post PC enrollment. For Chicago, 24 CD4 and 24 viral load values were from first visit post PC enrollment. No CD4 or viral load values for NYC were from the first visit post enrollment

who were out of care or newly diagnosed at enrollment. Ninety percent of MSM enrolled in project IN-CARE were engaged in care after enrollment. Seventy-six percent were retained in care and 50 % had a suppressed viral load at either 6 or 12 months follow-up. We found no differences among IN-CARE participants in engagement in care. We found that participants who had known their HIV serostatus for ten years or more were less likely to be retained [PR 0.87 (95 % CI 0.76–0.99), $P = 0.02$, $X^2 = 5.06$] and that

Chicago participants who were older were more likely to reach viral suppression compared to participants who were younger (≤ 24 years of age).

Louisiana captures data on the continuum of care for at risk PLWH living throughout Louisiana, including formerly incarcerated individuals, persons who were out of care, and individuals who were newly diagnosed. In Louisiana, 92 % of participants were engaged in care, 57 % were retained in care, and 36 % had a suppressed

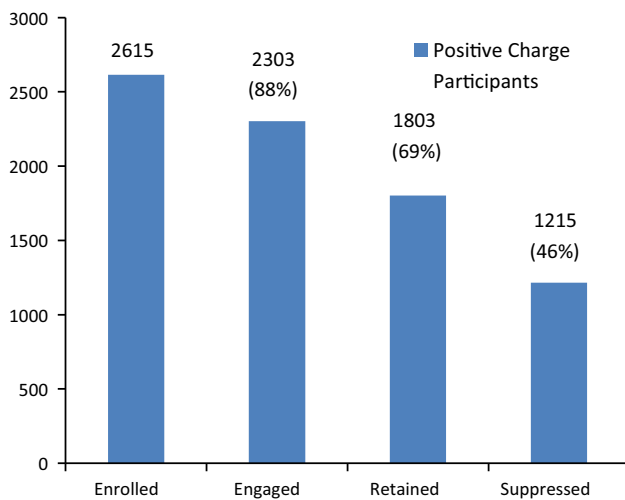


Fig. 1 Post enrollment continuum of care for Positive Charge participants

viral load. Here, we found that women [PR 1.04 (95 % CI 1.00–1.08), $P = 0.04$, $X^2 = 4.08$] and older individuals [35–44: PR 1.06 (95 % CI 1.00–1.14), $P = 0.05$, $X^2 = 3.70$; 45–54: PR 1.10 (95 % CI 1.03–1.17), $P = 0.00$, $X^2 = 9.07$] were more likely to be engaged in care. We also found that individuals who had known their HIV status for 1–5 years were less likely to be retained in care compared to individuals who were diagnosed in the past year [PR 0.88 (95 % CI 0.76–1.02), $P = 0.03$, $X^2 = 4.67$]. White participants were more likely to have a suppressed viral load compared to African American/Black participants [PR 1.63 (95 % CI 1.35–1.96) $P = 0.00$, $X^2 = 23.36$] and that older participants were more likely to have a suppressed viral load compared to younger participants [45–54: PR 1.60 (95 % CI 1.21–2.10), $P = 0.00$, $X^2 = 10.10$; 55+: PR = 1.72 (95 % CI 1.22–2.43), $P = 0.01$, $X^2 = 8.03$].

ACCESS NY's continuum of care includes Medicaid-eligible PLWH with a 6 month gap in care or who were new to Amida Care and had not yet had a visit with a provider. Among ACCESS NY participants, 83 % were engaged in care, 77 % were retained in care, and 54 % had a suppressed viral load. In NYC we found that older participants [45–54: PR 1.15 (95 % CI 1.02–1.31), $P = 0.01$, $X^2 = 7.12$] and transgender participants [PR 1.20 (95 % CI 1.16–1.24), $P = 0.05$, $X^2 = 3.74$] were more likely to be engaged in care. Older participants were also more likely to be retained in care. Women were less likely to be virally suppressed [PR 0.84 (95 % CI 0.74–0.96), $P = 0.01$, $X^2 = 7.59$] while Hispanic/Latino participants were more likely than African American/Black participants to be virally suppressed [PR 1.30 (95 % CI 1.10–1.53), $P = 0.00$, $X^2 = 8.55$].

Discussion

AIDS United's PC programs aimed to increase access to care by engaging vulnerable PLWH in HIV care and treatment services. Engagement in care among PC participants ranged from 83 to 92 % which compares favorably with other programs [14, 17–19, 30, 31]. The National HIV/AIDS Strategy (NHAS) prioritizes linkage to care, retention in care, and the provision of support services (such as housing and other basic needs) to facilitate long-term, continued engagement in care and adherence to HAART in the United States [4]. If we use the NHAS goal of 85 % linked to medical care as a benchmark, we find that PC's results are in line with national policy targets. However, this comparison is limited because PC's participant population was comprised primarily of individuals who had known their HIV status for some time and were out of care while the NHAS's benchmark is for newly diagnosed Ryan White HIV/AIDS Program clients. Prior research suggests that there are fewer challenges to HIV linkage and retention in care for PLWH who are newly diagnosed compared to PLWH who are out of care but not newly diagnosed [32].

We found evidence of improvements along each step of HIV care engagement. In Chicago, retention in care increased from 0 % at baseline to 76 % at follow-up, and viral suppression increased from 44 to 50 %. In Louisiana, 23 % of participants were retained in care at baseline compared to 57 % at follow-up and 15 % of Louisiana's participants had a suppressed viral load at baseline compared to 36 % at follow-up. The NHAS set forth goals to increase the proportion of PLWH retained in care by seven percentage points (from 73 to 80 %) and to increase the proportion with an undetectable viral load by 20 percentage points (among at least three key populations). The PC initiative met these benchmarks with exception of viral suppression for the Chicago program which improved by six percentage points. This improvement is still noteworthy; prior research suggests that improvement in linkage to care and retention in care leads to minimal decreases in viral load [3].

Despite these promising findings, some drop off still occurred along each step of the continuum of care with the most substantial drop off occurring at retention and viral suppression. This leakage mirrors other research [33] and reflects the nature of the PC programs. PC focused on re-engagement or linkage to care, rather than retention in care or ART adherence. This finding highlights the need for program coverage along each stage of the continuum of care.

When we looked at the continuum of care for the PC programs stratified by participant demographic characteristics some important trends emerged. Disparities seen

Table 3 Continuum of Care for Positive Charge by demographic characteristics of participants

	Total	Engaged	PR Engaged	X ² , P value	Retained	PR Retained	X ² , P value	SVL ^a	PR SVL ^a	X ² , P value
Chicago	564	510 (90.0)	NA	NA	426 (75.5)	NA	NA	283 (50.2)	NA	NA
Race/ethnicity										
African American/Black	306	276 (90.2)	ref	ref	224 (73.2)	ref	ref	143 (46.7)	ref	ref
Hispanic/Latino	132	123 (93.2)	1.03 (0.97–1.10)	0.69, 0.41	101 (76.5)	1.05 (0.93–1.17)	0.42, 0.52	70 (53.0)	1.13 (0.93–1.39)	0.64, 0.42
White	106	95 (89.6)	0.99 (0.92–1.07)	1.43, 0.23	87 (82.1)	1.12 (1.00–1.25)	2.70, 0.10	60 (56.6)	1.21 (0.99–1.49)	3.60, 0.06
Not African American/Black, Hispanic/Latino or White	17	14 (82.4)	0.91 (0.73–1.14)	0.76, 0.38	12 (70.6)	0.96 (0.70–1.32)	0.11, 0.74	9 (52.9)	1.13 (0.71–1.80)	1.38, 0.24
Missing	3	2 (66.7)	0.74 (0.33–1.65)	NA	2 (66.7)	0.91 (0.41–2.03)	NA	1 (33.3)	0.71 (0.14–3.55)	NA
Age										
≤24	42	36 (85.7)	ref	ref	29 (69.1)	ref	ref	10 (23.8)	ref	ref
25–34	232	211 (91.0)	1.06 (0.93–1.21)	0.04, 0.84	179 (77.2)	1.12 (0.90–1.38)	1.94, 0.16	110 (47.4)	1.99 (1.14–3.48)	9.34, 0.00
35–44	147	137 (93.2)	1.09 (0.95–1.24)	0.48, 0.49	109 (74.2)	1.07 (0.86–1.34)	0.43, 0.51	81 (55.1)	2.32 (1.32–4.05)	17.09, 0.00
Chicago										
Age										
45–54	122	107 (87.7)	1.02 (0.89–1.18)	0.03, 0.87	92 (75.4)	1.09 (0.87–1.37)	0.65, 0.42	70 (57.4)	2.41 (1.37–4.23)	21.84, 0.00
55+	21	19 (90.5)	1.06 (0.87–1.27)	1.5, 0.21	17 (81.0)	1.17 (0.88–1.57)	1.01, 0.32	12 (57.1)	2.40 (1.25–4.62)	7.04, 0.01
Time since first seropositive test										
<1 year	250	228 (91.2)	ref	ref	199 (79.6)	ref	ref	124 (49.6)	ref	ref
1–5 years	107	97 (90.7)	0.99 (0.93–1.07)	0.02, 0.89	77 (72.0)	0.90 (0.79–1.03)	2.50, 0.11	52 (48.6)	0.98 (0.78–1.24)	0.62, 0.43
>5–10 years	67	63 (94.0)	1.03 (0.96–1.11)	0.33, 0.57	51 (76.1)	0.96 (0.82–1.09)	0.28, 0.60	31 (46.2)	0.93 (0.70–1.24)	0.04, 0.85
>10 years	127	109 (85.8)	0.94 (0.87–1.02)	0.17, 0.68	88 (69.3)	0.87 (0.76–0.99)	5.06, 0.02	68 (53.5)	1.08 (0.88–1.32)	1.10, 0.29
Missing	13	13 (100.0)	1.10 (1.06–1.14)	NA	11 (84.6)	1.06 (0.83–1.35)	NA	8 (61.5)	1.24 (0.79–1.94)	NA
Louisiana	998	918 (92.0)	NA	NA	571 (57.2)	NA	NA	362 (36.3)	NA	NA
Gender										
Male	661	599 (90.6)	ref	ref	365 (55.2)	ref	ref	242 (36.6)	ref	ref
Female	306	289 (94.4)	1.04 (1.00–1.08)	4.08, 0.04	190 (62.1)	1.12 (1.00–1.25)	1.94, 0.17	111 (36.3)	0.99 (0.83–1.19)	0.28, 0.60
Transgender	31	30 (97.0)	1.07 (1.00–1.14)	1.36, 0.24	16 (51.6)	0.93 (0.66–1.32)	0.69, 0.41	9 (29.0)	0.79 (0.45–1.39)	2.67, 0.10
Race/ethnicity										
African American/Black	814	748 (92.0)	ref	ref	467 (57.4)	ref	ref	275 (33.8)	ref	ref
Hispanic/Latino	21	20 (95.2)	1.04 (0.94–1.14)	0.31, 0.58	7 (33.3)	0.58 (0.32–1.07)	6.21, 0.01	8 (38.1)	1.13 (0.65–1.96)	0.05, 0.82
White	122	116 (95.1)	1.03 (0.99–1.08)	1.52, 0.22	79 (64.8)	1.13 (0.98–1.30)	1.39, 0.24	67 (55.0)	1.63 (1.35–1.96)	23.36, 0.00
Other	11	11 (100.0)	1.09 (1.07–1.11)	0.97, 0.33	10 (91.0)	1.58 (1.30–1.93)	3.77, 0.05	6 (54.5)	1.61 (0.93–2.79)	0.65, 0.42
Missing	30	23 (76.7)	0.83 (0.68–1.02)	8.49, 0.00	8 (26.7)	0.47 (0.26–0.84)	7.21, 0.01	6 (20.0)	0.59 (0.29–1.22)	0.69, 0.41

Table 3 continued

	Total	Engaged	PR Engaged	X ² , P value	Retained	PR Retained	X ² , P value	SVL ^a	PR SVL ^a	X ² , P value
Louisiana										
Age										
≤24	185	161 (87.0)	ref	ref	102 (55.1)	ref	ref	52 (28.1)	ref	ref
25–34	314	289 (92.0)	1.06 (0.99–1.13)	3.30, 0.07	167 (53.1)	0.96 (0.82–1.14)	1.33, 0.25	107 (34.1)	1.21 (0.92–1.60)	1.43, 0.23
35–44	232	215 (92.7)	1.06 (1.00–1.14)	3.70, 0.05	138 (59.5)	1.08 (0.91–1.27)	0.28, 0.87	81 (34.9)	1.24 (0.93–1.66)	1.60, 0.21
45–54	203	194 (95.6)	1.10 (1.03–1.17)	9.07, 0.00	122 (60.1)	1.09 (0.92–1.29)	0.01, 0.93	91 (44.8)	1.60 (1.21–2.10)	10.10, 0.00
55+	64	59 (92.2)	1.06 (0.97–1.16)	1.23, 0.27	42 (65.6)	1.19 (0.96–1.48)	1.17, 0.28	31 (48.4)	1.72 (1.22–2.43)	8.03, 0.01
Time since first seropositive test										
<1 year	413	376 (91.0)	ref	ref	249 (60.3)	ref	ref	155 (37.5)	ref	ref
1–5 years	207	193 (93.2)	1.02 (0.98–1.07)	0.88, 0.35	110 (53.1)	0.88 (0.76–1.02)	4.67, 0.03	71 (34.3)	0.91 (0.73–1.15)	0.00, 0.97
>5–10 years	150	142 (94.7)	1.04 (0.99–1.09)	1.97, 0.16	86 (57.3)	0.95 (0.81–1.11)	1.45, 0.23	59 (39.3)	1.05 (0.83–1.33)	1.23, 0.27
>10 years	223	207 (92.8)	1.02 (0.97–1.07)	0.60, 0.44	126 (56.5)	0.94 (0.82–1.08)	1.67, 0.12	77 (34.5)	0.92 (0.74–1.15)	0.02, 0.90
Missing	5	0 (0)	NA	NA	0(0)	NA	NA	0 (0)	NA	NA
New York City	1,053	875 (83.1)	NA	NA	806 (76.5)	NA	NA	570 (54.1)	NA	NA
Gender										
Male	703	587 (83.5)	ref	ref	540 (76.8)	ref	ref	402 (57.2)	ref	ref
Female	331	269 (81.3)	0.97 (0.92–1.03)	0.79, 0.38	248 (74.9)	0.98 (0.91–1.05)	0.44, 0.51	159 (48.0)	0.84 (0.74–0.96)	7.59, 0.01
Transgender	19	19 (100.0)	1.20 (1.16–1.24)	3.74,0.05	18 (94.7)	1.23 (1.10–1.38)	3.39, 0.07	9 (47.4)	0.83 (0.51–1.34)	0.73, 0.39
Race/ethnicity										
African American/Black	284	247 (87.0)	ref	ref	233 (82.0)	ref	Ref	147 (51.8)	ref	ref
Hispanic/Latino	128	114 (89.1)	1.02 (0.95–1.10)	0.36, 0.55	106 (82.8)	1.01 (0.92–1.11)	0.04, 0.85	86 (67.2)	1.30 (1.10–1.53)	8.55, 0.00
White	45	38 (84.4)	0.97 (0.85–1.11)	0.21, 0.64	37 (82.2)	1.00 (0.87–1.16)	0.00, 1.0	28 (62.2)	1.20 (0.93–1.55)	1.71, 0.19
Other	318	268 (84.3)	0.97 (0.91–1.03)	0.89, 0.35	240 (75.5)	0.92 (0.85–1.00)	3.85, 0.05	175 (55.0)	1.06 (0.92–1.24)	0.65, 0.42
Missing	278	208 (74.8)	0.86 (0.79–0.93)	13.63, 0.00	190 (68.3)	0.83 (0.76–0.92)	0.83, 0.00	134 (48.2)	0.93 (0.79–1.10)	0.71, 0.40
New York City										
Age										
≤24	86	65 (75.6)	ref	ref	57 (66.3)	ref	ref	44 (51.2)	ref	ref
25–34	191	159 (83.2)	1.10 (0.96–1.26)	2.25, 0.13	147 (77.0)	1.16 (0.98–1.38)	3.49, 0.06	98 (51.3)	1.00 (0.78–1.29)	0.00, 0.98
35–44	281	225 (80.1)	1.06 (0.93–1.21)	0.80, 0.37	214 (76.2)	1.15 (0.97–1.35)	3.33, 0.07	149 (53.0)	1.03 (0.82–1.31)	0.09, 0.76
45–54	356	310 (87.1)	1.15 (1.02–1.31)	7.12, 0.01	276 (77.5)	1.17 (1.00–1.37)	4.72, 0.03	195 (54.8)	1.07 (0.85–1.34)	0.36, 0.55
55+	139	116 (83.5)	1.10 (0.96–1.27)	2.09, 0.15	112 (80.6)	1.22 (1.02–1.44)	5.81, 0.02	84 (60.4)	1.18 (0.92–1.51)	1.86, 0.17
Time since first seropositive test										
<1 year	17	16 (94.1)	ref	ref	15 (88.2)	ref	Ref	13 (76.5)	ref	Ref
1–5 years	74	65 (87.8)	0.93 (0.81–1.08)	0.56, 0.46	54 (73.0)	0.83 (0.66–1.03)	1.76, 0.19	48 (65.0)	0.85 (0.62–1.16)	0.84, 0.36
>5–10 years	89	74 (83.1)	0.88 (0.76–1.03)	1.34, 0.25	69 (77.5)	0.88 (0.71–1.08)	0.99, 0.32	57 (64.0)	0.84 (0.62–1.14)	0.98, 0.32

Table 3 continued

	Total	Engaged	PR Engaged	X ² , P value	Retained	PR Retained	X ² , P value	SVL ^a	PR SVL ^a	X ² , P value
>10 years	230	200 (87.0)	0.92 (0.81–1.05)	0.74, 0.39	181 (78.7)	0.89 (0.74–1.07)	0.88, 0.35	140 (60.9)	0.80 (0.60–1.06)	1.63, 0.20
Missing	643	520 (80.9)	0.86 (0.76–0.97)	1.90, 0.17	487 (75.7)	0.85 (0.72–1.03)	1.42, 0.23	312 (48.5)	0.63 (0.48–0.84)	5.18, 0.02

^a Suppressed viral load

nationally [2] and in prior research [34] emerged at some sites but not others. For example, in Louisiana women were more likely to be engaged in care than men and were equally likely to be virally suppressed, while in NYC women were equally likely to be engaged in care and less likely to be virally suppressed compared to men. Across all grantee locations there were no differences by race in engagement, but there were differences in viral suppression by race. For example, in Louisiana White participants were more likely to be virally suppressed than African American/Black participants. Differences that arose between grantee locations were most likely due to a variety of factors including the diversity of locations, target populations, program strategies employed, and the duration of the intervention.

Though the continuums of care developed for PC programs used standardized measures and are similar in aim and general content to other continuums of care [3, 35], direct comparisons of percentages are not possible due to differences in methodology. Currently, there are no standard methods for the development of continuums of care, and there are multiple standards for measuring the steps along the continuum of care. Clear methodological standards in areas such as definition of denominators, how to handle multiple viral loads within the evaluation period [36], and missing data would facilitate comparisons.

This multi-site study faced several limitations. The study design was a longitudinal panel study without a control or comparison group. Given this design, we were not able to estimate a counterfactual to test causal hypotheses. Data sources for cascade construction varied across the three sites. However, all CD4, viral load, and clinic visit data were either directly abstracted from medical records or taken from surveillance databases. In addition, at one site, CD4 and viral load measures were used as a proxy for clinic visits while other sites had access to clinic visit data. Studies suggest that more generalized laboratory monitoring measures are suitable for looking at trends in response to interventions [13] and have a higher predictive value for virologic suppression compared to clinic visit measures [37]. This work was conducted under an implementation science framework in real-world settings where sustainability was a primary concern. Therefore, using existing data sources that could be easily accessed by implementing partners was a high priority. However, the differences in methods highlighted above are a limitation to the study and, as a result, a direct comparison of the results across sites is not appropriate. Another limitation of this study was that we were not able to gather high-quality data on HAART use, and therefore this bar was omitted from our continuums of care. Each program used availability sampling, therefore the external validity of our findings is limited, and we are not able to generalize

our study findings beyond program participants. However, in the absence of probability sampling, replication is one method for building generalizability. We found that participants enrolled in three PC programs using similar strategies all had linkage/re-engagement percentages above 80 % despite variations in context, location, and target audience.

Conclusions

The findings from this study suggest that individuals enrolled in PC made positive strides across all stages of the HIV continuum of care. Future programmatic development should focus on devising strategies to reach the specific needs and barriers for the groups with the greatest disparities in viral suppression (such as, younger individuals and minority MSM) and future research should focus on identifying the mechanisms through which these disparities operate. These findings also help to support a growing body of research that points to the important role that peer health navigators can play in engagement in care. However, additional rigorous evaluation and research (such as a randomized control trial) is needed to understand the effectiveness of this promising strategy. This study also suggests that the goals of the NHAS strategy can be achieved, even with underserved populations, when services are offered to support engagement in care such as case finding, outreach, peer/patient navigation, and case management. However, capitalizing on these strategies on a large enough scale to make a population-level impact would most likely require a commitment by public and private healthcare payer systems to reimburse organizations for these services.

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Appendix

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