Clinical Infectious Diseases Advance Access published October 9, 2014

Improvements in HIV care engagement and viral load suppression following enrollment in a comprehensive HIV care coordination program

Mary K. Irvine[1], Stephanie A. Chamberlin[1], Rebekkah S. Robbins[1], Julie E. Myers[1,2], Sarah L. Braunstein[1], Beau J. Mitts[1], Graham A. Harriman[1], and Denis Nash[3,4]

[1]Bureau of HIV/AIDS Prevention and Control, New York City Department of Health and Mental Hygiene, New York, NY, USA

[2]Division of Infectious Diseases, Department of Medicine, Columbia University Medical Center, New York, NY, USA

[3]School of Public Health, The City University of New York New York, NY, USA

[4]Hunter College, The City University of New York, New York, NY, USA

Correspondence and reprint requests to: Mary Irvine, DrPH, MPH, New York City Department of Health and Mental Hygiene, 42-09 28th Street, Queens, NY 11101-4132. Telephone: 347.396.7712; Fax: 347.396.7559; E-mail: mirvine@health.nyc.gov

Alternate corresponding author: Stephanie Chamberlin, MPH, MIA, New York City Department of Health and Mental Hygiene, 42-09 28th Street, Queens, NY 11101-4132. Telephone: 347.396.7645; Fax: 347.396.7559; E-mail: schamberlin@health.nyc.gov

Summary: Gaps in the HIV care continuum jeopardize the success of the National HIV/AIDS Strategy. An intent-to-treat, pre-post analysis of one-year outcomes among NYC Ryan White Part A Care Coordination clients demonstrated substantial improvements in HIV care engagement and viral suppression.

ABSTRACT

Background: Substantial evidence gaps remain regarding HIV intervention strategies that improve engagement in care (EiC) and viral load suppression (VLS). We assessed EiC and VLS before and after enrollment in a comprehensive intervention for persons at risk of poor HIV care outcomes.

Methods: NYC's Ryan White Part A HIV Care Coordination Program (CCP), launched at 28 agencies in 2009, applies multiple strategies to promote optimal utilization of medical and social services. Using laboratory test records from an HIV Surveillance Registry, we examined pre-post outcomes among 3,641 CCP clients enrolled before April 2011. For the year before and after enrollment, we assessed EiC (defined as ≥2 tests, ≥90 days apart, with ≥1 in each half-year) and VLS (defined as VL≤200 copies/mL on latest VL test in the second half of the year). We estimated relative risks (RRs), comparing pre- and post-enrollment proportions achieving EiC and VLS.

Results: Among newly diagnosed clients, 90.5% (95% CI: 87.9-93.2%) and 66.2% (95% CI: 61.9-70.6%) achieved EiC and VLS, respectively. Among previously diagnosed clients, EiC increased from 73.7% to 91.3% (RR=1.24, 95% CI: 1.21-1.27) and VLS increased from 32.3% to 50.9% (RR=1.58, 95% CI: 1.50-1.66). Clients without evidence of HIV care during the 6 months pre-enrollment contributed most to overall improvements. Pre-post improvements were robust, retaining statistical significance within most sociodemographic and clinical subgroups, and in 89% (EiC) and 75% (VLS) of CCP agencies.

Conclusions: Clients in comprehensive HIV care coordination for persons with evident barriers to care showed substantial and consistent improvement in short-term outcomes.

INTRODUCTION

Advances in care and treatment have improved opportunities for health, quality of life and longevity among persons with HIV, as well as opportunities for preventing infections at the population level [1-4]. The challenge for realizing the individual and public health benefits of HIV treatment resides in ensuring a continuum of HIV care, from timely diagnosis to prompt linkage to care, and from linkage to retention in care over time [5, 6], with consistent access and adherence to antiretroviral medications [7-11]. In recognition of this challenge, the 2010 U.S. National HIV/AIDS Strategy (NHAS) issued a call to increase HIV care access and enhance outcomes along the care continuum, with specific targets to be met by 2015 [12].

National estimates have suggested suboptimal population-level care continuum outcomes, with 72%-80% of those diagnosed with HIV promptly linked to care, 45-59% retained in care, and 24%-43% virally suppressed [13-17]. Factors associated with suboptimal HIV health care utilization and clinical outcomes include black or Latino race/ethnicity [15, 17, 18], younger age [17-19], lower income [19], non-AIDS status at baseline [17-19], mental health or substance use disorders [15, 17, 20-23], stigma or low social support [24], non-U.S. country of birth [15, 18] and unstable housing [25, 26]. However, there remains little evidence on how best to address these disparities, or which interventions are broadly capable of improving both care utilization and specific biomedical outcomes, such as viral load (VL) suppression [27], in real-world service settings [28-31]. We report here on a large-scale, multi-site evaluation of short-term (one-year) care engagement and VL suppression outcomes, as well as subgroup variations in those outcomes, among clients enrolling in a comprehensive HIV care coordination intervention delivered in New York City (NYC).

METHODS

Intervention Description

In December 2009, using Ryan White Part A funds, the NYC Department of Health and Mental Hygiene (DOHMH) launched an HIV Care Coordination Program (CCP) to support clients with high risk for, or a recent history of, suboptimal HIV care outcomes. CCP eligibility criteria permit enrollment of HIV-infected adults or emancipated minors who are eligible for local Ryan White Part A services (based on residence within the New York grant area and household income <435% of federal poverty level) and are: (1) newly diagnosed with HIV; (2) never in care or lost to care for at least nine months; (3) irregularly in care or often missing appointments; (4) starting a new antiretroviral treatment (ART) regimen; (5) experiencing ART adherence barriers; or (6) manifesting treatment failure or ART resistance. The NYC CCP model combines several evidence-based or best-practice programmatic elements [27]: outreach for initial case-finding and after any missed appointment; case management; multidisciplinary care team communication and decision-making via case conferences; patient navigation including accompaniment to primary care visits; ART adherence support, including directly observed therapy (DOT) for individuals with greatest need; and structured health promotion utilizing a curriculum developed by the Prevention and Access to Care and Treatment (PACT) program [32, 33]. Many of these intervention components are offered in the client's home and other field-based settings. The 28 CCP-funded agencies (17 hospitals and 11 community-based organizations that have co-location and/or formal partnerships with clinical facilities) operate approximately 70 service sites across the five boroughs of NYC, with higher concentration in areas with the highest HIV prevalence. Further program description and materials can be found on the DOHMH website, at: http://www.nyc.gov/html/doh/html/living/hiv-care-coord.shtml.

Data Sources

The population-based NYC DOHMH HIV/AIDS Surveillance Registry (the Registry) contains demographic and clinical information on all diagnoses of HIV (since 2000) and AIDS (since 1981) reported in NYC, with the addition of comprehensive HIV-related laboratory reporting (including all CD4 and VL test results) starting in 2005. Vital status information is updated through regular matches with the NYC Death Registry, National Death Index and Social Security Death File. Data on CCP clients and service utilization were drawn from the Electronic System for HIV/AIDS Reporting and Evaluation (eSHARE), a secure, web-based, named reporting system developed and maintained by the DOHMH. NYC Ryan White Part A service providers are contractually required to submit programmatic data through eSHARE.

Study Population (Figure 1)

We conducted a pre-post retrospective cohort evaluation of CCP intervention effectiveness using individuals as their own controls. The intent-to-treat analysis examined all CCP clients who met inclusion criteria, regardless of service activity or duration of CCP exposure. Included clients were enrolled in the CCP by March 31, 2011 and matched to the Registry, based on a previously described deterministic algorithm [34]. Additionally, to ensure adequate follow-up time, we excluded clients who died within 12 months of enrollment. All clients in the analysis were categorized as either *newly diagnosed* (diagnosed with HIV in the 12 months prior to enrollment) or *previously diagnosed* (diagnosed more than 12 months prior to enrollment). To explore outcome differences among the *previously diagnosed* by care status immediately prior to enrollment in the CCP, those clients were further classified as *current to care* at baseline (with a

CD4 or VL reported to the Registry in the 6 months prior to enrollment) or *out of care* at baseline (with no CD4 or VL in the 6 months prior to enrollment).

Outcome Measures

Complete outcome histories pre- and post-CCP enrollment were derived by merging CCP client data from eSHARE with the HIV Registry. Using Registry-based CD4 and VL test records as proxies for medical care visits, two primary outcome variables, engagement in care (EiC) and viral load suppression (VLS), were constructed for the 12-month review periods pre- and post-CCP enrollment. EiC was defined as having at least two laboratory tests (CD4 or VL) dated at least 90 days apart, with at least one of those tests in each half of a given 12-month review period. VLS was defined as having a VL value ≤200 copies/mL at the most recent VL test in the second half of the 12-month review period. Individuals with no VL test in the Registry in the second half of the 12-month review period were considered to have unsuppressed VL.

Descriptive Data

All enrollment details and some client characteristics were drawn from Ryan White provider reporting in eSHARE. Other demographic characteristics and baseline clinical/care history factors were drawn from the Registry. eSHARE-based frequencies were generated (for CCP clients only) to ascertain 12-month enrollment/closure status as well as provider-reported reasons for CCP enrollment and closure. Using Registry-based characteristics, the CCP eligible study sample was directly compared to the population of other (non-CCP-enrolled) HIV-infected New Yorkers who were in medical care at some point during the CCP enrollment period of interest (December 1, 2009-March 31, 2011).

Statistical Methods

For each outcome, proportions were computed for the 12-month period before CCP enrollment (previously diagnosed only) and the 12-month period after CCP enrollment (all eligible CCP clients). Relative risks (RRs) were used to compare post-enrollment with pre-enrollment proportions for EiC and VLS among previously diagnosed clients, both overall and stratified within client subgroups according to: baseline care status, sociodemographic characteristics (sex, race/ethnicity, age, primary language spoken, insurance status, housing status, income level, and country of birth), and clinical/treatment factors (ART status at enrollment, year of HIV diagnosis, viral suppression at enrollment, and CD4 cell count at enrollment). To account for correlation in the repeated-measure, pre-post design, we used Generalized Estimating Equations (GEE) to estimate pre-post RRs and 95% confidence intervals (CIs). All analyses were conducted using SAS® software version 9.2.

Ethics Statement

This study was approved by the NYC DOHMH and the City University of New York School of Public Health (CUNY SPH) Institutional Review Boards.

RESULTS

Sample Characteristics

Table 1 describes client characteristics at time of CCP enrollment. Most of the 3,641 CCP clients in the analysis were black or Hispanic (91.5%), male (62.8%), U.S.-born (66.0%), and diagnosed prior to 2005 (66.6%). At CCP enrollment, median client age was 45 years, and 45.5% of clients had CD4<350 cells/μL. In terms of baseline care status, 73.7% were current to care, with 79.3% on ART; 13.6% were out of care; and 12.8% were newly diagnosed.

Compared with others receiving HIV care in NYC during the same period (n=70,823), CCP clients included in this analysis were more often female (37.2% vs. 29.5%), black or Hispanic (91.5% vs. 77.7%), and diagnosed since 2005 (33.5% vs. 24.2%). They were also slightly younger (median age of 45 vs. 47), with lower CD4 counts (median of 302 vs. 464), and with a lower proportion showing viral suppression at baseline (29.4% vs. 46.7%). Based on the (non-mutually-exclusive) reasons reported by their providers for enrollment in the CCP, half (50.0%) of the clients in this sample had irregular care patterns; 41.3% had adherence issues; 13.0% were newly diagnosed; 10.7% were lost to care/never in care; 9.2% were starting a new ART regimen; and 9.0% had treatment failure or ART resistance.

Engagement in Care (Figure 2) and Viral Load Suppression (Figure 3)

Among previously diagnosed clients, the proportion with EiC (Table 2 and Figure 2) increased from 73.7% to 91.3% (RR_{EiC}=1.24, 95% CI: 1.21-1.27) and the proportion with VLS (Table 3 and Figure 3) increased from 32.3% to 50.9% (RR_{VLS}=1.58, 95% CI: 1.50-1.66) from the pre- to the post-CCP enrollment period. While gains were observed for all previously diagnosed CCP clients, those out of care at CCP enrollment contributed most to overall improvements. However, even among those current to care, significant improvements were observed for both outcomes (RR_{EiC}=1.06, 95% CI: 1.05-1.08; and RR_{VLS}=1.34, 95% CI: 1.27 - 1.40). Among newly diagnosed clients (Table 4), the proportions with EiC and VLS at 12 months after CCP enrollment were 90.5% and 66.2%.

Stratified Analysis to Assess CCP Effects within Subgroups (Tables 2 and 3)

In analyses stratified by baseline demographic and clinical/treatment variables, the significant overall improvements observed for both study outcomes generally held across the examined subgroups, except for those clients with baseline CD4 ≥500 (VLS only), baseline viral load ≤200, or "other/unknown" race (EiC only). Within stratifying variables, the greatest relative improvements were observed among those under age 45, diagnosed after 2004, without an antiretroviral prescription at enrollment, born male (EiC only), making <$9,000/year (EiC only), uninsured (EiC only), homeless (EiC only), virally unsuppressed at enrollment (EiC only), and having CD4 <200 at enrollment (VLS only). Stratifying by agency of first CCP enrollment, statistically significant improvements were observed for EiC at 25 (89%) and for VLS at 21 (75%) of the 28 CCP agencies.

CCP Enrollment Status and Duration at 12-month Follow-up

As of 12 months post-enrollment, 61.3% of clients were still enrolled. Among the 38.7% with a program closure during the 12-month follow-up period, the median CCP enrollment was 197 days or 0.54 years (IQR 117-278 days), and 6.9% had graduated due to achieving self-sufficiency (defined as meeting specific criteria including ≥95% treatment adherence, reduced hospitalizations, and maintenance of scheduled appointments). Other reasons for closure included: discharge based on program requirements (e.g., due to client non-participation, staff safety concerns or income or residence-based ineligibility) (47.2%); loss to follow-up (19.0%); relocation out of neighborhood (7.2%), or transfer of care to another provider (19.5%). A check of both outcomes by enrollment duration confirmed significant relative risks even for those enrolled <6 months. Though the 95% confidence intervals overlapped, relative risks trended upward with longer enrollment (comparing 0-6 and 6-12 months with continuous enrollment throughout the follow-up period).

DISCUSSION

Results Summary and Context

These findings suggest substantial and robust positive impact of an HIV care coordination model on short-term engagement in care and viral load suppression, especially among those out of care prior to CCP enrollment. The gains observed among CCP clients reinforce and extend the findings from a recent evaluation of a similar, Washington, DC-based Ryan White-funded comprehensive medical case management (MCM) program. In a comparison of client outcomes at MCM-funded and non-MCM-funded facilities, adjusting for demographic and clinic-level differences, that study found greater likelihood of retention in HIV care among patients at the MCM-funded facilities, but did not detect a significant difference in likelihood of viral load suppression [35]. Among newly diagnosed individuals, the CCP 12-month outcomes (>90% EiC and >66% VLS) compare favorably against 12-month outcomes from the multisite Antiretroviral Treatment and Access Study (ARTAS), in which 64% of newly diagnosed individuals exposed to the strengths-based case management intervention achieved regular care [36], and 12-month outcomes from the U.S. SPNS Outreach Initiative, in which 45% of newly diagnosed individuals achieved undetectable viral load [37].

Interestingly, a recent randomized trial of enhanced personal contact between patients and staff showed significant improvements in HIV primary care retention, but little benefit among patients with unmet needs [21]. Our estimates of improvements in EiC and VLS remained robust within nearly all subgroups examined, suggesting advantages in the comprehensive approach of the CCP, with tailoring of clinical and supportive services to the needs of the individual.

Nonetheless, the outcome variations by baseline care status in our study suggest the potential value of even more specifically prioritizing for CCP enrollment those never in care or out of care for at least six months, as well as those newly diagnosed. Differences found in the degree of improvement post-CCP enrollment by demographic characteristics suggest a higher potential impact among low-income, uninsured, unstably housed, and younger populations, while differences by clinical/treatment factors suggest a higher potential impact for those with lower CD4, unsuppressed viral load, and/or no current prescription for ART at enrollment. These differences (even among groups sharing significant improvements) will inform future phases of effectiveness and cost-effectiveness research and guide future applications of the program model.

As recent reviews have described, complex intervention designs, employing multiple evidence-informed strategies and means of service delivery (e.g., home-based, clinic-based, and via telecommunications) appear to represent the direction of retention/adherence support services evolution, and may be essential for addressing the multiple impediments to accessing and maintaining HIV primary care and antiretroviral treatment [30, 38]. Further research is needed, however, to investigate the relative effectiveness and cost-effectiveness of different components of such complex interventions, to assess the cost-effectiveness of retaining all elements (vs. a pared-down package), and to continue to examine outcomes for longer periods post-enrollment, given that interventions to improve HIV care outcomes often show a tapering of the effect with distance in time from the intervention (e.g., [38]).

Limitations and Strengths

As an observational study based in a real-world setting, this study has certain limitations. For example, given that many elements of the CCP intervention are delivered simultaneously or based on client indication, it is challenging to assess the relative contributions of specific components of the CCP intervention. We also could not account for exposure to other contemporaneous interventions or environmental changes external to the CCP, which may have partially driven some of the improvements observed. In addition, due to CCP selection criteria, there is the potential that previously diagnosed individuals may have come into the program at a time when they were more vulnerable to (and expressive of) suboptimal outcomes than at other times in their post-diagnosis history. However, we were able to measure client health at baseline via clinical markers, and we observed significant improvements in EiC and VLS in all CD4 categories except CD4>500 cells/μL (accounting for 19.0% of the sample).

The selection of clients based on known care and treatment barriers may in part explain the programmatic closure of over a third of the sample during the follow-up period, generally for reasons other than graduation. However, the significant improvements observed in this analysis even for those enrolled less than six months, as well as the small group of clients graduating during the follow-up period, suggest that some individuals obtain what they need from the program in under a year. The upward trend in relative risks with increased enrollment duration suggests that exposure time does matter, and warrants further dose-response analyses.

Regarding data sources, the use of laboratory data from a surveillance registry may result in under- or over-estimation of engagement in HIV primary care. Some primary care visits may not be accompanied by laboratory tests, and some laboratory tests may be ordered outside of the context of primary care, including during emergency department visits or inpatient stays [39]. However, this would only introduce bias in our study if it occurred differentially (pre- vs. post-), in which case the more likely scenario would be overestimating care engagement prior to CCP enrollment (due to misclassification of acute care encounters as HIV primary care), potentially leading to underestimates of the CCP effect on care engagement.

Our study also has several strengths. The use of subjects as their own controls helps to address many potential confounding variables at the client level, such as factors predicting enrollment in the program. Further, in contrast to many observational HIV treatment adherence intervention studies [40], we employed an intent-to-treat approach including all persons enrolled in the CCP (regardless of how long they remained in the program), to avoid selection bias stemming from factors that would affect both the outcomes of interest and the ability to remain and participate in the CCP. Finally, the merging of programmatic data with surveillance data permitted standardized, objective and highly complete outcome measurement across all clients and program sites before and after CCP enrollment, regardless of enrollment duration.

Conclusion

Among vulnerable populations with HIV, comprehensive care coordination may substantially improve short-term outcomes for previously diagnosed clients, especially those returning to care after a >6-month gap. Newly diagnosed clients in this study also fared well in the year after enrollment. It is particularly encouraging that observed improvements for the previously diagnosed held across subgroups defined by baseline care status, as well as most demographic or clinical/treatment experience categories. Despite the limitations of an observational pre-post design, our initial analyses of short-term CCP client outcomes suggest the promise of this comprehensive combination intervention model for optimizing the individual and community impact of HIV care among persons at risk for suboptimal outcomes.

FUNDING

This work was supported by the National Institutes of Health [grant number R01 MH101028-01A1] and the Health Resources and Services Administration [grant number H89 HA 00015].

ACKNOWLEDGMENTS

The authors are indebted to Fabienne Laraque, Kent Sepkowitz, Sarah Gorrell-Kulkarni, Levi Waldron, Bisrat Abraham, PACT staff and consultants, and Care Coordination Program providers and clients, for their input at different stages of this work and their invaluable contributions to real-world program implementation and evaluation.

DISCLAIMER

The findings and conclusions in this report are those of the authors and do not necessarily represent the official position of the Health Resources and Services Administration or the National Institutes of Health.

POTENTIAL CONFLICTS OF INTEREST

All authors: No reported conflicts, though some authors were supported in their roles through federal HIV services and/or HIV research grants to their employing institutions.

REFERENCES

1. Cohen MS, Chen YQ, McCauley M, et al. Prevention of HIV-1 infection with early antiretroviral therapy. N Engl J Med **2011**; 365(6): 493-505.
2. Das M, Chu PL, Santos GM, et al. Decreases in community viral load are accompanied by reductions in new HIV infections in San Francisco. PLoS One **2010**; 5(6): e11068.
3. Lingappa JR, Hughes JP, Wang RS, et al. Estimating the impact of plasma HIV-1 RNA reductions on heterosexual HIV-1 transmission risk. PLoS One **2010**; 5(9): e12598.
4. Montaner JS, Lima VD, Barrios R, et al. Association of highly active antiretroviral therapy coverage, population viral load, and yearly new HIV diagnoses in British Columbia, Canada: a population-based study. Lancet **2010**; 376(9740): 532-9.
5. Giordano TP, Gifford AL, White AC, Jr., et al. Retention in care: a challenge to survival with HIV infection. Clin Infect Dis **2007**; 44(11): 1493-9.
6. Mugavero MJ, Lin HY, Willig JH, et al. Missed visits and mortality among patients establishing initial outpatient HIV treatment. Clin Infect Dis **2009**; 48(2): 248-56.
7. Bangsberg DR, Hecht FM, Charlebois ED, et al. Adherence to protease inhibitors, HIV-1 viral load, and development of drug resistance in an indigent population. AIDS **2000**; 14(4): 357-66.
8. Mannheimer S, Friedland G, Matts J, Child C, Chesney M. The consistency of adherence to antiretroviral therapy predicts biologic outcomes for human immunodeficiency virus-infected persons in clinical trials. Clin Infect Dis **2002**; 34(8): 1115-21.
9. Nachega JB, Hislop M, Dowdy DW, Chaisson RE, Regensberg L, Maartens G. Adherence to nonnucleoside reverse transcriptase inhibitor-based HIV therapy and virologic outcomes. Ann Intern Med **2007**; 146(8): 564-73.
10. Paterson DL, Swindells S, Mohr J, et al. Adherence to protease inhibitor therapy and outcomes in patients with HIV infection. Ann Intern Med **2000**; 133(1): 21-30.
11. Zaragoza-Macias E, Cosco D, Nguyen ML, Del Rio C, Lennox J. Predictors of success with highly active antiretroviral therapy in an antiretroviral-naive urban population. AIDS research and human retroviruses **2010**; 26(2): 133-8.
12. White House Office of National AIDS Policy. National HIV/AIDS Strategy. Available at: http://www.whitehouse.gov/administration/eop/onap/nhas/. Accessed 25 March 2013.
13. Gardner EM, McLees MP, Steiner JF, Del Rio C, Burman WJ. The spectrum of engagement in HIV care and its relevance to test-and-treat strategies for prevention of HIV infection. Clin Infect Dis **2011**; 52(6): 793-800.
14. Gray KM, Cohen SM, Hu X, Li J, Mermin J, Hall HI. Jurisdiction level differences in HIV diagnosis, retention in care, and viral suppression in the United States. J Acquir Immune Defic Syndr **2014**; 65(2): 129-32.
15. Hall HI, Gray KM, Tang T, Li J, Shouse L, Mermin J. Retention in care of adults and adolescents living with HIV in 13 U.S. areas. J Acquir Immune Defic Syndr **2012**; 60(1): 77-82.
16. Marks G, Gardner LI, Craw J, Crepaz N. Entry and retention in medical care among HIV-diagnosed persons: a meta-analysis. AIDS **2010**; 24(17): 2665-78.
17. Torian LV, Wiewel EW. Continuity of HIV-related medical care, New York City, 2005-2009: Do patients who initiate care stay in care? AIDS Patient Care STDS **2011**; 25(2): 79-88.
18. Hsu LC, Chen M, Kali J, Pipkin S, Scheer S, Schwarcz S. Assessing receipt of medical care and disparity among persons with HIV/AIDS in San Francisco, 2006-2007. AIDS Care **2011**; 23(3): 383-92.

19. Israelski D, Gore-Felton C, Power R, Wood MJ, Koopman C. Sociodemographic characteristics associated with medical appointment adherence among HIV-seropositive patients seeking treatment in a county outpatient facility. Prev Med **2001**; 33(5): 470-5.
20. Altice FL, Kamarulzaman A, Soriano VV, Schechter M, Friedland GH. Treatment of medical, psychiatric, and substance-use comorbidities in people infected with HIV who use drugs. Lancet **2010**; 376(9738): 367-87.
21. Gardner LI, Giordano TP, Marks G, et al. Enhanced personal contact with HIV patients improves retention in primary care: a randomized trial in six U.S. HIV clinics. Clin Infect Dis **2014**.
22. Gonzalez JS, Batchelder AW, Psaros C, Safren SA. Depression and HIV/AIDS treatment nonadherence: a review and meta-analysis. J Acquir Immune Defic Syndr **2011**; 58(2): 181-7.
23. Malta M, Magnanini MM, Strathdee SA, Bastos FI. Adherence to antiretroviral therapy among HIV-infected drug users: a meta-analysis. AIDS Behav **2010**; 14(4): 731-47.
24. Wohl AR, Galvan FH, Myers HF, et al. Do social support, stress, disclosure and stigma influence retention in HIV care for Latino and African American men who have sex with men and women? AIDS Behav **2011**; 15(6): 1098-110.
25. Aidala AA, Lee G, Abramson DM, Messeri P, Siegler A. Housing need, housing assistance, and connection to HIV medical care. AIDS Behav **2007**; 11(6 Suppl): 101-15.
26. Smith MY, Rapkin BD, Winkel G, Springer C, Chhabra R, Feldman IS. Housing status and health care service utilization among low-income persons with HIV/AIDS. J Gen Intern Med **2000**; 15(10): 731-8.
27. Thompson MA, Mugavero MJ, Amico KR, et al. Guidelines for improving entry into and retention in care and antiretroviral adherence for persons with HIV: evidence-based recommendations from an International Association of Physicians in AIDS Care panel. Ann Intern Med **2012**; 156(11): 817-33.
28. Charania MR, Marshall KJ, Lyles CM, et al. Identification of Evidence-Based Interventions for Promoting HIV Medication Adherence: Findings from a Systematic Review of U.S.-Based Studies, 1996-2011. AIDS Behav **2014**; 18(4): 646-60.
29. Liau A, Crepaz N, Lyles CM, et al. Interventions to Promote Linkage to and Utilization of HIV Medical Care Among HIV-diagnosed Persons: A Qualitative Systematic Review, 1996-2011. AIDS Behav **2013**.
30. Higa DH, Marks G, Crepaz N, Liau A, Lyles CM. Interventions to improve retention in HIV primary care: a systematic review of U.S. studies. Curr HIV/AIDS Rep **2012**; 9(4): 313-25.
31. Horstmann E, Brown J, Islam F, Buck J, Agins BD. Retaining HIV-infected patients in care: Where are we? Where do we go from here? Clin Infect Dis **2010**; 50(5): 752-61.
32. Onie R, Farmer P, Behforouz H. Realigning Health with Care. Stanford Social Innovation Review. **2012** Summer 2012:28-35.
33. Behforouz HL, Farmer PE, Mukherjee JS. From directly observed therapy to accompagnateurs: enhancing AIDS treatment outcomes in Haiti and in Boston. Clin Infect Dis **2004**; 38 Suppl 5: S429-36.
34. Miller L, Arakaki L, Ramautar A, et al. Elevated risk for invasive meningococcal disease among persons with HIV. Ann Intern Med **2014**; 160(1): 30-7.
35. Willis S, Castel AD, Ahmed T, Olejemeh C, Frison L, Kharfen M. Linkage, engagement, and viral suppression rates among HIV-infected persons receiving care at medical case management programs in Washington, DC. J Acquir Immune Defic Syndr **2013**; 64 Suppl 1: S33-41.
36. Gardner LI, Metsch LR, Anderson-Mahoney P, et al. Efficacy of a brief case management intervention to link recently diagnosed HIV-infected persons to care. AIDS **2005**; 19(4): 423-31.

37. Naar-King S, Bradford J, Coleman S, Green-Jones M, Cabral H, Tobias C. Retention in care of persons newly diagnosed with HIV: outcomes of the Outreach Initiative. AIDS Patient Care STDS **2007**; 21 Suppl 1: S40-8.
38. Simoni JM, Amico KR, Smith L, Nelson K. Antiretroviral adherence interventions: translating research findings to the real world clinic. Curr HIV/AIDS Rep **2010**; 7(1): 44-51.
39. Dombrowski JC, Kent JB, Buskin SE, Stekler JD, Golden MR. Population-based metrics for the timing of HIV diagnosis, engagement in HIV care, and virologic suppression. AIDS **2012**; 26(1): 77-86.
40. Mathes T, Pieper D, Antoine SL, Eikermann M. Adherence-enhancing interventions for highly active antiretroviral therapy in HIV-infected patients - a systematic review. HIV medicine **2013**; 14(10): 583-95.

TABLES

Table 1.

Demographic and clinical characteristics of New York City (NYC) Care Coordination Program (CCP) clients at baseline.

	NYC CCP Clients[1]	
	N	**%**
TOTAL	**3,641**	**100.0**
Care status at enrollment		
Newly diagnosed[2]	465	12.8
Out of care[3]	494	13.6
Current to care[4]	2,682	73.7
Sex^		
Male	2,286	62.8
Female	1,355	37.2
Race/Ethnicity^		
Black	1,936	53.2
Hispanic	1,393	38.3
White	204	5.6
Other/Unknown	108	3.0
Age (years) at CCP enrollment^		
≤ 24	224	6.2
25 – 44	1,534	42.1
45 – 64	1,767	48.5
65+	116	3.2
Median age (years) at CCP enrollment (IQR)^	45 (35 - 52)	
Primary language spoken at home§		
English	2,717	74.6
Spanish	736	20.2
Other	188	5.2
Insurance status at CCP enrollment§		
Insured	2,643	72.6
Uninsured	998	27.4
Housing status at CCP enrollment§		
Homeless	820	22.5
Not Homeless	2,707	74.3
Unknown	114	3.1
Household income level at CCP enrollment§		
< $9,000	1,403	38.5
$9,000+	1,229	33.8

Table 1.

Demographic and clinical characteristics of New York City (NYC) Care Coordination Program (CCP) clients at baseline.

Missing	1,009	27.7
Taking ART at CCP enrollment[§]		
Yes	2,562	70.4
No	1,079	29.6
Country of birth[^]		
US/US dependency	2,403	66.0
Foreign country	828	22.7
Unknown	410	11.3
Year of HIV diagnosis[^]		
<1995	690	19.0
1995 - 2004	1,732	47.6
2005 - 2011	1,219	33.5
Viral suppression (≤200 copies/mL) at enrollment[^5]		
Yes	1,072	29.4
No[6]	2,569	70.6
Median viral load (copies/mL) at enrollment (IQR)[^5]	1,660.5 (0 - 35,072)	
CD4 (cells/µL) at enrollment[^5]		
< 200	972	26.7
200 – 349	683	18.8
350 – 499	509	14.0
500+	692	19.0
Unknown - no CD4 6 months prior to enrollment	785	21.6
Median CD4 (cells/µL) at enrollment (IQR)[^5]	302 (141 - 494)	

IQR: interquartile range.

Prepared by the Bureau of HIV/AIDS Prevention and Control with data reported to the NYC HIV Registry as of September 30, 2013.

[^] Client characteristic based on information reported to the NYC HIV Registry.

[§] Client characteristic as reported on client’s first intake assessment for CCP in the Electronic System for HIV/AIDS Reporting and Evaluation (eSHARE).

[1] Clients enrolled in the NYC CCP between December 1, 2009 and March 31, 2011, matched to the NYC HIV Registry, and living 12 months after the date of enrollment.

[2] Newly diagnosed: CCP clients who were diagnosed in the 12 months prior to their CCP enrollment window (defined as the 31 days leading up to and including date of enrollment).

[3] Out of care: CCP clients who were diagnosed more than 12 months prior to their CCP enrollment window and had no evidence of primary care (CD4 or VL test) in the 6 months prior to their CCP enrollment window.

[4] Current to care: CCP clients who were diagnosed more than 12 months prior to their CCP enrollment window and had evidence of primary care in the 6 months prior to their CCP enrollment window.

[5] Median viral load (VL), viral suppression, median CD4, and CD4 at enrollment are determined by client’s most recent CD4 or VL test occurring in the 6 months prior to their enrollment window.

[6] Clients who did not have a VL test reported during the 6 months prior to their CCP enrollment window were categorized as unsuppressed.

Table 2.

Previously diagnosed Care Coordination Program (CCP) clients[1]: 12-month pre- and post-enrollment engagement in care outcomes and relative risk estimates, by demographic and clinical characteristics at baseline.

	All previously diagnosed clients - engagement in care[2]			
		12 months prior to CCP enrollment[3]	12 months after CCP enrollment	Post- vs. pre-enrollment
	Total	% (95% CI)	% (95% CI)	RR* (95% CI)
TOTAL	**3,176**	**73.7 (72.2 - 75.2)**	**91.3 (90.3 - 92.3)**	**1.24 (1.21 - 1.27)**
Care status				
Out of care[4]	494	0	82.8 (79.5 - 86.1)	*n/a***
Current to care[5]	2,682	87.3 (86.0 - 88.5)	92.9 (92.0 - 93.9)	1.06 (1.05 - 1.08)
Sex^				
Male	1,957	71.5 (69.5 - 73.5)	91.1 (89.8 - 92.4)	1.27 (1.24 - 1.31)
Female	1,219	77.3 (74.9 - 79.6)	91.6 (90.1 - 93.2)	1.19 (1.15 - 1.23)
Race/Ethnicity^				
Black	1,733	72.8 (70.7 - 74.9)	91.2 (89.9 - 92.6)	1.25 (1.22 - 1.29)
Hispanic	1,193	74.7 (72.2 - 77.2)	92.5 (91.0 - 94.0)	1.24 (1.20 - 1.28)
White	170	72.4 (65.6 - 79.1)	84.7 (79.2. - 90.2)	1.17 (1.06 - 1.30)
Other/Unknown	80	81.3 (72.5 - 90.0)	90.0 (83.3 - 96.7)	1.11 (0.99 - 1.23)
Age (years) at CCP enrollment^				
≤ 24	153	61.4 (53.6 - 69.2)	88.9 (83.9 - 93.9)	1.45 (1.27 - 1.65)
25 - 44	1,297	66.7 (64.1 - 69.3)	88.7 (86.9 - 90.4)	1.33 (1.28 - 1.38)
45 - 64	1,629	80.0 (78.0 - 81.9)	93.6 (92.4 - 94.7)	1.17 (1.14 - 1.20)
65+	97	81.4 (73.6 - 89.3)	92.8 (87.5 - 98.0)	1.14 (1.03 - 1.26)
Primary language spoken at home§				
English	2,421	73.6 (71.8 - 75.3)	91.0 (89.8 - 92.1)	1.24 (1.21 - 1.27)
Spanish	615	74.5 (71.0 - 77.9)	92.7 (90.6 - 94.7)	1.24 (1.19 - 1.31)
Other	140	72.9 (65.4 - 80.3)	91.4 (86.7 - 96.1)	1.25 (1.13 - 1.40)
Insurance status at CCP enrollment§				
Insured	2,387	77.2 (75.5 - 78.9)	91.5 (90.4 - 92.6)	1.19 (1.16 - 1.21)
Uninsured	789	63.2 (59.9 - 66.6)	90.7 (88.7 - 92.8)	1.43 (1.36 - 1.51)
Housing status at CCP enrollment§				
Homeless	726	69.0 (65.6 - 72.4)	91.6 (89.6 - 93.6)	1.34 (1.26 - 1.40)
Not Homeless	2,346	75.4 (73.7 - 77.1)	91.5 (90.3 - 92.6)	1.21 (1.18 - 1.24)
Unknown	104	68.3 (59.2 - 77.4)	85.6 (78.7 - 92.4)	1.25 (1.10 - 1.43)
Household income level at CCP enrollment§				
< $9,000	1,213	70.0 (67.4 - 72.6)	91.3 (89.8 - 92.9)	1.31 (1.26 - 1.36)
$9,000+	1,070	76.1 (73.5 - 76.8)	91.6 (89.9 - 93.3)	1.20 (1.16 - 1.25)

Table 2.

Previously diagnosed Care Coordination Program (CCP) clients[1]: 12-month pre- and post-enrollment engagement in care outcomes and relative risk estimates, by demographic and clinical characteristics at baseline.

	All previously diagnosed clients - engagement in care[2]			
		12 months prior to CCP enrollment[3]	12 months after CCP enrollment	Post- vs. pre-enrollment
	Total	% (95% CI)	% (95% CI)	RR* (95% CI)
Missing	893	75.9 (73.1 - 78.7)	90.3 (89.0 - 92.8)	1.20 (1.15 - 1.25)
Taking ART at CCP enrollment[§]				
Yes	2,389	80.0 (78.4 - 81.6)	92.9 (91.9 - 94.0)	1.16 (1.14 - 1.19)
No	787	54.6 (51.2 - 58.1)	86.4 (84.0 - 88.8)	1.58 (1.48 - 1.69)
Country of birth[^]				
US/US dependency	2,185	74.3 (72.4 - 76.1)	90.8 (89.5 - 92.0)	1.22 (1.19 - 1.25)
Foreign country	596	71.0 (67.3 - 74.6)	92.8 (90.7 - 94.9)	1.31 (1.24 - 1.38)
Unknown	395	74.7 (70.4 - 79.0)	92.2 (89.5 - 94.8)	1.23 (1.16 - 1.31)
Year of HIV diagnosis[^]				
<1995	690	80.4 (77.5 - 83.4)	93.9 (92.1 - 95.7)	1.17 (1.12 - 1.21)
1995 - 2004	1,732	76.0 (74.0 - 78.1)	91.4 (90.1 - 92.7)	1.20 (1.17 - 1.24)
2005 - 2011	754	62.2 (58.7 - 65.7)	88.7 (86.5 - 91.0)	1.43 (1.35 - 1.51)
Evidence of viral suppression (≤200 copies/mL) at enrollment[^6]				
Yes	1,026	92.3 (90.7 - 93.9)	94.2 (92.7 - 95.6)	1.02 (0.99 - 1.04)
No[7]	2,150	64.8 (62.8 - 66.9)	90.0 (88.7 - 91.2)	1.39 (1.34 - 1.43)
CD4 (cells/µL) at enrollment[^6]				
< 200	909	85.5 (83.2 - 87.8)	93.5 (91.9 - 95.1)	1.09 (1.06 - 1.13)
200 - 349	632	87.3 (84.7 - 89.9)	91.0 (88.7 - 93.2)	1.04 (1.00 - 1.08)
350 – 499	465	87.3 (84.3 - 90.3)	94.0 (91.8 - 96.1)	1.08 (1.03 - 1.12)
500+	634	90.7 (88.4 - 93.0)	93.4 (91.4 - 95.3)	1.03 (1.00 - 1.06)
Unknown - no CD4 6 months prior to enrollment	536	5.8 (3.8 - 7.8)	83.2 (80.0 - 86.4)	14.39 (10.22 - 20.25)

CI: confidence interval.

Prepared by the Bureau of HIV/AIDS Prevention and Control with data reported to the NYC HIV Registry as of September 30, 2013.

[*] Relative risk (RR) calculated using Generalized Estimating Equations (GEE).

[**] By definition, clients in this group had no evidence of care in the 6 months prior to CCP enrollment, and thus were not engaged or suppressed at baseline; no post- vs. pre- relative risk can be constructed.

[^] Client characteristic based on information reported to the NYC HIV Registry.

[§] Client characteristic as reported on client's first intake assessment for CCP in the Electronic System for HIV/AIDS Reporting and Evaluation (eSHARE).

[1] Clients enrolled in the NYC CCP between December 1, 2009 and March 31, 2011, matched to the NYC HIV Registry, and living 12 months after the date of enrollment.

[2] Engagement in care is defined as ≥2 CD4 or viral load (VL) tests ≥90 days apart, with ≥1 test in each half of the 12-month period specified.
[3] 12 months prior to the client's CCP enrollment window (defined as the 31 days leading up to and including date of enrollment).
[4] Out of care: CCP clients who were diagnosed more than 12 months prior to their CCP enrollment window and had no evidence of primary care (CD4 or VL test) in the 6 months prior to their CCP enrollment window.
[5] Current to care: CCP clients who were diagnosed more than 12 months prior to their CCP enrollment window and had evidence of primary care in the 6 months prior to their CCP enrollment window.
[6] Median VL, viral suppression, median CD4, and CD4 at enrollment are determined by client's most recent CD4 or VL test occurring in the 6 months prior to their enrollment window.
[7] Clients who did not have a VL test reported during the 6 months prior to their enrollment window were categorized as unsuppressed.

Table 3.

Previously diagnosed Care Coordination Program (CCP) clients[1]: 12-month pre- and post-enrollment viral load suppression outcomes and relative risk estimates, by demographic and clinical characteristics at baseline.

	All previously diagnosed clients - viral load suppression[2]			
	N	12 months prior to CCP enrollment[3] % (95% CI)	12 months after CCP enrollment % (95% CI)	Post- vs. pre-enrollment RR* (95% CI)
TOTAL	**3,176**	**32.3 (30.7 - 33.9)**	**50.9 (49.2 - 52.7)**	**1.58 (1.50 - 1.66)**
Care status				
Out of care[4]	494	0	50.0 (45.6 - 54.4)	*n/a***
Current to care[5]	2,682	38.3 (36.4 - 40.1)	51.1 (49.2 - 53)	1.34 (1.27 - 1.40)
Sex^				
Male	1,957	31.0 (29.0 - 33.1)	51.1 (48.9 - 53.4)	1.65 (1.54 - 1.76)
Female	1,219	34.4 (31.7 - 37.0)	50.5 (47.7 - 53.3)	1.47 (1.36 - 1.59)
Race/Ethnicity^				
Black	1,733	28.9 (26.8 - 31.0)	46.8 (44.4 - 49.1)	1.62 (1.51 - 1.75)
Hispanic	1,193	35.4 (32.7 - 38.1)	53.9 (51.1 - 56.7)	1.52 (1.41 - 1.65)
White	170	33.5 (26.4 - 40.7)	60.6 (53.2 - 68.0)	1.81 (1.48 - 2.21)
Other/Unknown	80	57.5 (46.4 - 68.6)	75.0 (65.3 - 84.7)	1.30 (1.10 - 1.54)
Age (years) at CCP enrollment^				
≤ 24	153	19.6 (13.2 - 26.0)	35.9 (28.3 - 43.6)	1.83 (1.31 - 2.57)
25 - 44	1,297	26.0 (23.6 - 28.4)	48.8 (46.1 - 51.5)	1.88 (1.71 - 2.06)
45 - 64	1,629	37.3 (34.9 - 39.6)	52.7 (50.2 - 55.1)	1.41 (1.33 - 1.51)
65+	97	53.6 (43.5 - 63.7)	73.2 (64.2 - 82.2)	1.37 (1.15 - 1.62)
Primary language spoken at home§				
English	2,421	30.2 (28.3 - 32.0)	47.6 (45.6 - 49.6)	1.58 (1.48 - 1.68)
Spanish	615	37.1 (33.2 - 40.9)	59.5 (55.6 - 63.4)	1.61 (1.45 - 1.78)
Other	140	48.6 (40.2 - 57.0)	70.7 (63.1 - 78.3)	1.46 (1.24 - 1.71)
Insurance status at CCP enrollment§				
Insured	2,387	33.7 (31.8 - 35.6)	51.7 (49.7 - 53.7)	1.54 (1.45 - 1.62)
Uninsured	789	28.1 (25.0 - 31.3)	48.4 (44.9 - 51.9)	1.72 (1.53 - 1.93)
Housing status at CCP enrollment§				
Homeless	726	22.2 (19.1 - 25.2)	38.3 (34.7 - 41.8)	1.73 (1.50 - 1.98)
Not Homeless	2,346	35.8 (33.8 - 37.7)	55.2 (53.2 - 57.2)	1.54 (1.46 - 1.63)
Unknown	104	25.0 (16.5 - 33.5)	42.3 (32.7 - 52.0)	1.69 (1.18 - 2.42)
Household income level at CCP enrollment§				

Table 3.

Previously diagnosed Care Coordination Program (CCP) clients[1]: 12-month pre- and post-enrollment viral load suppression outcomes and relative risk estimates, by demographic and clinical characteristics at baseline.

	All previously diagnosed clients - viral load suppression[2]			
	N	12 months prior to CCP enrollment[3] % (95% CI)	12 months after CCP enrollment % (95% CI)	Post- vs. pre-enrollment RR* (95% CI)
< $9,000	1,213	28.9 (26.4 - 31.5)	49.2 (46.4 - 52.0)	1.70 (1.55 - 1.86)
$9,000+	1,070	35.4 (32.6 - 38.3)	52.2 (49.2 - 55.2)	1.47 (1.36 - 1.60)
Missing	893	33.1 (30.1 - 36.2)	51.6 (48.3 - 54.9)	1.56 (1.42 - 1.71)
Taking ART at CCP enrollment§				
Yes	2,389	39.1 (37.1 - 41.1)	53.0 (51.0 - 55.0)	1.36 (1.29 - 1.43)
No	787	11.7 (9.4 - 13.9)	44.5 (41.0 - 48.0)	3.80 (3.13 - 4.62)
Country of birth^				
US/US dependency	2,185	29.2 (27.3 - 31.2)	47.6 (45.5 - 49.6)	1.63 (1.52 - 1.74)
Foreign country	596	40.9 (37.0 - 44.9)	62.1 (58.2 - 66.0)	1.52 (1.38 - 1.67)
Unknown	395	36.2 (31.4 - 41.0)	52.7 (47.7 - 57.6)	1.45 (1.28 - 1.65)
Year of HIV Diagnosis^				
<1995	690	33.5 (29.9 - 37.0)	47.5 (43.8 - 51.3)	1.42 (1.27 - 1.58)
1995 - 2004	1,732	32.6 (30.4 - 34.8)	49.9 (47.6 - 52.3)	1.53 (1.43 - 1.64)
2005 - 2011	754	30.5 (27.2 - 33.8)	56.2 (52.7 - 59.8)	1.84 (1.65 - 2.06)
Evidence of viral suppression (≤200 copies/mL) at enrollment^6				
Yes	1,026	100.0	75.1 (72.5 - 77.8)	*n/a****
No[7]	2,150	0	39.4 (37.3 - 41.4)	*n/a*****
CD4 (cells/µL) at enrollment^6				
< 200	909	19.7 (17.1 - 22.3)	37.0 (33.8 - 40.1)	1.88 (1.63 - 2.16)
200 - 349	632	34.3 (30.6 - 38.0)	49.7 (45.8 - 53.6)	1.45 (1.30 - 1.61)
350 – 499	465	44.5 (40.0 - 49.1)	60.2 (55.7 - 64.7)	1.35 (1.22 - 1.50)
500+	634	63.6 (59.8 - 67.3)	65.8 (62.1 - 69.5)	1.03 (0.97 - 1.10)
Unknown - no CD4 6 months prior to enrollment	536	3.7 (2.1 - 5.3)	50.4 (46.1 - 54.6)	13.50 (8.83 - 20.65)

CI: confidence interval.

Prepared by the Bureau of HIV/AIDS Prevention and Control with data reported to the NYC HIV Registry as of September 30, 2013.

*Relative risk (RR) calculated using Generalized Estimating Equations (GEE).

**By definition, clients in this group had no evidence of care in the 6 months prior to CCP enrollment, and thus were not engaged or suppressed at baseline; no post- vs. pre- relative risk can be constructed.

***By definition, all clients in this group were virally suppressed in the 6 months prior to CCP enrollment; due to a lack of variance in the baseline measure, no post- vs. pre- relative risk can be constructed.

****Because all clients in this group were unsuppressed at baseline, no post- vs. pre- relative risk can be constructed.

^Client characteristic based on information reported to the NYC HIV Registry.

[§] Client characteristic as reported on client's first intake assessment for CCP in the Electronic System for HIV/AIDS Reporting and Evaluation (eSHARE).

[1] Clients enrolled in the NYC CCP between December 1, 2009 and March 31, 2011, matched to the NYC HIV Registry, and living 12 months after the date of enrollment.

[2] Viral load suppression is defined as VL ≤200 copies/mL on most recent test in the second half of the 12-month period specified.

[3] 12 months prior to the client's CCP enrollment window (defined as the 31 days leading up to and including date of enrollment).

[4] Out of care: CCP clients who were diagnosed more than 12 months prior to their CCP enrollment window and had no evidence of primary care (CD4 or VL test) in the 6 months prior to their CCP enrollment window.

[5] Current to care: CCP clients who were diagnosed more than 12 months prior to their CCP enrollment window and had evidence of primary care in the 6 months prior to their CCP enrollment window.

[6] Median VL, viral suppression, median CD4, and CD4 at enrollment are determined by client's most recent CD4 or VL test occurring in the 6 months prior to their enrollment window.

[7] Clients who did not have a VL test reported during the 6 months prior to their enrollment window were categorized as unsuppressed.

Table 4.

Newly diagnosed[1] Care Coordination Program (CCP) clients[2]: 12-month post-enrollment engagement in care and viral load suppression outcomes, by demographic and clinical characteristics at baseline.

	All newly diagnosed clients - 12 months after CCP enrollment		
		Engagement in care[3]	Viral load suppression[4]
	N	% (95% CI)	% (95% CI)
TOTAL	**465**	**90.5 (87. 9 - 93.2)**	**66.2 (61.9 - 70.6)**
Sex^			
Male	329	90.6 (87.4 - 93.8)	65.7 (60.5 - 70.8)
Female	136	90.4 (85.4 - 95.4)	67.6 (59.7 - 75.6)
Race/Ethnicity^			
Black	203	91.1 (87.2 - 95.1)	63.1 (56.4 - 69.8)
Hispanic	200	92.5 (88.8 - 96.2)	71.0 (64.7 - 77.3)
White	34	82.4 (68.9 - 95.9)	61.8 (44.6 - 79.0)
Other/Unknown	28	82.1 (67.0 - 97.3)	60.7 (41.4 - 80.0)
Age (years) at CCP enrollment^			
≤ 24	93	92.5 (87.0 - 97.9)	55.9 (45.6 - 66.2)
25 - 44	270	89.3 (85.5 - 93.0)	69.3 (63.7 - 74.8)
45 - 64	94	91.5 (85.7 - 97.2)	67.0 (57.3 - 76.7)
65+	8	100.0	75.0 (36.3 - 100.0)
Primary language spoken at home§			
English	296	90.2 (86.8 - 93.6)	62.5 (57.0 - 68.0)
Spanish	121	94.2 (90.0 - 98.4)	77.7 (70.2 - 85.2)
Other	48	83.3 (72.4 - 94.3)	60.4 (46.1 - 74.8)
Insurance status at CCP enrollment§			
Insured	256	91.4 (87.9 - 94.7)	68.4 (62.6 - 74.1)
Uninsured	209	89.5 (85.3 - 93.7)	63.6 (57.1 - 70.2)
Housing status at CCP enrollment§			
Homeless	94	15.0 (7.6 - 22.2)	55.3 (45.1 - 65.6)
Not Homeless	361	92.0 (89.1 - 94.8)	69.3 (64.5 - 74.0)
Unknown	10	90.0 (67.4 - 100.0)	60.0 (23.1 - 96.9)
Household income level at CCP enrollment§			
< $9,000	190	87.4 (82.6 - 92.1)	67.9 (61.2 -74.6)
$9,000+	159	93.7 (89.9 - 97.5)	69.2 (61.9 - 76.4)
Missing	116	91.4 (86.2 -96.6)	59.5 (50.4 - 68.6)
Taking ART at CCP enrollment§			
Yes	173	93.1 (89.2 - 96.9)	80.9 (75.0 - 86.8)
No	292	89.0 (85.4 - 92.6)	57.5 (51.8 - 63.2)
Country of birth^			

Table 4.

Newly diagnosed[1] Care Coordination Program (CCP) clients[2]: 12-month post-enrollment engagement in care and viral load suppression outcomes, by demographic and clinical characteristics at baseline.

	All newly diagnosed clients - 12 months after CCP enrollment		
		Engagement in care[3]	Viral load suppression[4]
	N	% (95% CI)	% (95% CI)
US/US dependency	218	89.9 (85.9 - 93.9)	59.2 (52.6 - 65.8)
Foreign country	232	91.4 (87.7 – 95.0)	72.4 (66.6 - 78.2)
Unknown	15	86.7 (67.2 - 100.0)	73.3 (48.0 - 98.7)
Year of HIV Diagnosis^			
<1995	0	--	--
1995 - 2004	0	--	--
2005 - 2011	465	90.5 (87.9 - 93.2)	66.2 (61.9 -70.6)
Evidence of viral suppression (≤200 copies/mL) at enrollment^[5]			
Yes	46	91.3 (82.8 - 99.8)	82.6 (71.2 – 94.0)
No[6]	419	90.5 (87.6 - 93.3)	64.4 (59.8 - 69.0)
CD4 (cells/µL) at enrollment^[5]			
< 200	63	95.2 (89.8 - 100.0)	85.7 (76.8 - 94.6)
200 - 349	51	90.2 (81.7 - 98.6)	76.5 (64.4 - 88.5)
350 – 499	44	93.2 (85.4 – 100.0)	63.6 (48.8 - 78.4)
500+	52	89.7 (81.6 - 97.7)	44.8 (31.6 - 58.0)
Unknown - no CD4 6 months prior to enrollment	249	89.2 (85.3 - 93.0)	64.7 (58.7 - 70.6)

CI: confidence interval.
Prepared by the Bureau of HIV/AIDS Prevention and Control with data reported to the NYC HIV Registry as of September 30, 2013.

^Client characteristic based on information in the NYC HIV Registry.
§Client characteristic as reported on client's first intake assessment for CCP in the Electronic System for HIV/AIDS Reporting and Evaluation (eSHARE).
[1] Newly diagnosed: CCP clients who were diagnosed in the 12 months prior to their CCP enrollment window (defined as the 31 days leading up to and including date of enrollment).
[2] Clients enrolled in the NYC CCP between December 1, 2009 and March 31, 2011, matched to the NYC HIV Registry, and living 12 months after the date of enrollment.
[3] Engagement in care is defined as ≥2 CD4 or viral load (VL) tests ≥90 days apart, with ≥1 test in each half of the 12-month period specified.
[4] Viral load suppression is defined as VL ≤200 copies/mL on most recent test in the second half of the 12-month period following CCP enrollment.
[5] Median VL, viral suppression, median CD4, and CD4 at enrollment are determined by client's most recent CD4 or VL test occurring in the 6 months prior to their enrollment window.
[6] Clients who did not have a VL test reported during the 6 months prior to their enrollment window were categorized as unsuppressed.

FIGURE LEGEND/CAPTIONS

Figure 1: Sample population selection and categorization: New York City (NYC) Care Coordination Program (CCP) clients[1].

Prepared by the Bureau of HIV/AIDS Prevention and Control with data reported to the NYC HIV Registry as of September 30, 2013.

[1] CCP clients were matched between the Electronic System for HIV/AIDS Reporting and Evaluation (eSHARE) and the NYC HIV Registry in August 2013, utilizing eSHARE data as of July 15, 2013 and Registry data as of September 30, 2013.

[2] Newly diagnosed: CCP clients who were diagnosed in the 12 months prior to their CCP enrollment window (defined as the 31 days leading up to and including date of enrollment).

[3] Previously diagnosed: CCP clients who were diagnosed more than 12 months prior to their CCP enrollment window.

[4] Out of care: previously diagnosed CCP clients who had no evidence of primary care [CD4 or viral load (VL) test] in the 6 months prior to their CCP enrollment window.

[5] Current to care: previously diagnosed CCP clients who had evidence of primary care in the 6 months prior to their CCP enrollment window.

Figure 2: Pre- and post-enrollment engagement in care[1] (EiC) outcomes, by Care Coordination Program (CCP) client primary care status at baseline.

RR: Relative risk.
CI: Confidence interval.

Prepared by the Bureau of HIV/AIDS Prevention and Control with data reported to the NYC HIV Registry as of September 30, 2013.

[*] Relative risks calculated using Generalized Estimating Equations (GEE).

[**] By definition, clients in this group had no evidence of care [CD4 or viral load (VL) test] in the 6 months prior to CCP enrollment, and thus were not engaged or suppressed at baseline; no post- vs. pre- relative risk can be constructed.

[1] Engagement in care is defined as ≥2 CD4 or viral load (VL) tests ≥90 days apart, with ≥1 test in each half of the 12-month period specified.

[2] Newly diagnosed: CCP clients who were diagnosed in the 12 months prior to their CCP enrollment window (defined as the 31 days leading up to and including date of enrollment).

[3] Previously diagnosed: CCP clients who were diagnosed more than 12 months prior to their CCP enrollment window (defined as the 31 days leading up to and including date of enrollment).

[4] Out of care: previously diagnosed CCP clients who had no evidence of primary care in the 6 months prior to their CCP enrollment window.

[5] Current to care: previously diagnosed CCP clients who had evidence of primary care in the 6 months prior to their CCP enrollment window.

Figure 3: Pre- and post-enrollment viral load suppression[1] (VLS) outcomes, by Care Coordination Program (CCP) client primary care status at baseline.

RR: Relative risk.
CI: Confidence interval.
Prepared by the Bureau of HIV/AIDS Prevention and Control with data reported to the NYC HIV Registry as of September 30, 2013.

[*] Relative risks calculated using Generalized Estimating Equations (GEE).

[**] By definition, clients in this group had no evidence of care [CD4 or viral load (VL) test] in the 6 months prior to CCP enrollment, and thus were not engaged or suppressed at baseline; no post- vs. pre- relative risk can be constructed.

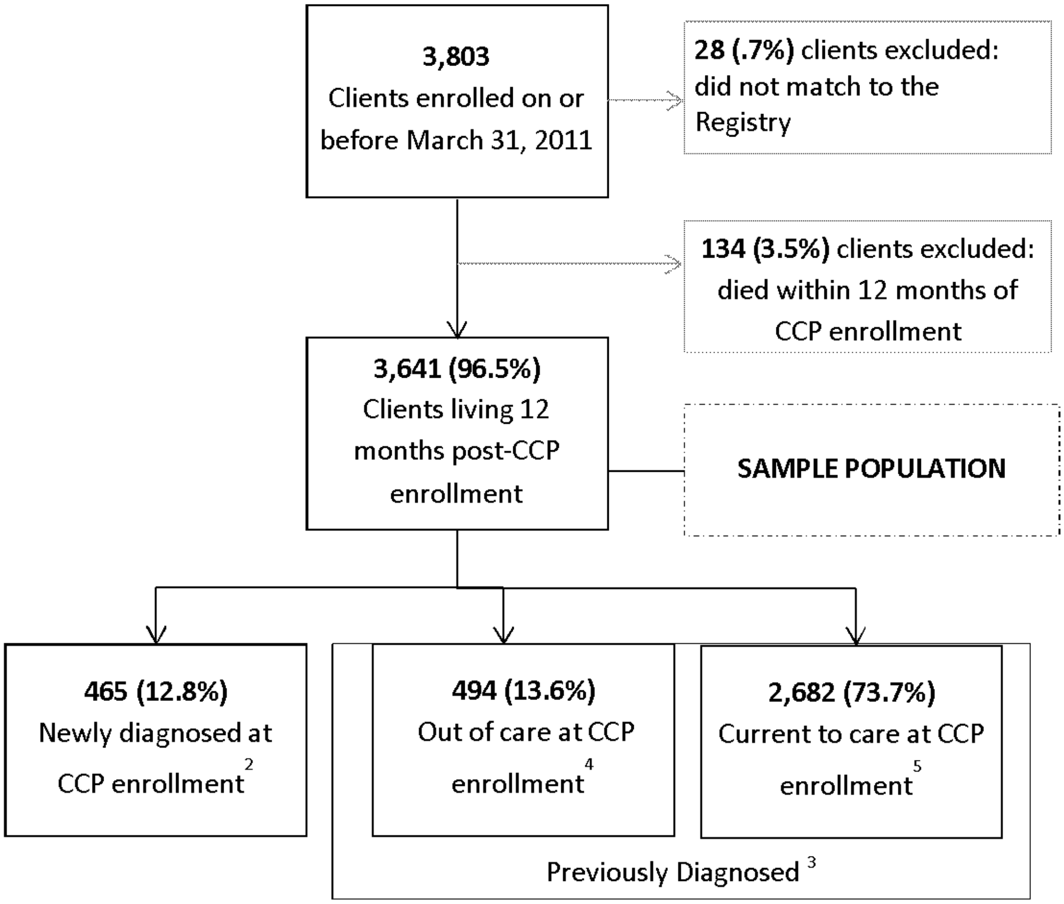
[1] VLS is defined as VL ≤200 copies/mL on most recent test in the second half of the 12-month period specified.

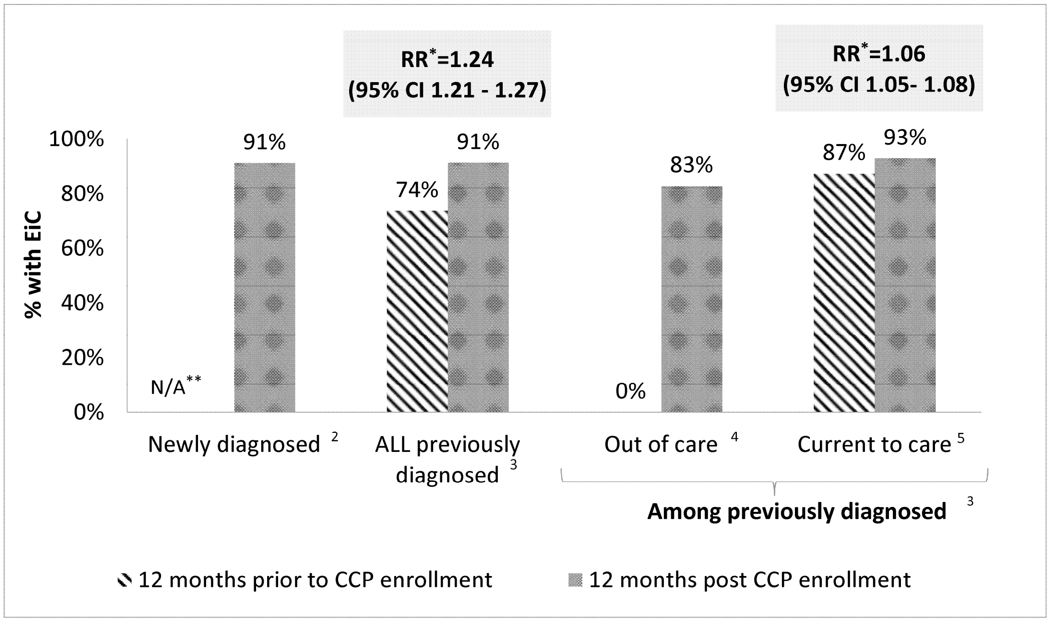
[2] Newly diagnosed: CCP clients who were diagnosed in the 12 months prior to their CCP enrollment window (defined as the 31 days leading up to and including date of enrollment).

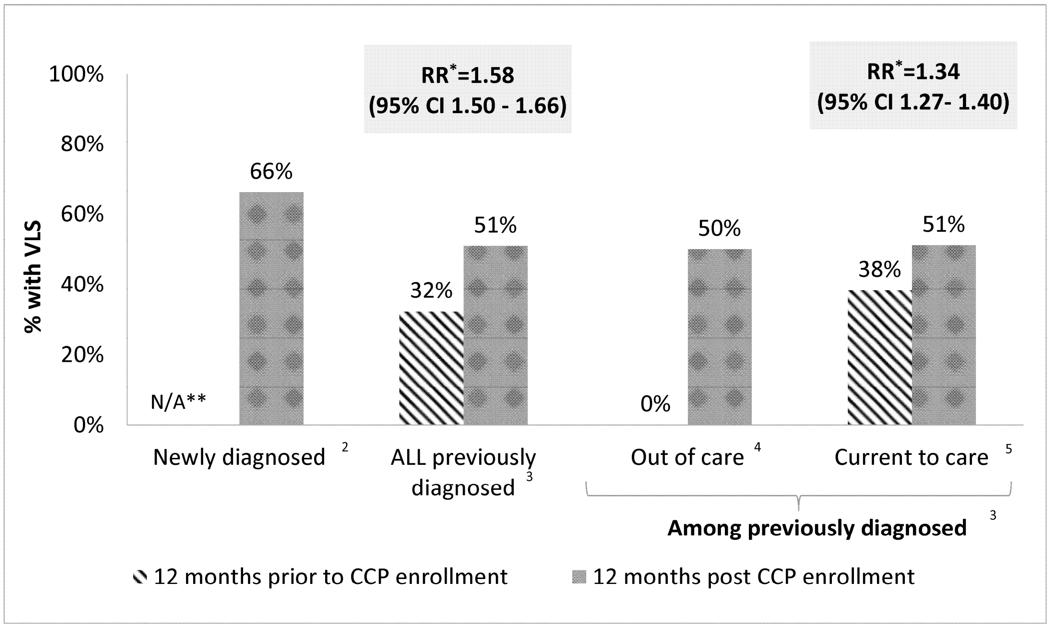
[3] Previously diagnosed: CCP clients who were diagnosed more than 12 months prior to their CCP enrollment window (defined as the 31 days leading up to and including date of enrollment).

[4] Out of care: previously diagnosed CCP clients who had no evidence of primary care in the 6 months prior to their CCP enrollment window.

[5] Current to care: previously diagnosed CCP clients who had evidence of primary care in the 6 months prior to their CCP enrollment window.


3,803
Clients enrolled on or before March 31, 2011
28 (.7%) clients excluded: did not match to the Registry
134 (3.5%) clients excluded: died within 12 months of CCP enrollment
3,641 (96.5%)
Clients living 12 months post-CCP enrollment
SAMPLE POPULATION
465 (12.8%)
Newly diagnosed at CCP enrollment 2
494 (13.6%)
Out of care at CCP enrollment 4
2,682 (73.7%)
Current to care at CCP enrollment 5
Previously Diagnosed 3


RR*=1.24
(95% CI 1.21 - 1.27)
RR*=1.06
(95% CI 1.05- 1.08)
% with EiC
100%
80%
60%
40%
20%
0%
N/A**
91%
74%
91%
0%
83%
87%
93%
Newly diagnosed 2
ALL previously diagnosed 3
Out of care 4
Current to care 5
Among previously diagnosed 3
12 months prior to CCP enrollment
12 months post CCP enrollment


RR*=1.58
(95% CI 1.50 - 1.66)
RR*=1.34
(95% CI 1.27- 1.40)
% with VLS
100%
80%
60%
40%
20%
0%
N/A**
66%
32%
51%
0%
50%
38%
51%
Newly diagnosed [2]
ALL previously diagnosed [3]
Out of care [4]
Current to care [5]
Among previously diagnosed [3]
12 months prior to CCP enrollment
12 months post CCP enrollment