THE HIV CARE CONTINUUM IN NEW JERSEY
HIV TESTING AND LINKAGE (2007-2011)
ENGAGEMENT AND RETENTION (2010-2011)
VIRAL LOAD MEASURES (2010)

BY DEBBIE YSMIN MOHAMMED

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ABSTRACT OF THE DISSERTATION

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Background: Gaps in medical care were identified in 2010 among HIV-infected persons in the United States. Linkage to medical care occurred for 77%, of whom 51% were retained in medical care. Of those receiving anti-retroviral medications, 77% had a suppressed viral load (SVL). New Jersey requires baseline evaluation of these measures to identify gaps that may exist in linking and retaining HIV-infected persons in medical care and viral load measures among population groups.

Methods: We obtained data from New Jersey Enhanced HIV/AIDS Reporting System (eHARS) that included 7289 newly diagnosed persons from 2007-2011 and 36,763 living HIV-infected persons; diagnosed at aged $\geq$ 13 years and by 12/31/2009. Routine measures reported by medical providers and laboratories included positive test results, CD4+ counts and HIV viral loads in addition to demographic variables. Time to linkage to medical care was evaluated by survival analysis. The relative risks (RR) and adjusted RR (aRR) were calculated for retention in care and SVL by exponentiating the coefficients from a generalized linear model with a log link and binomial outcome distribution. The mean monitored viral load (MMVL) was calculated using methods recommended by the Centers for Disease Control and Prevention.

Results: In 2007-2011, 71.6% of newly diagnosed persons were linked to medical care in $\leq$ 90 days. Among HIV-infected persons tested in non-clinical test-sites, a higher percentage tested by rapid were linked to medical care (62.3% vs. 54%) and in a shorter time (32 vs. 60 days), compared to EIA-WB. Among HIV-infected persons diagnosed by 2009, 47.6% were engaged in medical care and 35.5% were optimally retained in 2010-2011. HIV-infected persons with public funding were more likely to be engaged in and less likely to dropout from medical care during 2010-2011. The 2010 MMVL was 316 copies/ml and was higher among HIV-infected persons in the following high-prevalence cities: Irvington, Newark, East Orange, Elizabeth, Atlantic City and Camden. Overall, the SVL was 57.7% and slightly higher in Jersey City, a high-prevalence city (60.4%).

Conclusions: The findings in this evaluation provide baseline measures for linkage to, retention in medical care and viral suppression. Continued support in prevention and health care efforts in New Jersey is needed so that improvements towards the National HIV/AIDS Strategy goals may be achieved.

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INTRODUCTION

Background

HIV in the United States

Initial reports of infections in previously healthy young men alerted the medical community to the existence of a cellular-immune dysfunction that predisposed individuals to opportunistic infections (OIs) such as Pneumocystis carinii pneumonia (PCP) and candidiasis.[1] The case mortality rate in 1982 was 41% among persons with these diseases as there were no available medications and only palliative care was available to keep them comfortable until they died.[2] The subsequent discovery of a retrovirus that compromises the immune system by depleting CD4+ counts led to identification of Human Immunodeficiency Virus (HIV) and the sequelae manifested as an Acquired-Immunodeficiency Syndrome (AIDS).[3]

The Centers for Disease Control (CDC) implemented surveillance for AIDS cases based on a clinical case definition for AIDS-defining OIs to track the progression of the epidemic.[4] The case definition was revised by 1985 to include laboratory evidence of HIV infection following identification of the virus and the development of sensitive and specific antibody tests.[5]

AIDS incidence increased rapidly through the 1980s, peaked in the early 1990s, and then declined.[5] The peak of new diagnoses was associated with the expansion of the AIDS surveillance case definition in 1993 to include all HIV-infected persons with CD4+ counts of less than 200 cells or a CD4+ percentage of less than 14.[6] Following the approval of the first antiretroviral medication, azidothymidine, also called zidovudine or AZT, in 1987, and with the introduction of highly active anti-retroviral therapy (HAART) by 1996, sharp declines were reported in AIDS incidence and deaths.[7] By 2007, five classes of antiretrovirals, totaling over twenty medications comprised the HIV treatment arsenal. HAART or combination therapy is usually comprised of two or three classes of medications that impact the virus from entry, to reproduction and budding from the CD4+ cell. A decline in viral load (VL) is accompanied by a rise in CD4+ cells allowing the immune system to combat OIs and reduce the risk of HIV-related cancers. The net result is that HIV infection has become a chronic disease rather than the death sentence it was in the 1980s.

From 1998 through June 2000, AIDS incidence and deaths leveled off, however AIDS prevalence continued to increase as more HIV-infected persons remained alive.[4] Together with the recommendation that all states implement reporting of cases of HIV (without AIDS), a revised HIV case definition was published in December 1999 which included HIV RNA detection tests (i.e. VL test results).[8] As states began reporting of HIV-positive tests and VL they identified additional prevalent HIV or AIDS cases.

In the early 1980s, most AIDS cases occurred among whites.[4] However, cases among blacks increased steadily and by 1996, more cases occurred among blacks than any other racial/ethnic population. Male-to-male sex (MSM) was the most common mode of exposure among persons reported with AIDS, followed by injection drug use (IDU) and heterosexual contact.

At the end of 2008, an estimated 1.2 million HIV-infected persons, aged $\geq$13 years, were alive in the United States (U.S.), of whom 20.1% were undiagnosed.[9] Most HIV-infected persons were male (75.0%), of whom 65.7% reported MSM contact. HIV prevalence rates among non-Hispanic blacks and Hispanics were higher than among whites. Greater percentages of undiagnosed infection were estimated to be among those aged 13-24 years (58.9%) and 25-34 years (31.5%) and among males with high-risk heterosexual contact (25.0%) and MSM (22.1%) than among those in other transmission categories.

In the early stage of infection, HIV is usually asymptomatic. Approximately 10 years may elapse between initial infection and the development of AIDS without receipt of ART.[10] HIV-infected persons may not seek or be offered HIV testing until they have an OI or when their CD4+ counts are < 200 cells which is considered a late diagnosis.[11] These late diagnoses represent missed opportunities for medical care and receipt of antiretroviral therapy (ART) that can improve life expectancy to that of a non-infected person[12-13] Delays in treatment initiation ultimately generate higher healthcare expenditures. In one study comparing the estimated annual expenditure for HIV-related care, after the introduction of ART, a decline from $20,300 per patient in 1996 to $18,300 in 1998 was observed.[14] Another study among 635 HIV-infected persons in a large clinic in Alabama, reported that the 2001 total annual expenditures for those with CD4+ counts <50 cells ($36,533 per patient) were 2.6-times greater than the total annual expenditures for those with CD4+ counts $\geq$ 350 cells ($13,885 per patient), primarily because of increased expenditures for non-antiretroviral medication and hospitalization.[15] Furthermore, HIV-infected persons depending on their personal behaviors may unknowingly transmit HIV infection to their injecting and/or sex partners. Estimated transmitted infection is 3.5 times higher from HIV-infected persons who are unaware of their HIV status compared to those who know their status.[16]

HIV in New Jersey

By June 30, 2011, of 75,976 cumulative HIV cases reported in New Jersey (NJ), approximately 50% were deceased, leaving 35,841 alive.[17] Nationally, NJ ranked fifth in cumulative AIDS cases and third in cumulative pediatric AIDS cases in the U.S. In the early 1990s, HIV infection was concentrated among injection drug users (IDU) with concomitant transmission to their sex/drug using partners and babies. This resulted in differences in the current epidemic in NJ compared to U.S. Higher proportions of women (34% vs. 24%) were living with HIV in NJ compared to reports from 46 states and 5 U.S. dependent areas that included American Samoa, Guam, the Northern Mariana Islands, Puerto Rico, the Republic of Palau, and the U.S. Virgin Islands.[9,17] A higher percentage of minorities, including non-Hispanic blacks and Hispanics were affected and accounted for 75% of cases compared to 62% nationally. A lower percentage of HIV-infected persons reported MSM in NJ, (30% vs. 58%) compared to national reports. Similar percentages of males and females in NJ reported IDU (37%) vs. 11% in males and 18% in females nationally.

The NJ Department of Health (NJDOH) has demonstrated a commitment to combating the epidemic by being at the forefront in developing and implementing new initiatives. Some of these accomplishments include being the first state with a high prevalence of disease to implement name-based HIV reporting, electronic reporting of CD4+ counts and HIV viral loads (VL) into the Enhanced HIV/AIDS Reporting System (eHARS), decreasing the number of annual pediatric infections by 90% since 2000, providing ART with a minimum wait time before approval of payment from public funding sources, implementing a statewide prevention and testing program, implementing rapid HIV testing and developing the statewide capacity to provide prevention, care and treatment services to HIV-infected persons, that included a pediatric network of medical professionals and clinics.[17,18]

HIV Testing and Linkage to Care

HIV testing is the first step in identification of infected persons. Successful linkage to care will ensure that they have an opportunity to be evaluated by a medical provider, obtain baseline laboratory testing, including CD4+ counts and VLs, and receipt of ART. Voluntary counseling and testing services were offered to persons at high risk for infection at publicly funded sites since 1987, after the development of the first HIV antibody test, the enzyme immunoassay (EIA).[19] A blood specimen was drawn and submitted to the laboratory for analysis. If the initial EIA screening was positive, repeat EIA testing was performed. Specimens found to be repeatedly reactive were confirmed by Western Blot analysis. Results were available in about two weeks, at which time HIV-infected persons were required to return to the testing site for the results. However, in 2002, approximately 35% of HIV-infected persons in NJ failed to return for their test results.[20] These HIV-infected persons did not access medical care and were at risk for increases in VL, declines in CD4+ counts and the development of AIDS. Higher VLs are related to an increased risk of transmission therefore those with untreated HIV infection pose a risk of transmitting the virus.

The development of rapid HIV tests provided an opportunity to eliminate return visits for negative test results and HIV-infected persons could leave on the day of testing with knowledge of their preliminary positive results. On November 7, 2002, the Food and Drug Administration announced approval of *OraQuick* ® rapid HIV-1 Antibody Test (OraSure Technologies, Inc., Bethlehem, Pennsylvania) for use by trained personnel.[21]

This point-of-care test, designated a Clinical Improvement Amendments of 1988 (CLIA) waived status in 2003, could be performed by staff without formal laboratory training and outside traditional settings. Point-of-care rapid HIV testing was introduced to NJ in 2003.[22] Despite this innovation, in 2005, among 326 HIV-infected persons who tested preliminary HIV-positive, 25.2% failed to return for their confirmed results and did not access medical care.[23] After referral to the statewide Notification Assistance Program only 11(20%) HIV-infected persons were located and provided with confirmed results. In a subsequent analysis, between January 1, 2005 and December 31 2006, of 644 HIV-infected persons with a positive rapid HIV test confirmed by Western Blot, one third were not linked into medical care (as evidenced by at least one CD4+ count or VL in eHARS).[24] Despite leaving the test-site on the day of testing with the knowledge of a preliminary positive result, these HIV-infected persons, most likely had difficulty accepting their diagnosis as they felt well and did not think that they required medical care at this time.

In 2008, a new strategy to verify a preliminary positive test result immediately with a second rapid test was validated and implemented at some testing sites.[25] This provided a presumptive positive test result so that immediate referral and linkage into medical care for newly diagnosed persons was possible.[26] Preliminary findings were that 26% of HIV-infected persons did not obtain medical appointments on the same day as testing.[27] These early reports reveal that there were still delays in accessing medical care after testing positive in NJ, despite the “rapid-rapid” testing approach. This prompted the NJDOH to develop a patient navigator program to link those testing positive on both rapid tests to medical care.

HIV prevention programs in the U.S. had historically tailored activities for specific groups on the basis of behavioral risk factors and demographic characteristics.[28] The Sero-status Approach to Fighting the Epidemic (SAFE) launched in 2001, by the CDC, expanded previous prevention programs.[29] Resources were now focused on preventing the acquisition of infection among those who were HIV-negative as well as reducing the transmission of infection from those who were HIV-infected. The receipt of ART leads to lower VLs among HIV-infected persons and decreases in transmission to HIV-negative sex and drug using partners.[30-33] This has led to the development of the development of treatment as prevention (TasP) and the recommendation for universal ART to reduce HIV transmission.[34-35]

Low rates of linkage to medical care in $\leq$ 90 days, after HIV testing, were previously reported. The pilot phase of the CDC sponsored 'Never in Care' project, that included NJ, provided representative data for five states on HIV-infected persons who never entered care.[36] This study identified 20-25% of HIV-infected persons as never accessing medical care. Blacks, Hispanics and those aged 18-34 were less likely to be linked to medical care in $\leq$ 90 days. From 2004-2008, 3697 HIV-infected persons were identified in South Carolina, of whom 1768 (48%) entered care within three months, 1115 (30%) in 12 months after diagnosis, and 814 (22%) failed to initiate care within 12 months of HIV diagnosis.[37] Time to entry into care was longer for men (aHR 0.82; 95% CI 0.75-0.89) compared with women, blacks (aHR 0.91; 95% CI 0.83-0.98) compared with whites, and MSM (aHR 0.89; 95% CI 0.80-0.98) compared with heterosexual sex. In comparison, San Francisco, linked 79% of HIV-infected persons to medical care in $\leq$ 90 days among those diagnosed in 2006-2007.[38] Test-site was significantly associated with linkage to medical care. HIV-infected persons tested at the San Francisco County hospital were more likely to be linked to medical care in $\leq$ 90 days than those from a community clinic.

Engagement and Retention in Medical Care

After successful linkage, HIV-infected persons need to be engaged and retained in medical care, have routine medical evaluations and monitoring of CD4+ counts and HIV VLs. These laboratory tests are performed at the initial medical evaluation. The results of these tests determined whether HIV-infected persons were placed on ART up to 2011. Clinically stable HIV-infected persons with suppressed VL (< 200 copies/ml) could have CD4+ counts monitored every 6-12 months. There is an inverse relationship between these two measures with higher levels of VLs increasing the rate of CD4+ decline that may lead to AIDS and death. The prognosis of HIV-infected persons is defined by combined measurements of VL and CD4+ counts.[39] Regular monitoring of these two laboratory results while in medical care provides the opportunity to intervene in a timely manner when changes are noted to maximize survival and decrease transmission of disease.[40-41] The presence of either a CD4+ count or VL in eHARS is an indication that an HIV-infected person was seen by a medical provider who ordered these tests. Therefore, they are used as surrogate measures for engagement and retention in medical care. In population-based studies, engagement is defined as having reports of one or both of these laboratory tests in a specified period. Retention in care is defined as having reports of one or both of these laboratory tests in a defined time interval after engagement.

The medical and public health benefits for being engaged and retained in medical care are similar to the previous discussion for linkage to medical care for HIV-infected persons. Antiretroviral therapy (ART) is available which leads to a suppressed HIV VL

(< 200 copies/ml), decreased morbidity and mortality, prevention of OIs, and reduction in the transmission of infection perinatally and to sexual and injection drug using (IDU) partners.[30-33] The reduction in HIV VL and the potential for decreased transmission has led to the development of treatment as prevention (TasP) and the recommendation of universal ART to all HIV-infected persons.[34-35]

Previous population based studies in the U.S. report that approximately 50% of HIV-infected persons were not engaged in medical care in any given year. In Louisiana, 45% of living HIV-infected persons were not engaged in medical care from 2004-2006.[42] Among HIV-infected persons, higher proportions living with HIV (57%) were not in medical care than among those living with AIDS (33%). Higher percentages of HIV-infected persons in medical care included females, those reporting heterosexual contact or MSM, non-Hispanic blacks and whites. Those less likely to be in medical care included those aged 20-39 and Hispanics. Similar results were reported in North Carolina with the proportion of HIV-infected in care during any single year ranging from 44.0%-50.1% from 2004-2006.[43] Compared with HIV-infected persons 55 years or older, those who were 25-34 years old were less likely to be in care or have a transitional care pattern (no reports of CD4+ count or VL for at least one year). HIV-infected persons not in medical care in South Carolina (50%) included males, nonwhite race/ethnicity, younger age, and HIV-only status.[44]

Importance of HIV Viral Load Measures

Monitoring aggregated measures of VL at the population level may provide both an indicator of the burden of disease (e.g., higher proportions of patients virally suppressed (VL < 200 copies/ml) by ART will lower the community viral load (CVL), thus tracking treatment benefit) and as an indicator of potential epidemic propagation (e.g., more persons in a population with high VL point to increased likelihood of onward transmission for a given level of risky behavior).[45-46] Previous studies have documented that lower VLs lead to decreased transmission and incidence of new infections. In British Columbia, increased use of ART was associated with a decrease in the population's VL and new HIV infections.[32] Among a cohort of IDU in Vancouver, Canada, the estimated CVL was correlated with incidence regardless of transmission risk factors, until VL decreased to < 20,000 copies/ml, at which point CVL was no longer statistically significantly associated with HIV incidence.[33] Similarly, in San Francisco, declines in the population-level mean VL was associated with declining incidence in new HIV diagnosis from 2004- 2008.[45] These studies lend support for treatment as prevention (TasP) and the recommendation for universal ART to reduce HIV transmission.[34-35]

Previous population based studies with reports of the mean monitored viral load (MMVL) and suppressed VL include New York City (NYC), San Francisco and the District of Columbia (DC). In 2008, the MMVL in NYC was 44,749 copies/ml among HIV-infected persons (N=28,366).[47] Higher MMVLs were observed in males, those aged 20-49 years, with reports of MSM, an AIDS diagnosis, a CD4+ cell count of 200 cells or less and diagnosed after 2006. Overall, 54.7% of HIV-infected persons had a SVL (VL < 400 copies/ml). A MMVL of 23,348 copies/ml among 2,512 HIV-infected persons was reported in San Francisco for 2005-2008.[45] This study reported higher MMVLs for blacks, Hispanics, females and IDU whereas MSM had the lowest. The percentage of HIV-infected persons with an undetectable VL (< 75 copies/ml) increased from 45% in 2005 to 78% in 2008. Among 15,467 HIV-infected persons, at the end of 2008, DC reported a MMVL of 33,847 copies/ml and 57.4% had an undetectable VLs.[46]

Rationale

In 2010, an estimated 942,000 HIV-infected persons in the U.S. were aware of their infection, approximately 77% were linked to medical care, and 51% were retained in care.[48] Among HIV-infected adults, in care and receiving ART, 77% had a SVL. Thus, an estimated 28% of *all* HIV-infected persons had a SVL. These results revealed opportunities for improvement in these measures nationally, and to ensure that HIV-infected persons are diagnosed, in medical care, with a SVL to decrease viral transmission and have a normal life expectancy.

The White House Office of National AIDS Policy (ONAP) released the National HIV/AIDS Strategy (NHAS), the nation's first-ever comprehensive coordinated roadmap for prevention and care in response to a directive from President Obama.[49] Three key recommendations are 1) to increase the percentage of newly diagnosed HIV-infected persons linked to clinical care within three months of their HIV diagnosis from 65 percent to 85 percent 2) to improve retention in care from 73% to 80% and 3) to increase percentages of HIV-infected persons with an undetectable VL by 20%, from baseline measures in 2010, among specific population groups: blacks, Hispanics and MSM. These goals will be evaluated in 2015 by the federal government.

In the early 1980s, previously healthy young men were diagnosed with opportunistic infections that occurred only in persons with a severely compromised immune system. The etiologic agent of this Acquired Immuno-Deficiency Syndrome was the HIV virus identified shortly afterwards. Since then the CDC has monitored clinical presentations of OIs and laboratory reports of VL and CD4+ count results in these HIV-infected persons. These data are now collected routinely by each jurisdiction in the U.S and forwarded electronically to the CDC on a monthly basis.

The first testing technology required two laboratory tests for a diagnosis of HIV infection, EIA and WB. HIV infected persons were required to return for their results in two to three weeks and many of them did not return. In 2003, point of care HIV testing was approved in the U.S. and now HIV-infected persons were aware of their preliminary test results on the same day as testing. However, they still needed to return for their confirmatory results done by WB testing. These HIV-infected persons did not always return for their results and failed to be linked to medical care. A different testing strategy was implemented where the first rapid test was confirmed by a second rapid test; this allowed for same day linkage to medical care from test-sites.

Clinical care evolved from a single drug, AZT, to regimens including multiple drugs from different classes. These medications were initially given multiple times a day but it is now possible to have three medications in one pill. In recognition that it was necessary to not only target high risk persons for prevention measures, testing recommendations evolved from targeted risk-based testing to universal opt-out testing for adults and adolescents, aged 13-64 years, to decrease the percentage of HIV-infected persons who are unaware of their status. Prevention strategies shifted from only targeting at-risk HIV-negative populations to “treatment of HIV positives as prevention” to reduce their VL and reduce risk of transmission. ART is now recommended for all HIV-infected persons regardless of their CD4+ count or VL level.

Federal resources are allocated based on the eHARS data to populations that are most affected and increasingly, these same data are being used at the national level and in many states to assess how well testing and treatment guidelines are doing in reducing HIV-related morbidity and mortality. Thus, in NJ, we now have the opportunity to use eHARS data to monitor testing and linkage to care, retention in care, and VL measures to evaluate NHAS goals. Therefore, this dissertation addressed the following three questions:

1) What percentage of newly diagnosed HIV-infected persons in NJ were linked to medical care in $\leq$ 90 days, by testing method, from 2007-2011?
2) What percentage of HIV-infected persons who were diagnosed by 12/31/2009 in NJ, were subsequently retained in medical care over a two-year period, by funding source?
3) What was the a) mean monitored HIV VL and b) suppressed VL in NJ, in 2010, in specific populations and geographic areas?

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DATA SOURCES

HIV and AIDS Case Reporting

Human Immunodeficiency Virus (HIV) and Acquired Immunodeficiency Syndrome (AIDS) case surveillance in the United States (U.S.) is defined as the ongoing and systematic collection, analysis, interpretation, dissemination, and evaluation of population-based information about HIV-infected persons or those diagnosed with AIDS.[1] AIDS has been a reportable condition since 1981, in all 50 states, the District of Columbia, and U.S. dependencies including American Samoa, Guam, the Northern Mariana Islands, Puerto Rico, the Republic of Palau, and the U.S. Virgin Islands [2]. Initially, AIDS cases were reported to the Centers for Disease Control and Prevention (CDC) using a uniform case definition that included the indicator diseases, Kaposi's Sarcoma and Pneumocystis Carinii Pneumonia and other opportunistic infections (OIs).[3] The retrovirus, HIV was identified as the causative agent of AIDS in 1984.[4] This virus integrates with the CD4+ cell, replicates, and eventually the numbers of CD4+ cells decline leading to AIDS. This causes the infected host to become susceptible to OIs, also called indicator diseases. Some of these diseases still occur commonly in HIV-infected persons without access to antiretroviral medications and include candidiasis, cervical dysplasia, herpes zoster and idiopathic thrombocytopenic purpura. By 1985, the case definition was revised to include laboratory evidence of HIV infection following the identification of the virus and the development of sensitive and specific antibody tests.[4-6] The increased understanding of the natural history of the disease and availability of CD4+ counts, that were done as part of routine monitoring of HIV-infected persons, facilitated the change in the AIDS case definition in 1993 to reflect HIV-infected persons with severely compromised immune systems.[7]

HIV case reporting has been part of several states' comprehensive HIV/AIDS surveillance systems since 1985 when HIV antibody testing was first available and as of April 2008, all states, dependent territories and the District of Columbia successfully implemented name-based HIV case reporting as an extension of their AIDS case reporting system.[8] Of note, New Jersey (NJ) was the first high prevalence state to implement HIV name-based reporting in 1992 and began collecting viral load (VL) results in 2000.[9] This has allowed for the data to stabilize and now can be used for evaluation of the prevalence of disease, in different population groups, and can inform program planning and evaluation in NJ.

Enhanced HIV/AIDS Reporting System

The enhanced HIV/AIDS Reporting System (eHARS) is a secure, relational database accessed by a web browser that facilitates monitoring, review, and analysis of discrete events over time and is appropriate for surveillance of HIV infection. CDC calls this information system "document-based surveillance".[10] Case reports submitted by hospitals and health care providers are complemented by laboratory reporting. This was previously done manually but in the future will be done electronically to ensure that results of positive HIV tests and those used in the routine monitoring of HIV-infected persons are available in a timely manner. These tests include enzyme immunoassay (EIA), confirmatory Western Blot (WB) results, CD4+ counts and HIV viral loads (VL). NJ submits de-identified data electronically on a monthly basis to the CDC's national database through a secure data network. Data in eHARS are compared monthly to the NJ Death Registry and yearly to the National and Social Security Death Index to ascertain vital status. Yearly comparisons are conducted through Routine Interstate Duplicate

Review with other states to assess and resolve potential case matches among HIV-infected persons moving in and out of NJ.[11]

Data on racial categories and transmission risks were collected on the HIV Case Report Form at the time of diagnosis as mandated by the Federal Register on October 30th 1987. Racial categories include: American Indian or Alaska Native, Asian, non-Hispanic black or African American, Native Hawaiian or other Pacific Islander and white. Additionally, data on ethnicity, Hispanic or Latino were collected. For this analysis the following categories will be used: non-Hispanic black, white Non-Hispanic, Hispanic and other (as there was small numbers of HIV-infected persons of other races). Transmission risk is the term that summarizes a person's probable HIV risk.[12] Four transmission risks will be considered in these analyses: male-to-male sexual contact (MSM), injection drug use (IDU), heterosexual contact and unknown. HIV-infected persons with both IDU and MSM transmission risks will be assigned to the MSM risk category due to small numbers and as their behaviors may be more like MSM in NJ.

Strength and Limitations of eHARS

Name-based HIV reporting, collection of CD4+ counts and HIV VL have been ongoing since 2001in NJ that has allowed for data collection to stabilize and to enable monitoring of NJ trends. This will allow the findings of this study to be generalized to HIV-infected persons in medical care. Those who receive care outside NJ may not have current laboratory results uploaded into the system and that may lead to an underestimate in our study parameters of linkage, engagement and retention, and viral load measures. States routinely share data on cases that appear in multiple jurisdictions and apply uniform national criteria to minimize the risks of over counting in the national database so duplication will be minimized. Additionally, not all HIV-infected persons are included in eHARS, as about 20% have not been tested and diagnosed.[13] CD4+ counts and HIV VL data may be unavailable for the estimated one-third of HIV-infected persons who are not in ongoing medical care.[14] These two groups of HIV-infected persons will not have routine monitoring of CD4+ counts and VL conducted and may have elevated VLs. This could lead to underestimates of the VL measures that was done as part of this study, but will correctly reflect the percentages of those who were linked, engaged or retained in medical care as the results of these tests were used as surrogate markers for those outcome measures. Compliance with case reporting can affect completeness of the data. Information on the mode of transmission is not complete for all HIV-infected persons, due to failure to report behavioral risks on laboratory and provider reports to eHARS, which likely accounts for increased reports of unreported risk in the database. HIV-infected persons without these reports may reflect risks that are less likely to be reported by HIV-infected persons or providers, like IDU and MSM. The results of this study will be underestimated in these groups.

Publicly Funded Medical Care: Medication Use

Approximately 7,000 HIV-infected persons meeting NJ residency and the income criteria of earning less than 500% of the Federal Poverty Level (FPL), (if for one person), obtained medications with funding provided by Ryan White Part B in 2012, through the AIDS Drug Distribution Program (ADDP).[15] They represented an estimated 20% of living HIV-infected persons in New Jersey in 2012. The ADDP drug formulary is relatively unrestricted if one met the eligibility criteria for residency and income.

Other publicly funded medication assistance available to HIV-infected persons include PADD (Pharmaceutical Assistance to the Aged and Disabled), Senior Gold, and Medicaid.[16] Eligibility for PAAD includes NJ residency, $\geq$ 65 years, or $\geq$18 years and receiving Social Security Title II Disability benefits, and an annual income for 2012 of ≤$25,312 if single or ≤ $31,035 if married. Requirements for Senior Gold are similar to PADD. Annual income requirements, for 2012 were $25,312 - $35,312 if single or between $31,035- $41,035 if married. Medicaid eligibility is determined by NJ residence and is available if one's gross monthly income is ≤ $903. Data from the Medicaid Drug Utilization database is routinely merged with eHARS and served to identify HIV-infected persons who received publicly funded care and treatment. Data on medication utilization were not available for HIV-infected persons who received medical care paid by private insurance or the Veteran's Administration.

Limitations of medication utilization databases

While eligibility for Medicaid and Medicare entitlement benefits are stable, eligibility for receipt of ADDP may change depending on a person's life circumstances over time and the FPL that changes annually. In order to minimize the effect of these changes, we will limit our analysis to a two-year period in measuring engagement in medical care. The development and availability of anti-retrovirals was relatively rapid from 1996 to 2006. Initial regimens were complex and with multiple side effects, however, newer regimens since 2006 are better tolerated with minimal side effects. This has allowed adherence to be higher and engagement in medical care to be increasingly stable.

Merging of databases

HIV-infected persons obtaining medications by any public funding source (ADDP, Senior Gold, PADD and Medicaid) undergo review by the NJ Medicaid Drug Utilization Board. Matching of data in eHARS to the Medicaid Drug Utilization database is done routinely by NJDOH staff utilizing AutoMatch Software (MatchWare

Technologies, Burtonsville, MD), a probabilistic matching software. Multiple sequential rounds of matching were conducted based on linking algorithms including full social security number, full names (including aliases), date of birth, sex, street address and other identifiers. Potential matches were clerically reviewed and verified before being merged with eHARS. Non-matched cases were sent to field investigators for further review as potential new cases. This ensures that the data in eHARS are accurate and reflect current public funding information on HIV-infected persons.

Data Quality

Staff at the NJDOH routinely evaluate the data in eHARS for completeness, timeliness and completeness of CD4+ count as recommended by the CDC.[17] New Jersey eHARS has been in existence since 2000 and data are at least 85% complete. The following measures of completeness and timeliness of eHARS were provided by staff at NJDOH[18]

1) Completeness: The estimated completeness of reporting of HIV-infected persons diagnosed in 2010, assessed at 12 months after the end of diagnosis period is 95.2% (this is based on capture-recapture log linear models). This is higher than the standard set by CDC (≥85%).

2) Timeliness: The estimated percentage of cases residing in NJ, diagnosed with HIV between 1/1/2010 through 12/31/2010 that were reported within 6 months of diagnosis, assessed at 12 months after the end of the diagnosis period based on capture-recapture log-linear models is 71.9% which is higher than CDC standard (≥66%).

3) The completeness of reporting CD4+ (count or percent) measured within 3 months following diagnosis among adult/adolescents residing in NJ when diagnosed with

HIV disease between 1/1/2010 through 12/31/2010, assessed at 12 months after the end of diagnosis period is 62.3%, and is higher than the CDC standard (≥50%).

4) The completeness of reporting VL measured within 3 months following diagnosis among adult/adolescents residing in NJ when diagnosed with HIV disease between 1/1/2010-12/31/2010, assessed at 12 months after the end of diagnosis period is 69.1%, is higher than the CDC standard (≥50%).

These completeness measures represent minimum percentages in the database due to lags in reporting. Because laboratory data are continuously entered when they become available, we allowed for at least one-year lag in reporting in all analyses.

Protection of Subjects and Confidentiality

After matching was concluded, observations were de-identified and assigned a random unique identifying number by staff at NJDOH. The database utilized for this doctoral study was available only to researchers identified on the Institutional Review Board applications to the NJDOH and Rutgers University. The link for the de-identified data was kept at NJDOH and no one involved in the analysis had access to the identifiers. Data were analyzed at a designated NJDOH site. Aggregate results will be presented and individual HIV-infected persons will not be identifiable.

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HIV TESTING AND LINKAGE (2007-2011)

Background

Human Immunodeficiency Virus (HIV) causes a chronic infection that may progress to an Acquired Immunodeficiency Syndrome (AIDS), characterized by severe opportunistic infections, resulting in substantial morbidity and premature death.[1] In the United States (U.S.), approximately 50,000 persons were infected annually with HIV during 2006-2009.[2] At the end of 2008, there were an estimated 1,178,350 living HIV-infected persons, aged ≥13 years, of whom 20.1% had not been diagnosed.[3] Most HIV-infected persons were male (75.0%), and 65.7% reported male-to-male sex (MSM). HIV prevalence rates among non-Hispanic blacks and Hispanics were higher than among whites. Greater percentages of those living with undiagnosed infection were among persons aged 13-24 years (58.9%) and 25-34 years (31.5%). Greater percentages of undiagnosed HIV were observed among males with high-risk heterosexual contact (25.0%) and MSM (22.1%) than among those in other transmission categories.

HIV prevention programs in the U.S. historically tailored activities for specific groups on the basis of behavioral risk factors and demographic characteristics. The Sero-status Approach to Fighting the Epidemic (SAFE), launched in 2001 by the Centers for Disease Control and Prevention (CDC), expanded prevention programs.[4] Resources were focused on preventing the acquisition of infection among those who were negative, as well as reducing the transmission of infection from those who were HIV-infected.

Linkage to medical care is the first important step to accessing anti-retroviral therapy (ART) for HIV-infected persons. This leads to a suppressed HIV viral load (VL), decreased morbidity and mortality, prevention of opportunistic infections, and reduction in HIV transmission perinatally and to sexual and injection drug using (IDU) partners.[5-9]

Case managers link HIV-infected persons to other needed services that may include housing, home health care, transportation, substance abuse and mental health therapy. However, the most important outcome of linkage to medical care is receipt of ART, which allows HIV-infected persons to live longer with a normal life expectancy.[10] It is estimated that a 20-year-old HIV-positive adult on ART in the U.S. or Canada can live into his or her early 70's, a life expectancy approaching that of the general population.

Estimated transmission from HIV-infected persons unaware of their infection accounts for about 50% of new infections yearly.[11] When HIV-infected persons are aware of their status, they are more likely to take steps to protect their partners. A meta-analysis on 11 studies found that HIV-infected persons aware of their status were less likely to transmit to uninfected persons; indeed, learning one's positive status may prompt initiation of risk reduction behaviors, including disclosure to primary partners.[12] ART may also reduce infectiousness, thus providing another important public health reason for considering HIV-infected persons as a priority population for prevention programs. If a low VL is associated with a lower risk of transmission and if ART reduce VL, then receipt of ART may reduce transmission; hence the development of treatment as prevention (TasP).[13] This has led to the U.S. guidelines for treatment to recommend universal ART to reduce HIV transmission.[14]

On July 13, 2010, the White House released the National HIV/AIDS Strategy (NHAS), the nation's first-ever roadmap for prevention and care as directed by President Obama.[15] A key recommendation is to increase the percentage of newly diagnosed HIV-infected persons linked to clinical care within three months of their HIV diagnosis from 65 percent to 85 percent. This goal will be evaluated in 2015 by the federal government.

Previous reports of HIV testing and linkage to medical care using population-based data are available from other jurisdictions. The pilot phase of the Centers for Disease Control and Prevention (CDC) sponsored 'Never in Care' project provided representative data for five states (including New Jersey (NJ)) on HIV-infected persons who never entered care.[16] This study identified 20-25% of HIV-infected persons as never accessing medical care. Among HIV-infected persons tested in New York City in 2003, 1228 (63.7%) initiated care within 3 months of diagnosis, 369 (19.1%) initiated care later than 3 months, and 331 (17.2%) never initiated care.[17] From 2004-2008, 3697 HIV-infected persons were identified in South Carolina, of whom 1768 (48%) entered care within three months, 1115 (30%) in 12 months after diagnosis, and 814 (22%) failed to initiate care within 12 months of HIV diagnosis.[18] By comparison, in San Francisco, 79% of HIV-infected persons were linked to medical care in $\leq$ 90 days among those diagnosed in 2006-2007.[19]

Test Methods

The 1980s saw the development of an enzyme immunoassay (EIA) for screening and the Western Blot (WB) for confirmation of HIV infection, two tests which required laboratory testing and prolonged wait times of up to two weeks before results were available.[20] Since that time, point of care testing was developed allowing for same day screening and preliminary HIV-positive results.[21]

Two test methods for HIV infection were commonly performed in NJ from 2007-2011: 1) rapid HIV testing, followed by a WB, and 2) EIA followed by WB for confirmation. Initially, rapid HIV testing with OraQuick® was used. However from 2008, this test was gradually replaced by Clearview® HIV 1/2 STAT-PAK as it was less costly. All tests have at least 97% sensitivity and 99% specificity for HIV-1.[22] For a negative test result there was no need to return to the test-site. However, for a preliminary positive, a confirmatory WB was needed and follow up visits were scheduled in 1-2 weeks, when a referral for medical care would be initiated. Preliminary reports indicated that 25% did not receive a medical appointment for care after rapid testing.[23] A single test-site in Newark, NJ reported linking 72% of HIV-infected persons into medical care with a verified medical visit $\leq$ 90 days, after using the rapid-WB method.[24]

In 2008, a rapid test algorithm was gradually introduced to NJ Department of Health (NJDOH) funded test-sites.[25] If the first rapid test was preliminary positive, a second rapid test was immediately performed using UniGold™ Recombigen® HIV, which has comparable sensitivity and specificity to other rapid tests.[22] Two tests from different manufacturers were used to minimize an inaccurate test result. This allowed for *same day* presumptive confirmation of HIV infection and referral to medical care.

Confirmed test results were submitted to NJDOH using the HIV Case Report Form. These reports are enhanced by electronic and manual submission of EIA, WB, VL and CD4+ counts by laboratories. For cases in which only laboratory reports were available, staff contacted individual medical providers to assure completeness of the data. Our study will be, to our knowledge, the first time that linkage to medical care in $\leq$ 90 days will be analyzed by HIV-testing methods using population-based data from the NJ enhanced HIV/AIDS Reporting System (eHARS).

Test-Site

Linkage to medical care appears to be influenced by the type of site where HIV testing was conducted. In 2003, New York City (NYC) reported that HIV-infected persons diagnosed in community testing sites without co-located primary medical care were significantly less likely to have initiated care within 3 months (53.2% vs. 66.5%)

than those diagnosed at sites that also offered primary medical care.[26] Similarly in San Francisco, of 160 HIV-infected persons tested from 2006-2007, 78.8% had a CD4+count or HIV viral load reported in eHARS $\leq$ 90 days.[27] HIV-infected persons tested at the county hospital or primary care clinics were more likely to be linked into medical care than from the sexually transmitted diseases clinic. A meta-analysis of 26 studies, conducted in multiple regions of the U.S. from 1995 to 2009, indicated that 69% [95% confidence interval (CI) 66%-71%, k = 28] of HIV-infected persons entered medical care, averaged across the assessment intervals examined in the studies.[28] A higher percentage entered care when HIV testing was done in emergency/urgent care departments than when testing was done in other community venues (76% vs. 67%, P = 0.07).

Linkage to Care

CD4+cell counts and VL are used to determine the stage of HIV disease and, during the time period considered in this study, were used to decide when to initiate anti-retroviral therapy (ART). These tests are commonly obtained on the first visit for HIV medical care. They can therefore serve as surrogate measures to evaluate entry into medical care.[14] This study reports linkage to medical care among NJ HIV-infected persons, aged $\geq$ 13 years at diagnosis, from 2007-2011, with data reported up to 12/31/2012, as follows:

1) Described the demographic, transmission risk, and geographic characteristics of NJ HIV-infected persons, diagnosed from 2007-2011, by test-type;
2) Described the demographic, transmission risk, and geographic characteristics of NJ HIV-infected persons, diagnosed from 2007-2011, by test-site;
3) Calculated the percentage of HIV-infected persons ever linked and linked to medical care in $\leq$ 90 days after the first positive HIV test by test-type, test-site and

a composite variable (test-site*test-type) and by demographic, transmission risk and geographic factors;

4) Identified predictors among HIV-infected persons ever linked and linked to medical care in $\leq$ 90 days, by demographic, transmission risk and geographic characteristics and the composite variable test-site*test-type.

Ethics Statement

Approval for this study was obtained from both Rutgers University and the NJ Department of Health (DOH) Institutional Review Boards.

Methods

Data Sources

Data for this study were obtained from the NJDOH Enhanced HIV/AIDS Reporting System (eHARS). AIDS has been a reportable condition since 1981, in all 50 states, the District of Columbia, U.S. dependencies and possessions in free association with the U.S.[29] HIV case reporting has been part of several states' comprehensive HIV/AIDS surveillance systems since 1985. As of April 2008, all states, dependent territories and the District of Columbia have successfully implemented name-based HIV case reporting as an extension of their AIDS case reporting system.[30] In NJ, HIV case reporting was implemented in 1992 and laboratory reporting of CD4+counts and VL from 2000.

eHARS is a secure, relational database accessed by a Web browser that facilitates monitoring, review, and analysis of discrete events over time and is appropriate for surveillance of HIV infection. The Centers for Disease Control and Prevention (CDC) calls this information system "document-based surveillance."[31] Laboratory reporting complements case reports submitted by hospitals and health care providers. The NJDOH submits de-identified data electronically on a monthly basis to CDC's national database through a secure data network. Vital status is updated through quarterly matches to the NJ Death Registry and yearly to the National Death Index. Data for this analysis is current as of December 31, 2012. Study observations from eHARS were de-identified and assigned a random unique identifying number by staff at NJDOH. The link between data from eHARS and the de-identified database was kept in a secure location inaccessible to the researchers who did not have access to the identifiers. Data were analyzed at a designated NJDOH site on a computer that did not have Internet access.

Eligibility Criteria

Of all HIV/AIDS cases reported to NJDOH, through 12/31/2012, eligibility was determined by a) year of diagnosis, 2007-2011; b) state of initial HIV test; and c) state of last known residence, as of 12/31/2012 (Figure 1.1). Cases were excluded if their first HIV-positive test result was not from NJ or they were non-NJ residents as of 12/31/2012. Additional exclusions were cases diagnosed by a doctor or by a viral load only (i.e., lacking a diagnosis by rapid-WB, rapid-rapid or EIA-WB) as these cases were presumed to be in medical care at the time of diagnosis.

Analytic Variables

Outcome variable: Time to linkage to medical care was measured by the number of days between either rapid (refers to either rapid-WB or rapid-rapid) or EIA-WB and the date of the first CD4+count or HIV VL in the eHARS database, with an observation period from the time of diagnosis to 12/31/2012. HIV-infected persons were followed until a report of their death, or the administrative censoring date of 12/31/2012, whichever was earliest. HIV-infected persons who died or were not linked to medical care were censored.

Main effect variable: Test-type included EIA-WB and rapid (followed by WB or rapid). Test-site was categorized as clinical, non-clinical and unknown. Non-clinical-sites included counseling and testing sites (CTS) and emergency department (ED)-CTS. Clinical sites included correctional facilities, ED-non-CTS, inpatient medical sites, outpatient medical sites and doctors' offices. A composite variable test-site*test-type (TSTT) was created: the levels of this variable were Clinical-EIA-WB, Clinical-rapid, Non-Clinical EIA-WB, Non-Clinical-rapid, Unknown-EIA-WB, Unknown rapid. This composite variable was created to account for the possibility that test site (clinical vs. non-clinical) might modify test-type (EIA-WB vs, rapid) effects, i.e., to test for the interaction between test-site and test-type.

Covariates: These included demographic, transmission risks and geographic factors. Demographic variables included age (13-24, 25-34, 35-44, 45-54, $\geq$55 years), gender (Male, Female), and race/ethnicity (non-Hispanic black, non-Hispanic white, Hispanic (any race) and other (which included Asian, American Indian/Alaska native, Native Hawaiian, multiple races and unknown race/ethnicity). Transmission risk factors were assigned based on CDC's hierarchy of risk: male-to-male sex (MSM), IDU, heterosexual, and unknown.[32] Men who inject drugs and have sex with men were combined with MSM in our analyses due to small numbers (n=78, 1.1%).

Residence as of December 31st 2012 was used to determine the city variable. The Intensive Mobilization to Promote AIDS Awareness through Community-based Technologies (IMPAACT) is a NJ initiated city-by-city community mobilization initiative designed to galvanize and support African-American leaders in reducing the spread of HIV/AIDS in cities with the highest prevalence of HIV/AIDS.[33] The top ten cities include Atlantic City, Camden, Jersey City, Elizabeth, New Brunswick, Plainfield, Paterson, Newark, Asbury Park, and Trenton. This was collapsed to IMPAACT City (Yes, No). Other variables were AIDS diagnosis (Yes, No), and year of diagnosis (2007, 2008, 2009, 2010, 2011). Clinical status included first reported CD4+ counts (< 200, 200-349, 350-499, $\geq$500 and missing), and reported HIV VL (Yes, No). AIDS was defined as the report of a CD4+count < 200 cells.

Data Analysis

This study included HIV-infected persons, aged $\geq$ 13 years at diagnosis, from 2007-2011, who were NJ residents at the time of the initial positive HIV test, and as of 12/31/2012. They were assessed for differences in test-type and test-site by demographic, transmission risk, geographic and clinical characteristics. Differences between these groups were tested using $\chi 2$ tests of association with a p-value of < 0.05 being statistically significant.

Competing risk analysis was used to account for the fact that death played a role in never linking to medical care and was not an independent event, i.e. death precluded or altered the probability of the occurrence of linkage to medical care.[34] Cumulative Incidence Curves of each variable were evaluated using Gray's Test for Equality of Cumulative Incidence Functions (CIF) with a p-value < 0.05 being statistically significant. The CIF of linking to medical care is the probability of linking to medical care in the presence of a competing risk, that is, death. Multivariate Cox proportional hazards models that accounted for competing risks were used to determine the predictors for *ever* linked and linked to medical care in $\leq$ 90 days.[35] A p-value of 0.20 was used to identify variables to be included in an initial multivariable model, following which backward elimination was applied to develop the final models. An analysis stratified by the year of diagnosis and adjusted for the composite variable test-site*test-type, gender, race/ethnicity, age, transmission risk, IMPAACT city, AIDS diagnosis was performed to account for an increase in positive rapid tests from 2007-2011. All statistical analyses were performed using SAS version 9.3 (SAS Institute, Cary NC, USA).

Results

A total of 7,289 HIV/AIDS cases, aged ≥13 years at diagnosis, from 2007-2011, were reported to NJDOH as of December 31, 2012. Cases excluded from this analysis were non-NJ residents at the time of diagnosis (298, 4.1%), or as of December 31, 2012 (106, 1.5%) or at either time (275, 3.7%) (Table 1.1). When compared to NJ HIV-infected persons, they were more likely to be male, white, tested from 2007-2009 and represented 9.3% of all reported cases. Among NJ cases (n=6,610), further cases excluded had an initial diagnosis by HIV VL (n=575, 8.7%) or a doctor's diagnosis only (n= 207, 3.2%) as they were likely already in medical care (Figure 1.1). The population analyzed included 5,827 HIV-infected persons tested by EIA-WB or rapid, whose initial positive test was in NJ and who were residents as of 12/31/2012. Prior to being linked to medical care, 80 (1.4%) HIV-infected persons died during the observation period, with 53 (66.3%) dying in ≤ 90 days.

NJ HIV-infected persons testing HIV-positive from 2007-2011, by Test-Type

Overall, 3,936 (67.6%) HIV-infected persons tested positive by EIA-WB and 1,891 (32.4%) by rapid (Table 1.2). From 2007-2011, the percentage of positive tests by rapid increased (from 20.0% to 41.0%) and EIA-WB decreased (from 80.0% to 59.0%) (Figure 1.2a). Higher percentages of those tested by EIA-WB were older (35-44, 45-54, ≥

55 years), tested from 2007-2009, in a clinical-site and resided in a non-IMPAACT city. Rapid testing was more likely in non-Hispanic blacks, Hispanics, younger HIV-infected persons (aged 13-24 and 25-34) and those with a reported risk of MSM, IDU or heterosexual contact. They were more likely to have been tested in a non-clinical-site and to reside in an IMPAACT city.

NJ HIV-infected persons testing HIV-positive from 2007-2011, by Test-Site

Overall, higher percentages of HIV-infected persons tested positive in a clinical-site (4,064, 69.7 %) than a non-clinical site (1,525, 26.1%) (Table1.3). The percentage of positive tests in non-clinical sites increased, (from 22.0% to 26.0%), but decreased in clinical sites (from 78.0% to 60%) from 2007-2011 (Figure 1.2b). HIV-infected persons in clinical-sites were older (aged 35-44, 45-54 or $\geq$ 55 years) and resided in a non-IMPAACT city. At non-clinical sites they were more likely to be non-Hispanic black or Hispanic, younger (aged 13-24 and 25-34), MSM, and to reside in an IMPAACT city

NJ HIV-infected persons testing HIV-positive from 2007-2011, and linkage to medical care

Overall, 93.1% (95% Confidence Interval (CI): 91.8-94.3) of newly diagnosed HIV-infected persons were *ever* linked to medical care from 2007-2011, in a median time of 20 days (Interquartile Range (IQR): 3-135)(Table 1.4). A lower percentage of HIV-infected persons tested by rapid (88.3%, 95%CI: 85.7-90.5), or in a non-clinical site (87.3%, 84.3-89.7) were *ever* linked to medical care than overall.

In the competing risk model adjusted for gender, race/ethnicity, age, transmission risk, year of diagnosis, IMPAACT city and AIDS diagnosis, HIV-infected persons *ever* linked to medical care were as likely to have been tested in a clinical-site by either a rapid or EIA-WB or in a non-clinical site, by a rapid, compared to testing in a non-clinical site by an EIA-WB (Table 1.5). Other significant factors for linkage were race/ethnicity, age, year of diagnosis, and AIDS diagnosis. HIV-infected persons less likely to ever link to medical care were non-Hispanic blacks, aHR: 0.9, 95% CI: 0.8-1.0, aged 13-24 years, aHR: 0.8, 95% CI: (0.7-0.9), or had a non-AIDS diagnosis, aHR: 0.9, 95% CI: 0.8-0.9.

When stratified by year of diagnosis, the composite variable, test-site*test-type race/ethnicity, age, and AIDS diagnosis remained significant as predictors for *ever* linking to medical care (Table 1.6a). In 2007 and 2009, HIV-infected persons more likely to ever link to medical care were tested in a clinical-site by either a rapid or EIA-WB, and in 2007 in a non-clinical site by rapid compared to non-clinical EIA-WB. In 2008 and 2009, blacks were less likely to be *ever* linked to medical care. HIV-infected persons aged 13-24, in 2007 and 2008, and aged 25-34, 35-44 and 45-54 in 2008 were less likely to ever link to medical care compared to those $\geq$ 55. A non-AIDS diagnosis was a predictor of being less likely to link to medical care among those testing positive in 2009 and 2010. However, by 2011, the 95% CI for all variables crossed "1" indicating that these differences did not remain statistically significant.

The percentage of HIV-infected persons linked to medical care in $\leq$ 90 days was 71.6%, (95% CI: 70.4-72.8) and was lower among those who had rapid testing (65.2%), tested in a non-clinical site (61.0%), non-Hispanic blacks (68.0%), those aged 13-24 years, (67.0%), diagnosed in 2007 (64.0%) or were residents in an IMPAACT city (67.5%) (Table 1.4). From 2007-2011, the percentage linked to medical care in $\leq$ 90 days increased from 64.0% (95%CI: 61.2-66.6) to 75% (95% CI: 72.0-78.0). When rapid was compared to EIA-WB in non-clinical sites, a higher percentage of HIV-infected persons were linked to medical care in $\leq$ 90 days, 62.3% vs. 54.0%, and in a shorter time, median 32 (IQR: 8-510) vs. 60 (IQR (21-531) days, respectively (Figure 1.3).

Compared to non-clinical EIA-WB, linkage to medical care in ≤ 90 days was more likely from a clinical site: rapid (aHR: 1.82, 95%CI: 1.49-2.22) or EIA-WB (aHR: 1.85, 95%CI: 1.55-2.21), or from a non-clinical site tested by a rapid (aHR: 1.48, 95%CI: 1.23-1.79) (Table 1.5). Females, non-Hispanic blacks, those aged 13-24 or with a non-AIDS diagnosis were less likely to link to medical care in ≤ 90 days.

When stratified by year of diagnosis, the composite variable, test-site*test-type gender, race/ethnicity, age, and AIDS diagnosis remained significant as predictors for linkage to medical care in ≤ 90 days (Table 1.6b). In 2007 and 2009, HIV-infected persons linked to medical care in ≤ 90 days were more likely to have been tested in a clinical-site by either a rapid or EIA-WB. In 2007-2010, there were no differences in linkage to medical care in ≤ 90 days for females but they were less likely to be linked in 2011, compared to males. Linkage to medical care in ≤ 90 days was less likely for blacks in 2008 and 2009 and for Hispanics in 2008. HIV-infected persons aged 25-34, 35-44 and 45-54 in 2008 were less likely to link to medical care in ≤ 90 days compared to those ≥ 55. A non-AIDS diagnosis was a predictor of being less likely to link to medical care among those testing positive in 2009, 2010 and 2011. By 2011, the 95% CI crossed "1" for the composite variable (test-site*test-type), race/ethnicity, age, transmission risk, and IMPAACT city, indicating that these differences did not remain statistically significant. Factors remaining significant for linkage to medical care in ≤ 90 days, by 2011, were female gender (aRR:0.81, 95%CI: 0.67-0.98) and HIV-infected persons with a non-AIDS diagnosis (aHR:0.82, 95%CI: 0.70-0.97).

Discussion

Overall, during 2007-2011, 71.6% of HIV-infected persons were linked to medical care in ≤ 90 days of diagnosis. This improved by at least 10.0% from 2007 to

2011 (from 64.0% to 75.0%). The 2011 rate is lower than reported nationally (79.8%) and the 2015 NHAS goal of increasing to 85% the percentage of HIV-infected persons' linked to HIV medical care in $\leq$ 90 days after diagnosis.[15, 36] However, the improvement in linkage to medical care from 2007 to 2011 indicates that NJ is making progress towards achieving the NHAS goals.

HIV-infected persons tested by rapid and in non-clinical sites were likely to reside in an IMPAACT city where at risk populations included non-Hispanic blacks, Hispanics, younger individuals (aged 13-24 and 25-34) and those with reported risks of MSM or heterosexual contact. Continued funding for prevention and treatment to IMPAACT cities, where the epidemic is most pronounced, and targeting populations at risk for infection is congruent with NHAS strategies to reduce HIV related racial disparities.[15]

We evaluated linkage to medical care by test-type as the initiation of newer technologies utilizing rapid testing was expected to facilitate quicker linkage into medical care. Overall, a lower percentage of HIV-infected persons linked to medical care in $\leq$ 90 days, 65.2 % vs. 74.6%, when rapid was compared to EIA-WB. When test-site was evaluated, differences in linkage to medical care were noted with higher percentages linked to care from clinical sites vs. non-clinical sites (75.9% vs. 61.0%). This is similar to reports from Philadelphia and NYC, where newly diagnosed HIV-infected persons from community based organizations or CTS were less likely to be linked to medical care compared to medical sites.[17, 37-38] However, when the composite variable test-site* test-type was evaluated in non-clinical sites, a higher percentage of HIV-infected persons tested by rapid linked to medical care in $\leq$ 90 days (62.3% vs. 54.0%), compared to EIA-WB. In this evaluation, providing rapid testing in non-clinical sites increased the percentage of HIV-infected persons linked to medical care in $\leq$ 90 days. Access to rapid, noninvasive HIV testing with immediate results and linkage to care for these HIV-infected persons provided the opportunity to access medical care and therapy. To our knowledge, this is the first study evaluating linkage to medical care utilizing this composite variable (test-site*test-type) and supporting the CDC's decision to provide rapid testing in nonclinical sites across the U.S. and in NJ to test, identify and link HIV-infected persons to medical care.[39-40]

The delay in linking newly diagnosed persons to medical care in NJ by non-clinical sites may be due to medical sites requiring that an additional positive confirmatory test (WB) be completed before making an appointment with a provider. NJ began same day presumptive confirmatory testing with the introduction of a second rapid test in 2008 that probably contributed to lessening this difference by 2011.[41]

Linkage activities from non-clinical to medical sites need to be strengthened to ensure that HIV-infected persons have access to a medical provider in the shortest time possible. NJ implemented a statewide patient navigator program in 2013 for newly diagnosed persons.[42] The second rapid test is provided at medical sites by navigators so that linkage to medical care occurs within 24-48 hours of initial testing. The navigator supports the HIV-infected person in accessing medical care. For example, this may include helping with charity care and Medicaid applications, setting up the initial medical visit, and providing a psychosocial assessment to elucidate any barriers to care that may be encountered.

One reason for poor linkage to care previously reported was lack of money or health insurance.[43] Enrollment is underway for Expanded Medicaid and Marketplace in

NJ based on income. Medicaid is available for those with incomes at < 133% of the federal poverty level ($11,670) and for those with incomes up to $46,680, insurance is available on the Marketplace exchange. As of January 2015, 1.7 million NJ residents were enrolled in Medicaid, and an additional 254,316 people enrolled in the NJ exchange during the second open enrollment period, from November 15 to February 22, 2015, and 83 percent of them qualified for premium subsidies.[44-45] Additionally Ryan White federal funding is in place as payment of last resort for HIV-infected persons who do not qualify for one of these insurance types.[46] Continued enrollment in these insurance programs will mitigate the associated costs of primary and HIV-related care.

The results of this analysis are generalizable to newly diagnosed HIV-infected persons in NJ, as data were available on all cases reported to eHARS. Name-based HIV reporting, collection of CD4+ counts, and HIV VL have been ongoing since 2001in NJ, which has allowed for data collection to stabilize and to enable monitoring of NJ trends. We restricted our analysis to HIV-infected persons who were residents of NJ at diagnosis and as of 12/31/2012. Those whose first positive test was outside NJ may have linked to medical care in the jurisdiction where they had an initial test, and reporting of CD4+ counts and VL for those who left the state would be officially transferred to their new jurisdiction under the CDC's Routine Interstate Duplicate Review. However, as those who moved in and out (INNJ, OUTNJ, and NEITHER in our data) were disproportionately male and white, it is possible that our data underrepresent white MSM who may have greater access to care, in which case their exclusion would result in a minimum estimate for our study parameter of linkage to care.

This analysis is subject to the following limitations. CD4+and HIV viral load were used as surrogate markers for successful linkage to medical care; this could actually underestimate linkage to medical care as HIV-infected persons may have medical care visits without having specimens drawn for testing. Approximately 10-20% of HIV-infected persons did not have HIV VL or CD4+ counts reported to eHARS by December 2012, which may indicate either that they truly were not linked to medical care, that they were linked to medical care in another state and their test results were not forwarded to NJDOH or they declined testing. Despite this limitation, we feel confident in our estimated time to linkage to medical care, as states routinely share data on cases that appear in multiple jurisdictions and apply uniform national criteria to minimize the risks of over counting in the national database and minimize duplication. HIV-infected persons may have received initial laboratory testing in a clinical site at the time of intake and not returned for evaluation by a clinical provider; this would potentially overestimate linkage to care.

Information on the mode of transmission is not complete for all HIV-infected persons due to failure to report behavioral risks on lab and provider reports to eHARS, which likely accounts for increased reports of unreported risk in the database. HIV-infected persons without these reports may reflect risks that are less likely to be reported by HIV-infected persons or providers, like IDU and MSM. Therefore linkage to medical care will be underestimated in these groups. Another variable with an unknown category was test-site, but this was a small number and the results were approximately between that of clinical and non-clinical sites; either way, this is not likely to affect our outcome, linkage to medical care.

In conclusion, NJ has been successful at improving the percentage of HIV-infected persons linked to medical care from 2007-2011. By 2011, there were no differences in linkage to medical care by test-type when test-site was considered. This finding demonstrates that non-clinical sites providing rapid testing have succeeded both in testing NJ populations at risk for HIV and in linking HIV-infected persons to medical care as well as clinical test-sites. Additionally, linkage to medical care from non-clinical sites among HIV-infected persons receiving a rapid test occurred in a shorter time, compared to EIA-WB. Further improvements in linkage to care $\leq$ 90 days of diagnosis can be accomplished by developing linkage programs that encourage same day medical appointments with medical providers, strengthening case management, focusing on high risk population groups, and fostering peer navigation. These strategies will facilitate meeting the goals of NHAS.[47-50]

Table 1.1: Characteristics of HIV-infected persons, by residence at diagnosis and as of 12/31/2012, New Jersey, 2007-2011***

Variable	NJ N (%)	OUTNJ N (%)	INNJ N (%)	Neither N (%)	Total N (%)
Gender					*
Female	1,951 (29.5)	23 (21.7)	50 (16.8)	54 (19.6)	2,078 (28.5)
Male	4,659 (70.5)	83 (78.3)	248 (83.2)	221 (80.4)	5,211 (71.5)
Race/ethnicity					*
Non-Hispanic black	3,417 (51.7)	50 (47.2)	151 (50.7)	147 (53.5)	3,765 (51.7)
Non- Hispanic White	1,214 (18.8)	32 (30.2)	66 (22.2)	74 (26.9)	1,413 (19.4)
Hispanic[a]	1,674 (25.3)	19 (17.9)	68 (22.8)	51 (18.5)	1,812 (24.9)
Other[b]	278 (4.2)	5 (4.7)	13 (4.3)	3 (1.1)	299 (4.1)
Age group (in years)					*
13-24	998 (15.1)	15 (14.2)	70 (23.5)	36 (13.1)	1,119 (15.4)
25-34	1,625 (24.6)	25 (23.6)	91 (30.5)	64 (23.3)	1,805 (24.8)
35-44	1,738 (26.3)	32 (30.2)	74 (24.8)	73 (26.6)	1,917 (26.3)
45-54	1,505 (22.8)	24 (22.6)	42 (14.0)	61 (22.2)	1,632 (22.4)
≥55	744 (11.2)	10 (9.4)	21 (7.0)	41 (14.8)	816 (11.2)
Transmission Risk					*
Male-to-Male sex[c]	1,966 (29.7)	44 (41.5)	131 (44.0)	81 (29.5)	2,222 (30.5)
Injection drug use	436 (6.6)	7 (6.6)	15 (5.0)	11 (4.0)	469 (6.4)
Heterosexual sex	850 (12.9)	8 (7.6)	32 (10.7)	26 (9.5)	916 (12.6)
Unknown[d]	3,358 (50.8)	47 (44.3)	120 (40.3)	157 (57.0)	3,682 (50.5)
Year of Diagnosis					*
2007	1,477 (22.3)	30 (28.3)	88 (29.5)	61 (22.2)	1,656 (22.7)
2008	1,370 (20.7)	30 (28.3)	88 (29.5)	61 (22.2)	1,549 (21.3)
2009	1,370 (20.7)	27 (25.4)	60 (20.1)	65 (23.6)	1,522 (20.9)
2010	1,267 (19.2)	15 (14.2)	36 (12.2)	47 (17.1)	1,365 (18.7)
2011	1,126 (17.1)	4 (3.8)	26 (8.7)	41 (14.9)	1,197 (16.4)
IMPAACT City					*
Yes	3,203 (48.5)		120 (40.3)		3,323 (45.6)
No	3,407 (51.5)	106 (100.0)	178 (59.7)	275 (100.0)	3,966 (54.4)
AIDS					*
Yes	2,377 (36.0)	33 (31.1)	113 (37.9)	62 (22.6)	2,585 (35.5)
No	2,913 (44.1)	89 (68.9)	185 (62.1)	143 (77.4)	5905 (64.4)
Unknown	1,320 (20.0)	23 (21.7)	50 (16.8)	140 (50.9)	1,533 (21.1)
Test-Type					*
EIA-WB	3,936 (59.6)	61 (57.5)	207 (69.5)	124 (45.1)	4,328 (59.4)
Rapid	1,891 (28.6)	31 (29.3)	39 (13.1)	34 (12.4)	1,995 (27.4)
Viral load only	575 (8.7)	11 (10.4)	26 (8.7)	59 (21.5)	671 (9.2)
Doctor's Diagnosis	208 (3.1)	3 (2.8)	26 (8.7)	58 (21.0)	295 (4.0)
Test-Site					*
Corrections	311 (4.7)	2 (1.8)	25 (8.4)	27 (9.7)	365 (5.0)
Emergency Department (Not CTS)	137 (2.1)	2 (1.8)	6 (2.0)	29 (10.6)	174 (2.4)
Emergency Department (CTS)	314 (4.8)	4 (3.8)	3 (1.0)	1 (0.5)	322 (4.4)
Community Based Organizations	1,215 (18.4)	18 (17.0)	25 (8.4)	19 (6.9)	1,277 (17.5)
Inpatient	1,551 (23.5)	28 (26.4)	56 (18.8)	96 (34.9)	1,731 (23.8)
Outpatient	1,163 (17.5)	16 (15.0)	58 (19.4)	30 (10.9)	1,267 (17.4)
Doctors Office	1,609 (24.3)	30 (28.3)	50 (16.8)	59 (21.5)	1,748 (24.0)
Unknown	310 (4.7)	6 (5.9)	75 (25.2)	14 (5.0)	405 (5.5)
Test-Site					*
Clinical	4,771 (72.2)	78 (73.6)	195 (65.4)	241 (87.6)	5,285 (72.5)
Non-clinical	1,529 (23.1)	22 (20.8)	28 (9.4)	20 (7.3)	1,599 (22.0)
Unknown	310 (4.7)	6 (5.7)	75 (25.2)	14 (5.1)	405 (5.5)
HIV Viral Load					*
Yes	5,413 (81.9)	89 (84.0)	260 (87.3)	143 (52.0)	5,905 (81.0)
No	1,197 (18.1)	17 (16.0)	38 (12.7)	132 (48.0)	1,384 (19.0)
CD4+ Count					*
<200	2,377 (36.0)	33 (31.1)	113 (37.9)	62 (22.6)	2,385 (35.5)
200-349	816 (12.3)	9 (8.5)	37 (12.4)	23 (8.4)	885 (12.1)
350-499	827 (12.5)	16 (15.1)	31 (10.4)	11 (4.0)	885 (12.1)
≥500	1,270 (19.2)	25 (23.6)	67 (22.5)	39 (14.2)	1,401 (19.2)
Missing	1,320 (20.0)	23 (21.7)	50 (16.8)	140 (50.8)	1,533 (21.1)
Test-Site*Test-Type					

Clinical- Doctor's Diagnoses	199 (3.0)		22 (7.4)	57 (20.7)	278 (3.8)
Clinical-EIA-WB	3,507 (53.2)	44 (41.5)	140 (47.0)	123 (44.7)	3,814 (52.3)
Clinical-RAPID	557 (8.4)	14(13.2)	14 (4.7)	14 (5.2)	599 (8.2)
Clinical-Viral Load	508 (7.7)	8 (7.5)	20 (6.7)	57 (20.7)	593 (8.1)
Non-Clinical-EIA-WB	243 (3.7)	5 (4.7)	16 (5.4)		264 (3.6)
Non-Clinical-RAPID	1,278 (19.3)	16 (15.1)	14 (4.7)	17 (6.2)	1,325 (18.3)
Non-Clinical-Viral Load	8 (0.1)				8(0.1)
Unknown- Doctor' Diagnoses	8 (0.1)	9 (8.5)			17 (0.2)
Unknown-EIA-WB	186 (2.8)	10(9.5)	47 (15.7)	7 (2.5)	250 (3.4)
Unknown-RAPID	56 (0.8)				71 (1.0)
Unknown-Viral Load	60 (0.9)				70 (1.0)
Total	6,610 (90.7)	106 (1.5)	298 (4.1)	275 (3.7)	7289

Legend Table 1.1

Abbreviations: AIDS: Acquired Immune Deficiency Syndrome

CD4: CD4+ count

HIV: Human Immunodeficiency Virus

N: Number

INNJ: First Positive HIV test not in NJ, but resident as of 12/31/2012

OUTNJ: First Positive HIV test in NJ, but not resident as of 12/31/2012

NJ: First Positive HIV test in NJ and a resident as of 12/31/2012

Neither: First Positive HIV test not in NJ, not a resident as of 12/31/2012

IMPAACT: Intensive Mobilization to Promote AIDS Awareness through Community based Technologies,

EIA-WB: Enzyme Immunoassay HIV test for screening followed by Western Blot for confirmation

Rapid: Rapid HIV test for screening followed by either a second rapid test or Western Blot for confirmation

CTS: Counseling and Testing Site

Non-clinical: CTS and emergency department (ED)-non-CTS

Clinical sites: included correctional facilities, ED-CTS, inpatient medical sites, outpatient medical sites and doctors' offices.

****** $\geq$ 13 years of age at HIV diagnosis, excluded perinatally infected HIV-infected persons diagnosed at any age**

***Chi-square statistically significant at $p < 0.05$**

a Hispanics can be of any race

b Other includes: Asian, American Indian/Alaska native, Native Hawaiian, Multiple Races and unknown race/ethnicity

c Male-to male sex includes HIV-infected persons with Male-to-male sex and injection drug use as these were small in number

d Includes HIV-infected persons with unreported risk

Table 1.2: Characteristics of HIV-infected persons by Test-Type, New Jersey, 2007-2011

Variable	EIA-WB N (%)	Rapid N (%)	Total N (%)
Gender			
Female	1,220 (31.0)	539 (28.5)	1,759 (30.2)
Male	2,716 (69.0)	1,352 (71.5)	4,068 (69.8)
Race/ethnicity		*	
Non-Hispanic black	1,999 (50.8)	1,058 (56.0)	3,057 (52.5)
Non- Hispanic White	819 (20.8)	207 (11.0)	1,026 (17.5)
Hispanic[a]	965 (24.5)	536 (28.2)	1,501 (25.8)
Other[b]	153 (3.9)	90 (4.8)	243 (4.2)
Age group (in years)		*	
13-24	503 (12.8)	431 (22.8)	934 (16.0)
25-34	928 (23.5)	554 (29.3)	1,482 (25.4)
35-44	1,037 (26.4)	468 (24.8)	1,505 (25.8)
45-54	965 (24.5)	314 (16.6)	1,279 (22.0)
$\geq$55	503 (12.8)	124 (6.5)	627 (10.8)
Transmission Risk		*	
Male-to-Male sex[c]	1,000 (25.4)	786 (41.6)	1,786 (30.7)
Injection drug use	232 (5.9)	144 (7.6)	376 (6.5)
Heterosexual sex	498 (12.7)	294 (15.6)	792 (13.6)
Unknown[d]	2,206 (56.0)	667 (35.2)	2,873 (49.3)
IMPAACT City		*	
Yes	1,777 (45.2)	1,115 (59.0)	2,892 (49.6)
No	2,159 (54.8)	776 (41.0)	2,935 (50.4)
AIDS		*	
Yes	1,587 (40.3)	555 (29.3)	2,142 (36.8)
No	1,684 (42.8)	850 (45.0)	2,534 (43.4)
Unknown	665 (16.9)	486 (25.7)	1,151 (19.8)
Test-Site		*	
Clinical	3,507 (89.0)	557 (29.4)	4,064 (69.7)
Non-clinical	243 (6.2)	1,278 (67.9)	1,521 (26.1)
Unknown	186 (4.8)	56 (2.7)	242 (4.2)
HIV Viral Load		*	
Yes	3,287 (83.5)	1,454 (76.8)	4,741 (81.4)
No	649 (16.5)	437 (23.2)	1,086 (18.6)
CD4+ count		*	
<200	1,587 (40.3)	555 (29.4)	2,142 (36.8)
200-349	478 (12.1)	237 (12.5)	715(12.2)
350-499	470 (12.0)	255 (13.5)	725(12.4)
$\geq$500	736 (18.7)	358 (18.9)	1,094 (18.8)
Missing	665 (16.9)	486 (25.7)	1,151(19.8)
Test-Site*Test-Type			
Clinical-EIA-WB	3507 (89.1)		3,507 (60.2)
Clinical-RAPID		557 (29.5)	557 (9.5)
Non-Clinical-EIA-WB	243 (6.2)		243 (4.2)
Non-Clinical-RAPID		1,278 (67.6)	1,278 (21.9)
Unknown-EIA-WB	186 (4.7)		186 (3.2)
Unknown-RAPID		56 (2.9)	56 (1.0)
Total	3,936 (67.6)	1,891 (32.4)	5827

Legend for Table 1.2

Abbreviations

AIDS: Acquired Immune Deficiency Syndrome

CD4: CD4+ count

HIV: Human Immunodeficiency Virus

N: Number

IMPAACT: Intensive Mobilization to Promote AIDS Awareness through Community based Technologies,

EIA-WB: Enzyme Immunoassay HIV test for screening followed by Western Blot for confirmation

Rapid: Rapid HIV test for screening followed by a second rapid test or Western Blot for confirmation

CTS: Counseling and Testing Site

Non-clinical: CTS and emergency department (ED)-non-CTS

Clinical sites: correctional facilities, ED-CTS, inpatient medical sites, outpatient medical sites and doctors' offices

***Chi-square statistically significant at $p < 0.05$**

a Hispanics can be of any race

b Other includes: Asian, American Indian/Alaska native, Native Hawaiian, Multiple Races and unknown race/ethnicity

c Male-to male sex includes HIV-infected persons with Male-to-male sex and injection drug use as these were small in number

d Includes HIV-infected persons with unreported risk

Table 1.3: Characteristics of HIV-infected persons by Test-Site, New Jersey 2007-2011

Variable	Clinical N (%)	Non-Clinical N (%)	Unknown N (%)	Total N (%)
Gender				
Female	1,263 (31.0)	418 (27.5)	78 (32.2)	1,759 (30.2)
Male	2,801 (69.0)	1,103 (72.5)	164 (67.8)	4,068 (69.8)
Race/ethnicity			*	
Non-Hispanic black	2,067 (50.9)	871 (57.3)	119 (49.2)	3,057 (52.5)
Non- Hispanic White	817 (20.1)	158 (10.4)	51 (21.1)	1,026 (17.5)
Hispanic[a]	1,020 (25.0)	422 (27.7)	59 (24.3)	1,501 (25.8)
Other[b]	160 (4.0)	70 (4.6)	13 (5.4)	243 (4.2)
Age group (in years)			*	
13-24	523 (12.9)	380 (25.0)	31 (12.8)	934 (16.0)
25-34	976 (24.0)	446 (29.3)	60 (24.8)	1,482 (25.4)
35-44	1,093 (26.9)	351 (23.0)	61 (25.2)	1,505 (25.8)
45-54	964 (23.7)	258 (17.0)	57 (23.6)	1,279 (22.0)
≥55	508 (12.5)	86 (5.7)	33 (13.6)	627 (10.8)
Transmission Risk			*	
Male-to-Male sex[c]	1,047 (25.8)	677 (44.5)	62 (25.5)	1,786 (30.7)
Injection drug use	254 (6.2)	108 (7.1)	14 (5.8)	376 (6.5)
Heterosexual sex	520 (12.8)	255 (16.8)	17 (7.0)	792 (13.6)
Unknown[d]	2,243 (55.2)	481 (31.6)	149 (61.7)	2,873 (49.3)
IMPAACT			*	
Yes	1,848 (45.5)	931 (61.1)	113 (46.7)	2,892 (49.6)
No	2,216 (54.5)	590 (38.9)	129 (53.3)	2,935 (50.4)
AIDS			*	
Yes	1,643 (41.2)	404 (26.6)	65 (26.9)	2,142 (36.8)
No	1,712 (42.1)	693 (45.5)	129 (53.3)	2,534 (43.)
Unknown	679 (16.7)	424 (27.9)	48 (19.8)	1,151 (19.8)
CD4+ count		*	*	
<200	1,673 (41.2)	404 (26.6)	65 (26.9)	2,142 (36.8)
200-349	481 (11.8)	199 (13.0)	35 (14.5)	715(12.2)
350-499	477 (11.7)	215 (14.2)	33 (13.6)	725(12.4)
≥500	754 (18.6)	279 (18.3)	61 (25.2)	1,094 (18.8)
Missing	679 (16.7)	424 (27.9)	48 (19.8)	1,151(19.8)
Test-Type			*	
EIA-WB	3,507 (86.3)	243 (16.0)	186 (76.9)	3,936 (67.5)
Rapid	557 (13.7)	1,278 (84.0)	56 (23.1)	1,891 (32.5)
Test-Site*Test-Type				
Clinical-EIA-WB	3,507 (86.3)			3,507 (60.2)
Clinical-RAPID	557 (13.7)			557 (9.5)
Non-Clinical-EIA-WB		243 (16.0)		243 (4.2)
Non-Clinical-RAPID		1,278 (84.0)		1,278 (21.9)
Unknown-EIA-WB			186 (76.9)	186 (3.2)
Unknown-RAPID			56 (23.1)	56 (1.0)
Total	4,064 (69.7)	1,521 (26.1)	242 (4.2)	5827

Legend for Table 1.3

Abbreviations: AIDS: Acquired Immune Deficiency Syndrome

CD4+: CD4+ count

HIV: Human Immunodeficiency Virus

N: Number

IMPAACT: Intensive Mobilization to Promote AIDS Awareness through Community based Technologies,

EIA-WB: Enzyme Immunoassay HIV test for screening followed by Western Blot for confirmation

Rapid: Rapid HIV test for screening followed by a second rapid test or Western Blot for confirmation

CTS: Counseling and Testing Site

Non-clinical: CTS and emergency department (ED)-non-CTS

Clinical sites: correctional facilities, ED-CTS, inpatient medical sites, outpatient medical sites and doctors' office

***Chi-square statistically significant at $p < 0.05$**

a Hispanics can be of any race

b Other includes: Asian, American Indian/Alaska native, Native Hawaiian, Multiple Races and unknown race/ethnicity

c Male-to male sex includes HIV-infected persons with Male-to-male sex and injection drug use as these were small in number

d Includes HIV-infected persons with unreported risk

Table 1.4: Percentage of HIV-infected persons Ever Linked to Medical Care, Linked to Medical Care in less than or equal to 90 days after diagnosis and overall median time to Linkage, New Jersey, 2007-2011[¶]

Variable	N	Ever linked to Medical Care % (95% CI)	Linked to Medical Care in ≤ 90 days % (95% CI)	Overall Median (Interquartile Range)
Overall	5827	93.1 (91.8-94.3)	71.6 (70.4-72.8)	20 (3-135)
Test-Type			*	
EIA-WB	3,936	94.9 (93.5-95.9)	74.6 (73.3-76.0)	17 (2-94)
rapid	1,891	88.3 (85.7-90.5)	65.2 (63.6-67.3)	28 (6-276)
Test-site			*	
Clinical	4,064	94.9 (93.4-96.0)	75.9 (74.5-77.2)	16 (2-83)
Non-Clinical	1,521	87.3 (84.3-89.7)	61.0 (59.1-63.4)	34 (10-517)
Unknown	242	97.2 (91.0-99.3)	68.0 (61.7-74.4)	25 (5-168)
Test-site*Test-type			*	
Clinical-EIA-WB	3,507	95.2 (93.8-96.4)	76.4 (75.0-77.8)	15 (2-76)
Clinical-RAPID	557	92.0 (87.8-94.9)	72.6 (68.7-76.1)	17 (2-132)
Non-Clinical-EIA-WB	243	88.9 (82.4-93.1)	54.0 (47.9-60.4)	60 (21-531)
Non-Clinical-RAPID	1,278	86.2 (83.3-88.6)	62.3 (59.7-65.0)	32 (8-510)
Unknown-EIA-WB	186	96.9 (88.9-96.9)	69.6 (62.4-76.0)	24 (6-164)
Unknown-RAPID	56	95.7 (64.8-99.6)	62.0 (48.8-74.0)	29 (2-149)
Gender				
Female	1,759	92.9 (90.5-94.7)	70.2 (68.0-72.3)	24 (4-149)
Male	4,068	93.1 (91.6-94.3)	72.2 (70.8-73.6)	18 (3-131)
Race/ethnicity			*	
Non-Hispanic black	3,057	91.6 (89.5-93.2)	68.0 (66.3-69.6)	23 (3-210)
Non- Hispanic White	1,026	95.2 (92.1-97.7)	77.6 (75.0-80.0)	14 (2-66)
Hispanic[a]	1,501	93.6 (91.6-95.2)	74.3 (72.0-76.4)	19 (3-96)
Other[b]	243	96.7 (91.0)-98.9)	77.0 (71.5-81.3)	18 (1-84)
Age group (in years)			*	
13-24	934	92.7 (86.9-96.0)	67.0 (63.9-70.0)	30 (6-258)
25-34	1,482	90.5 (88.1-92.5)	70.3 (67.9-72.6)	22 (4-152)
35-44	1,505	93.1 (90.6-94.9)	72.0 (69.6-74.2)	19 (3-125)
45-54	1,279	95.6 (93.5-97.0)	75.2 (72.7-77.5)	17 (2-90)
≥55	627	93.1 (90.0-95.3)	73.6 (70.0-77.3)	14 (1-100)
Transmission Risk			*	
Male-to-Male sex[c]	1,786	93.7 (91.7-95.2)	72.4 (70.3-74.4)	20 (5-118)
Injection drug use	376	91.7 (87.8-94.4)	71.4 (66.7-76.0)	18 (2-149)
Heterosexual sex	792	95.2 (92.9-96.7)	73.4 (70.1-76.3)	21 (3-104)
Unknown[d]	2,873	92.5 (90.0-94.3)	70.6 (68.9-72.3)	20 (3-141)
Year of Diagnosis			*	
2007	1,275	92.2 (90.2-92.2)	64.0 (61.2-66.6)	31 (5-239)
2008	1,214	92.1 (87.2-95.1)	71.2 (68.5-73.7)	22 (4-141)
2009	1,244	92.0 (89.3-94.1)	73.0 (70.4-75.7)	18 (3-110)
2010	1,138	90.7 (88.8-92.4)	76.4 (73.8-78.7)	15 (2-76)
2011	956	94.4 (64.0-99.3)	75.0 (72.0-78.0)	15 (2-84)
IMPAACT City			*	
Yes	2,892	92.0 (89.3-94.0)	67.5 (65.7-69.2)	22 (3-205)
No	2,935	94.5 (92.8-95.7)	75.7 (74.1-77.2)	18 (3-85)
AIDS				
Yes	1,643	99.7 (98.8-99.9)	76.1 (74.0-80.0)	16 (2-84)
No	1,712	99.9 (99.3-1.00)	80.0 (78.4-81.5)	18 (5-59)
Unknown	679	46.8 (43.2-50.3)	29.2 (26.5-31.9)	384 (56-1834)

<u>Legend for Table 1.4</u>

Abbreviations: AIDS: Acquired Immune Deficiency Syndrome

HIV: Human Immunodeficiency Virus

N: Number

CI: Confidence Interval

IMPAACT: Intensive Mobilization to Promote AIDS Awareness through Community based Technologies,

EIA-WB: Enzyme Immunoassay HIV test for screening followed by Western Blot for confirmation

Rapid: Rapid HIV test for screening followed by a second rapid test or Western Blot for confirmation

CTS: Counseling and Testing Site

Non-clinical: CTS and emergency department (ED)-non-CTS

Clinical sites: correctional facilities, ED-CTS, inpatient medical sites, outpatient medical sites and doctors' office

¶ Results from cumulative incidence function

*** p value < 0.05 , Gray's Test for equality of Cumulative Incidence curve**

a Hispanics can be of any race

b Other includes: Asian, American Indian/Alaska native, Native Hawaiian, Multiple Races and unknown race/ethnicity

c Male-to male sex includes HIV-infected persons with Male-to-male sex and injection drug use as these were small in number

d Includes HIV-infected persons with unreported risk

Table 1.5: Factors associated with Ever Linked and Linked to Medical Care in less than or equal to 90 days after diagnosis, New Jersey, 2007-2011

	Ever linked to Medical Care		Linked to Medical Care in ≤ 90 days	
Variable	**HR (95% CI)**	**aHR (95% CI)**	**HR (95% CI)**	**aHR (95% CI)**
Test-site*Test-Type				
Clinical-EIA-WB	1.68 (1.46-1.94)	1.61 (1.40-1.86)	2.00 (1.68-2.39)	1.85 (1.55-2.21)
Clinical-RAPID	1.51(1.28-1.78)	1.60 (1.36-1.88)	1.80 (1.48-2.19)	1.82 (1.49-2.22)
Non-Clinical-EIA-WB	1.00	1.00	1.00	1.00
Non-Clinical-RAPID	1.11 (0.96-1.29)	1.33 (1.15-1.55)	1.31 (1.09-1.59)	1.48 (1.23-1.79)
Unknown-EIA-WB	1.44 (1.18-1.77)	1.32 (1.07-1.63)	1.57 (1.23-2.00)	1.46 (1.14-1.86)
Unknown-RAPID	1.47(1.07- 2.01)	1.55 (1.13- 2.11)	1.39 (0.95-2.02)	1.43 (0.98-2.09)
Gender				
Female	0.95 (0.90 -1.01)	0.94 (0.88 -1.01)	0.92 (0.86 -0.98)	0.90 (0.83 -0.97)
Male	1.00	1.00	1.00	1.00
Race/ethnicity				
Non-Hispanic black	0.79 (0.73 - 0.85)	0.90 (0.83 -0.98)	0.78 (0.71 -0.84)	0.89 (0.81 -0.97)
Non- Hispanic White	1.00	1.00	1.00	1.00
Hispanic[a]	0.91 (0.84 - 0.99)	0.96 (0.88 - 1.04)	0.89 (0.81 - 0.97)	0.93 (0.80 - 1.10)
Other[b]	0.99 (0.86 - 1.15)	0.93 (0.80 - 1.08)	0.95 (0.81 - 1.11)	0.93 (0.80 - 1.10)
Age group (in years)				
13-24	0.76 (0.68 -0.85)	0.83 (0.74-0.93)	0.75 (0.67 -0.85)	0.86 (0.76-0.98)
25-34	0.84 (0.76 -0.93)	0.90 (0.81 -1.00)	0.84 (0.76 -0.94)	0.91 (0.81 -1.02)
35-44	0.91 (0.82 -1.00)	0.91 (0.82 -1.01)	0.90 (0.81 -1.01)	0.92 (0.82 -1.03)
45-54	0.98 (0.88 -1.08)	0.94 (0.84 -1.04)	0.98 (0.87 -1.09)	0.96 (0.85 -1.07
≥55	1.00	1.00	1.00	1.00
Transmission Risk				
Male-to-Male sex[c]	0.95 (0.87 -1.04)	1.03 (0.93 -1.13)	0.98 (0.89 -1.08)	1.01 (0.90 -1.12)
Injection drug use	0.93 (0.82 -1.06)	0.96 (0.84 -1.10)	0.98 (0.85 -1.13)	0.98 (0.84 -1.13)
Heterosexual sex	1.00	1.00	1.00	1.00
Unknown[d]	0.91 (0.83-0.98)	1.00 (0.92-1.09)	0.97(0.89-1.07)	1.02 (0.93-1.12)
Year of Diagnosis				
2007	1.00	1.00	1.00	1.00
2008	1.08 (0.99 -1.17)	1.11 (1.02 -1.20)	1.21 (1.10 -1.34)	1.11 (1.02 -1.20)
2009	1.18 (1.08 -1.28)	1.23 (1.13 -1.34)	1.30 (1.18 -1.43)	1.23 (1.13 -1.34)
2010	1.31 (1.20 -1.43)	1.35 (1.24 -1.48)	1.44 (1.30 -1.58)	1.35 (1.24 -1.48)
2011	1.29 (1.18 -1.41)	1.37 (1.25-1.51)	1.40 (1.26 -1.55)	1.37 (1.25-1.51)
IMPAACT				
Yes	0.86 (0.82 - 0.91)	0.95 (0.89 - 1.00)	0.84 (0.79 - 0.90)	0.94 (0.88 - 1.00)
No	1.00	1.00	1.00	1.00
AIDS				
Yes	1.00	1.00	1.00	1.00
No	0.89 (0.84- 0.94)	0.91 (0.86- 0.97)	0.85 (0.79- 0.90)	0.88 (0.82- 0.94)
Unknown	0.13 (0.12- 0.15)	0.14 (0.12- 0.15)	0.18 (0.16- 0.20)	0.19 (0.17- 0.21)
Test-Type				
EIA-WB	1.00		1.00	
Rapid	0.76 (0.72-0.81)		0.76 (0.71-0.81)	
Test-Site				
Clinical	1.00		1.00	
Non-clinical	0.66 (0.61- 0.70)		0.64 (0.59- 0.69)	
Unknown	0.87 (0.76- 1.00)		0.77 (0.66- 0.91)	

<u>Legend for Table 1.5</u>

Abbreviations: AIDS: Acquired Immune Deficiency Syndrome

HIV: Human Immunodeficiency Virus

CI: Confidence Interval

HR: Hazard Ratio

aHR: adjusted Hazard Ratio

IMPAACT: Intensive Mobilization to Promote AIDS Awareness through Community based Technologies,

EIA-WB: Enzyme Immunoassay HIV test for screening followed by Western Blot for confirmation

Rapid - Rapid HIV test for screening followed by a second rapid or followed by Western Blot for confirmation

CTS - Counseling and Testing Site

Non-clinical - CTS and emergency department (ED)-non-CTS

Clinical sites - correctional facilities, ED-CTS, inpatient medical sites, outpatient medical sites and doctors' offices

a Hispanics can be of any race

b Other includes: Asian, American Indian/Alaska native, Native Hawaiian, Multiple Races and unknown race/ethnicity

c Male-to male sex includes HIV-infected persons with Male-to-male sex and injection drug use as these were small in number

d Includes HIV-infected persons with unreported risk

Table 1.6a: Adjusted Hazard Ratios: Ever Linked to Medical Care, stratified by year of diagnosis, New Jersey, 2007-2011

	2007	2008	2009	2010	2011
Variable	**aHR (95% CI)**	**aHR (95% CI)**	**aHR (95% CI)**	**aHR (95% CI)**	**aHR (95% CI)**
Test-site*Test-Type					
Clinical-EIA-WB	1.47 (1.20-1.81)	1.10 (0.81-1.50)	2.06 (1.34-3.16)	1.67 (0.92-2.92)	1.47 (0.87-2.48)
Clinical-RAPID	1.47 (1.10-1.96)	0.91 (0.63-1.31)	1.91 (1.20-3.04)	1.65 (0.91-3.00)	1.37 (0.79-2.38)
Non-Clinical-EIA-WB	1.00	1.00	1.00	1.00	1.00
Non-Clinical-RAPID	1.47 (1.10-1.96)	0.81 (0.58-1.12)	1.43 (0.92-2.21)	1.40 (0.78-2.49)	1.37 (0.80-2.33)
Unknown-EIA-WB	1.09 (0.84-1.41)	0.41 (0.21-0.77)	1.01 (0.54-1.88)	1.54 (0.82-2.92)	1.22 (0.70-2.15)
Unknown-RAPID	0.66 (0.24-1.80)	4.23 (1.01-17.68)	2.85 (0.97-8.37)	1.22 (0.57-2.63)	1.14 (0.60-2.16)
Gender					
Female	0.95 (0.82 -1.09)	0.95 (0.82 -1.09)	0.96 (0.82 -1.11)	1.02 (0.87 -1.19)	0.84 (0.71 -1.00)
Male	1.00	1.00	1.00	1.00	1.00
Race/ethnicity					
Non-Hispanic black	0.93 (0.78 - 1.11)	0.79 (0.65-0.95)	0.82 (0.69-0.97)	0.99 (0.82-1.20)	1.11 (0.91-1.35)
Non- Hispanic White	1.00	1.00	1.00	1.00	1.00
Hispanic[a]	1.06 (0.88 - 1.28)	0.76 (0.63-0.93)	0.93 (0.77-1.12)	1.02 (0.84- 1.24)	1.06 (0.86-1.31)
Other[b]	1.24 (0.91 - 1.69)	0.81 (0.56-1.15)	0.76 (0.56-1.03)	0.87 (0.61-1.24)	1.08 (0.74-1.59)
Age group (in years)					
13-24	0.74 (0.57 -0.97)	0.68 (0.52 -0.89)	1.04 (0.81 -1.34)	0.85 (0.67-1.08)	0.92 (0.70-1.22)
25-34	0.81 (0.64 -1.02)	0.70 (0.55 -0.88)	1.12 (0.89 -1.40)	1.10 (0.89 -1.37)	0.98 (0.76-1.26)
35-44	0.88 (0.70 -1.10)	0.69 (0.55 -0.87)	1.24 (0.99 -1.56)	0.98 (0.79 -1.21)	1.09 (0.85-1.41)
45-54	0.82 (0.65 -1.03)	0.75 (0.59 -0.94)	1.08 (0.87 -1.35)	1.15 (0.93 -1.43)	1.08 (0.84 -138)
≥55	1.00	1.00	1.00	1.00	1.00
Transmission Risk					
Male-to-Male sex[c]	1.08 (0.87 -1.33)	0.94 (076 -1.16)	0.99 (079 -1.23)	1.06 (0.84 -1.32)	0.91 (0.70-1.20)
Injection drug use	1.00 (0.77 -1.30)	0.95 (0.72 -1.26)	0.95 (0.72 -1.25)	0.93 (0.81 -1.57)	0.94 (0.63 -1.39)
Heterosexual sex	1.00	1.00	1.00	1.00	1.00
Unknown[d]	1.04 (0.87-1.24)	0.94 (0.79-1.12)	1.01 (0.83-1.21)	0.92 (0.76-1.12)	0.99 (0.79-1.25)
IMPAACT					
Yes	0.99 (0.87-1.12)	0.94 (0.83-1.07)	1.01 (0.89-1.15)	0.91 (0.80-1.04)	0.88 (0.76 -1.02)
No	1.00	1.00	1.00	1.00	1.00
AIDS					
Yes	1.00	1.00	1.00	1.00	1.00
No	0.90 (0.79- 1.02)	0.94 (0.82- 1.02	0.87 (0.76- 0.98)	0.87 (0.76- 0.98)	0.88 (0.76-1.02)
Unknown	0.14 (0.11- 0.17)	0.11 (0.08- 0.14)	0.13 (0.10- 0.17)	0.12 (0.10- 0.16)	0.13 (0.10- 0.17)

Legend for Table 1.6a

Abbreviations: AIDS: Acquired Immune Deficiency Syndrome

HIV: Human Immunodeficiency Virus

CI- Confidence Interval

aHR- adjusted Hazard Ratio

IMPAACT: Intensive Mobilization to Promote AIDS Awareness through Community based Technologies,

EIA-WB: Enzyme Immunoassay HIV test for screening followed by Western Blot for confirmation

Rapid: Rapid HIV test for screening followed by a second rapid test for immediate confirmation or followed by Western Blot for confirmation

CTS: Counseling and Testing Site

Non-clinical: CTS and emergency department (ED)-non-CTS

Clinical sites: correctional facilities, ED-CTS, inpatient medical sites, outpatient medical sites and doctors' offices

a Hispanics can be of any race

b Other includes: Asian, American Indian/Alaska native, Native Hawaiian, Multiple Races and unknown race /ethnicity

c Male-to male sex includes HIV-infected persons with Male-to-male sex and injection drug use as these were small in number

d Includes HIV-infected persons with unreported risk

Table 1.6b: Adjusted Hazard Ratios: Linked to Medical Care, in less than or equal to 90 days, stratified by year of diagnosis, New Jersey, 2007-2011

Variable	2007 aHR (95% CI	2008 aHR (95% CI	2009 aHR (95% CI	2010 aHR (95% CI	2011 aHR (95% CI
Test-site*Test-Type					
Clinical-EIA-WB	1.85 (1.40-2.40)	1.02 (0.73-1.42)	1.85 (1.40-2.40)	1.56 (0.87-2.78)	1.56 (0.87-2.78)
Clinical-RAPID	2.01(1.41-2.87)	0.77 (0.51-1.15)	2.01(1.41-2.87)	1.61(0.88-2.94)	1.61(0.88-2.94)
Non-Clinical-EIA-WB	1.00	1.00	1.00	1.00	1.00
Non-Clinical-RAPID	1.11 (0.96-1.29)	0.70 (0.48-1.00)	1.11 (0.96-1.29)	1.27 (0.71-2.28)	1.27 (0.71-2.28)
Unknown-EIA-WB	1.27 (0.90-1.79)	0.20 (0.71-0.57)	1.27 (0.90-1.79)	1.35 (0.70-2.59)	1.35 (0.70-2.59)
Unknown-RAPID	0.40 (0.01-1.66)	4.00 (0.94-16.6)	1.39 (0.95-2.02)	0.88 (0.37-2.12)	0.88 (0.37-2.12)
Gender					
Female	0.89 (0.75 -1.05)	0.92 (0.78 -1.08)	0.88 (0.75-1.04)	1.00 (0.84 -1.18)	0.81(0.67-0.98)
Male	1.00	1.00	1.00	1.00	1.00
Race/ethnicity					
Non-Hispanic black	0.92 (0.73 - 1.13)	0.79 (0.65 -0.97)	0.80 (0.67-0.97)	0.90 (0.74-1.11)	1.10 (0.89-1.36)
Non- Hispanic White	1.00	1.00	1.00	1.00	1.00
Hispanic[a]	1.05 (0.85 -1.30)	0.74 (0.60 - 0.92)	0.93 (0.76-1.14)	0.97 (0.79-1.19)	1.00 (0.79-1.25)
Other[b]	1.20 (0.85 - 1.17)	0.88 (0.60 - 1.30)	0.74 (0.53-1.03)	0.92 (0.63-1.36)	1.03 (0.69-1.56)
Age group (in years)					
13-24	0.76 (0.56 -1.04)	0.75 (0.56-1.00)	1.05 (0.79-1.40)	0.89 (0.68-1.16)	1.00 (0.74-1.36)
25-34	0.76 (0.58 -1.00)	0.69 (0.53-0.89)	1.15 (0.89-1.48)	1.18 (0.94-1.50)	1.04 (0.80-1.37)
35-44	0.86 (0.66 -1.11)	0.68 (0.53-0.87)	1.33 (1.04-1.70)	1.00 (0.80-1.27)	1.12 (0.85-1.47)
45-54	0.85(0.64 -1.11)	0.76 (0.59-0.97)	1.11(0.87 -1.42)	1.21 (0.96-1.54)	1.09 (0.83-1.42)
≥55	1.00	1.00	1.00	1.00	1.00
Transmission Risk					
Male-to-Male sex[c]	1.01 (0.79 -1.29)	0.93 (0.73-1.18)	0.96 (0.75-1.22)	1.10 (0.86-1.40)	0.91 (0.69-1.20)
Injection drug use	1.01 (0.75 -1.38)	0.96 (0.71-1.32)	0.99 (0.73-1.35)	1.12 (0.79-1.61)	0.91 (0.60-1.38)
Heterosexual sex	1.00	1.00	1.00	1.00	1.00
Unknown[d]	1.02 (0.83-1.26)	1.00 (0.83-1.22)	1.04 (0.85-1.29)	0.97 (0.78-1.20)	0.97 (0.76-1.25)
IMPAACT					
Yes	0.94 (0.82 - 1.09)	0.95 (0.83-1.10)	1.06 (0.92-1.22)	0.90 (0.78- 1.03)	0.87(0.74-1.02)
No	1.00	1.00	1.00	1.00	1.00
AIDS					
Yes	1.00	1.00	1.00	1.00	1.00
No	0.89 (0.76- 1.03)	0.86 (0.74-1.00)	0.84 (0.73-0.97)	0.85 (0.74-0.99)	0.82 (0.70-0.97)
Unknown	0.22 (0.17- 0.29)	0.17 (0.13- 0.22)	0.19 (0.14- 0.24)	0.17 (0.13- 0.22)	0.17 (0.13- 0.22)

Legend for Table 1.6b

Abbreviations: AIDS: Acquired Immune Deficiency Syndrome

HIV: Human Immunodeficiency Virus

CI: Confidence Interval

aHR: adjusted Hazard Ratio

IMPAACT: Intensive Mobilization to Promote AIDS Awareness through Community based Technologies,

EIA-WB: Enzyme Immunoassay HIV test for screening followed by Western Blot for confirmation

Rapid: Rapid HIV test for screening followed by a second rapid test or Western Blot for confirmation

CTS: Counseling and Testing Site

Non-clinical: CTS and emergency department (ED)-non-CTS

Clinical sites: correctional facilities, ED-CTS, inpatient medical sites, outpatient medical sites and doctors' offices

a Hispanics can be of any race

b Other includes: Asian, American Indian/Alaska native, Native Hawaiian, Multiple Races and unknown race/ethnicity

c Male-to male sex includes HIV-infected persons with Male-to-male sex and injection drug use as these were small in number

d Includes HIV-infected persons with unreported risk

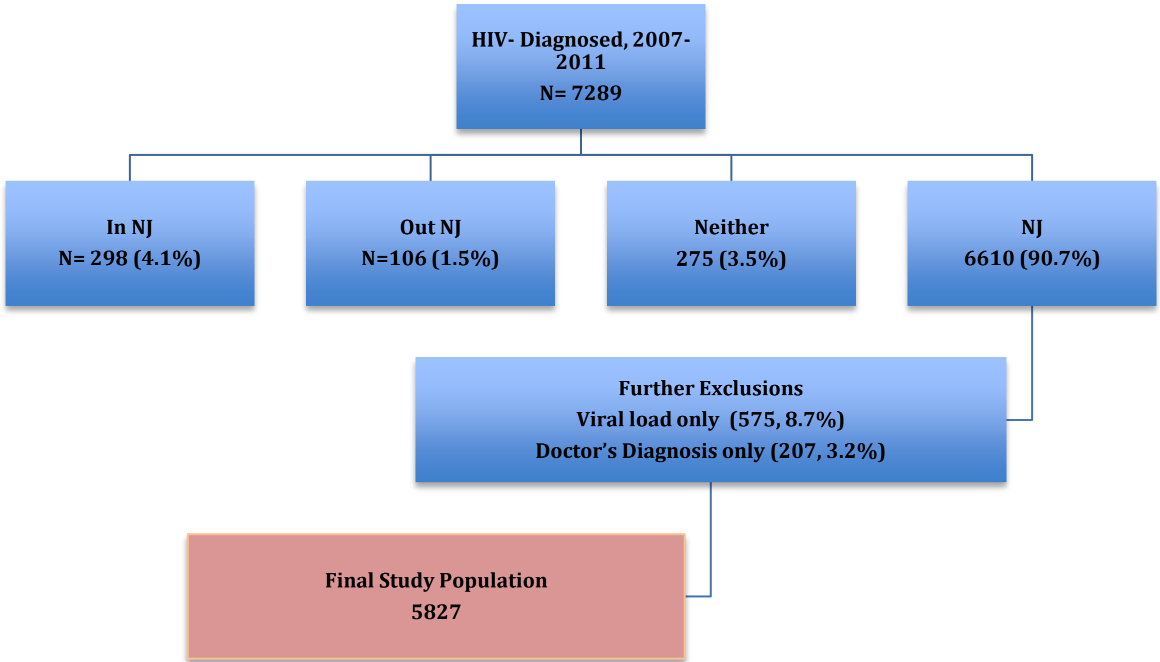
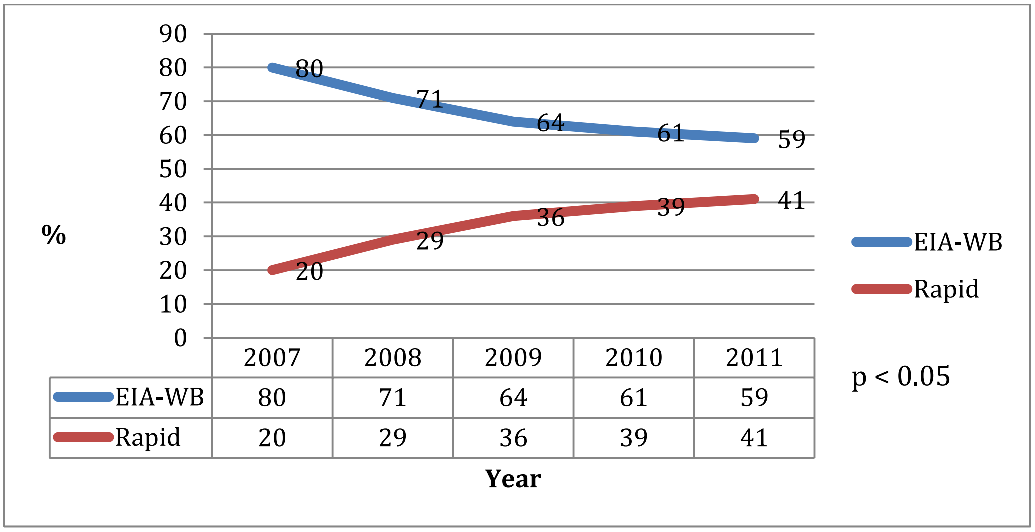


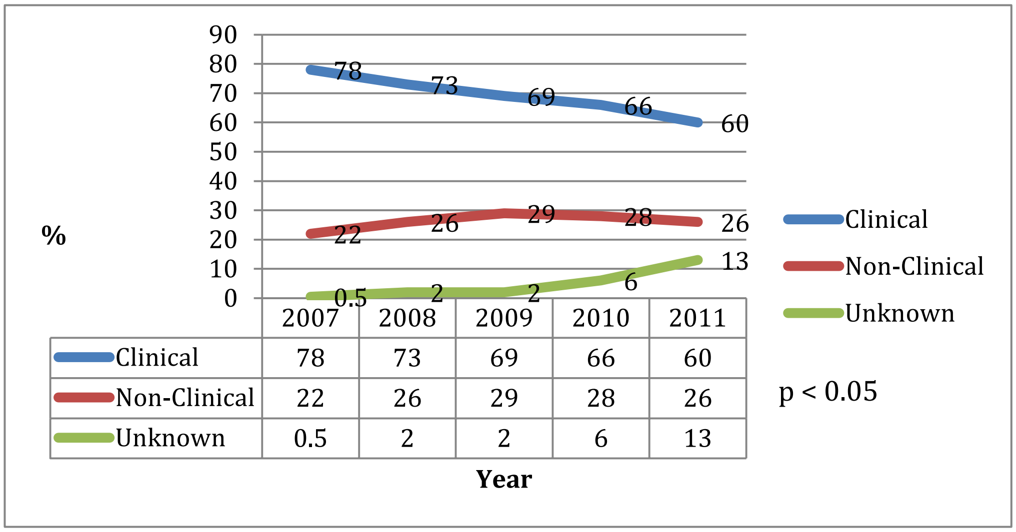
Figure 1.1: Newly Diagnosed, HIV-infected persons, alive, aged ≥ 13 years at diagnosis, New Jersey, 2007-2011

<u>Legend Figure 1.1</u>
Abbreviations
HIV- human Immunodeficiency Virus
N - Number
INNJ - First Positive HIV test not in NJ, but NJ resident as of 12/31/2012
OUTNJ - First Positive HIV test in NJ, but not NJ resident as of 12/31/2012
NJ- First Positive HIV test in NJ and a NJ resident as of 12/31/2012
Neither- First Positive HIV test not in NJ, not a NJ resident as of 12/31/2012



	2007	2008	2009	2010	2011
EIA-WB	80	71	64	61	59
Rapid	20	29	36	39	41

Figure 1.2a: Percentage of Newly Diagnosed, HIV-infected persons, by Test-Type, New Jersey, 2007-2011



	2007	2008	2009	2010	2011
Clinical	78	73	69	66	60
Non-Clinical	22	26	29	28	26
Unknown	0.5	2	2	6	13

Figure 1.2b: Percentage of Newly Diagnosed, HIV-infected persons, by Test-Site, New Jersey, 2007-2011

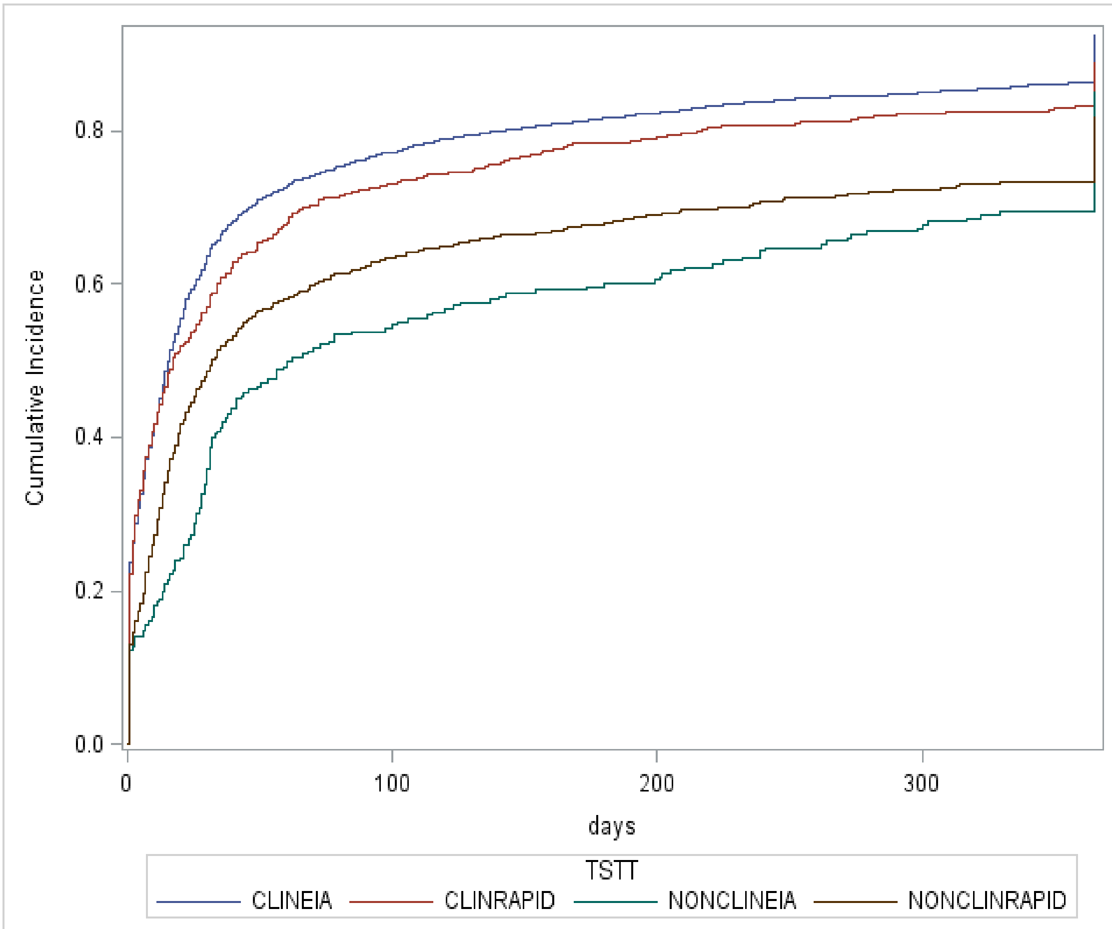


Figure 1.3: Time to Linkage to Medical Care by Test-Site*Test-type, New Jersey 2007-2011, p<0.05

<u>Legend Figure 1.3</u>
Abbreviations
TSTT: Test-Site*Test-Type
CLINEIA: Clinical site, Enzyme ImmunoAssay test followed by a Western Blot for confirmation
CLINRAPID: Clinical Site, Rapid test followed by a second rapid or Western Blot for confirmation
NONCLINEIA: Non-clinical site, Enzyme ImmunoAssay test followed by a Western Blot for confirmation
NONCLINRAPID: Non-clinical site, Rapid test followed by a second rapid test or a Western Blot for confirmation

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ENGAGEMENT (2009) AND RETENTION IN MEDICAL CARE (2010-2011)

Background

Human Immunodeficiency Virus (HIV) causes a chronic infection that may progress to an Acquired Immunodeficiency Syndrome (AIDS), characterized by severe opportunistic infections, resulting in substantial morbidity and premature death.[1] At the end of 2011, there was an estimated 1.2 million living HIV-infected persons, aged ≥13 years, of whom 14% were not aware of their sero-status, and only 40% were engaged in medical care, defined as having had a medical visit from January-April.[2]

A surrogate marker for medical visits at the population level is the report of a CD4+ count and/or HIV viral load (VL) to the Department of Health in a particular jurisdiction.[3] These tests are used in the evaluation of immune and disease status of HIV-infected persons. In population-based studies, engagement is defined as having reports of one or both of these laboratory tests in a specified period. Retention in care is defined as having reports of one or both of these laboratory tests in a specified time interval after engagement.

There are medical and public health benefits to being engaged and retained in medical care for HIV-infected persons. Antiretroviral therapy (ART) is available, which leads to a suppressed HIV VL (< 200 copies/ml /*ul*), decreased morbidity and mortality, prevention of opportunistic infections, and reduction in the transmission of infection perinatally and to sexual and injection drug using (IDU) partners.[4-7] The receipt of ART allows HIV-infected persons to have a normal life expectancy.[8] It is estimated that a 20-year-old HIV-infected person on ART in the United States (U.S) can live into their early 70's, similar to the general population. The reduction in HIV VL and the potential for decreased transmission has led to the development of treatment as prevention (TasP) and the recommendation of universal ART to all HIV-infected persons. [3,8-9]

Previous population- based studies in the U.S have found that 50 % of HIV-infected persons were not engaged and retained in medical care in any given year.[10] Louisiana reported that 45% of living HIV-infected persons were not in medical care in 2002, with higher proportions among those living with HIV (57%) than living with AIDS (33%).[11] In North Carolina from 2004-2006, the percentage of HIV-infected persons in care during any single year ranged from 44.0%-50.1%.[12] In comparison, San Francisco recently reported that 18.7% of HIV infected HIV-infected persons were not in medical care, which is markedly lower than other jurisdictions.[13] In other studies that examined engagement and retention in medical care over two or three years, similar percentages were observed. From 2004-2006, 40% of HIV-infected persons were not engaged in medical care, and an additional 25% had only one medical visit in this interval in South Carolina; in New York City (NYC), among newly diagnosed persons in 2005, and followed through 2009, (54.6%) were not engaged in medical care.[14-15]

On July 13, 2010, the White House released a roadmap for HIV prevention and care in response to a directive by President Obama.[16] Among HIV-infected persons enrolled in Ryan White HIV/AIDS Programs specifically, the National HIV/AIDS Strategy (NHAS) set clear and measurable targets to be achieved by 2015, with retention in care expected to improve from 73% to 80%.

Engagement (2009) and retention in medical care (2010-2011), among a cohort of living New Jersey (NJ) HIV-infected persons were evaluated as follows:

1) Among HIV-infected persons living in 2009, we described the demographic, transmission risk and geographic characteristics of those engaged in medical

care (≥ 1 CD4+ count or HIV VL).

2) We also sought to identify the factors associated with engagement in medical care in 2009, by demographic, transmission risk and geographic factors.

3) Among HIV-infected persons engaged in medical care in 2009, we evaluated the percentage retained in medical care (≥ 1 CD4+ count or HIV VL reported, in each six-month period), 2010-2011, by funding source.

4) We also sought to identify the predictors for retention in medical care in 2010-2011, by demographic, transmission risk, geographic factors, and funding source.

Ethics Statement

Approval for this study was obtained from Rutgers University and the New Jersey Department of Health (NJDOH) Institutional Review Boards.

Methods

Data Sources

Data for this study were obtained from the NJDOH Enhanced HIV/AIDS Reporting System (eHARS). AIDS has been a reportable condition since 1981, in all 50 states, the District of Columbia and U.S. dependencies (American Samoa, Guam, the Northern Mariana Islands, Puerto Rico, and the U.S. Virgin Islands).[17] Since 1985, HIV case reporting has been part of several states' comprehensive HIV/AIDS surveillance systems. As of April 2008, all states, dependent territories and the District of Columbia have successfully implemented name-based HIV case reporting as an extension of their AIDS case reporting system.[18] In NJ, HIV case reporting was implemented in 1992 and laboratory reporting of CD4+ counts and VL from 2000.

eHARS is a secure, relational database accessed by a Web browser that facilitates monitoring, review, and analysis of discrete events over time. The Centers for Disease Control and Prevention (CDC) calls this "document-based surveillance".[19] Laboratory reporting complements case reports submitted by hospitals and health care providers. The NJDOH submits de-identified data electronically on a monthly basis to CDC's national database through a secure data network. Vital status is updated through quarterly matches to the NJ Death Registry and yearly to the National Death Index. Data for this analysis is current as of December 31, 2012. Study observations from eHARS were de-identified and assigned a random unique identifying number by staff at NJDOH. The link between data from eHARS and the de-identified database was kept in a secure location inaccessible to the researchers. Data were analyzed at a designated NJDOH site on a computer that did not have Internet access.

Eligibility Criteria

Of all HIV/AIDS cases reported to NJDOH, eligibility was determined by a) state of initial HIV test and b) state of last known residence, as of 12/31/2012). Cases were excluded if they were non-NJ residents at the time of the first HIV-positive test or as of 12/31/2012. We used 2009 as the baseline year in order to examine retention in care in four half-year intervals during 2010 and 2011. We selected those who had $\geq$ 1 CD4+ count or VL during 2009 and were alive as of 12/31/2009 for inclusion in the observational interval. This is the most recent time interval for which complete data were available in eHARS at the time of this analysis. This time interval (2010-2011) was relatively stable in terms of treatment options, side effects to medications were minimal and compared to previous years when treatment options were frequently changing.

We excluded cases incarcerated in 2009 due to small numbers and limited generalizability and because prevention and medical care were managed by the Department of Corrections. Other cases excluded had a VL > 20,000,000 copies/ml in 2009, as these were extreme outliers, and perinatally acquired HIV infection regardless of the year of diagnosis. Similarly to the methods reported by Tripathi et al, cases reported as deceased during 2010 and 2011, as of 12/31/2012, were excluded after evaluation of their demographic, transmission risk and geographic characteristics.[12]

Analytic Variables

Outcome Variables: Engagement in medical care, a binary variable (Yes, No), was constructed from the presence of at least one VL or CD4+ count report in eHARS in 2009, and if more than one report was available, then the most recent report for 2009 was selected**.** Retention was defined as the presence of $\geq$ one CD4+ count or VL in eHARS in each six-month interval within two years (January 2010-December 2011). This was categorized into four groups similar to previous evaluations: optimal (visits in four out of four 6-month intervals), sub-optimal (visits in three out of four 6-month intervals), sporadic (visits in two or one out of four 6-month intervals) and dropout (no visits in any of the 4 intervals).[12, 20-22]

Covariates: These included demographic, transmission risks and geographic factors. Demographic variables include age-group (13-24, 25-34, 35-44, 45-54, $\geq$55 years), gender (male, female), and race/ethnicity (non-Hispanic black, non-Hispanic white, Hispanic (any race) and other (which included Asian, American Indian/Alaska Native, Native Hawaiian, multiple races and unknown). Transmission risk factors were assigned based on CDC's hierarchy of risk: males who have sex with males (MSM), IDU, heterosexual and other.[23] Men who inject drugs and have sex with men were combined with MSM in our analyses due to small numbers (n= 859, 2.4%).

Residence as of December 31, 2012 was used to determine geographic and city variables. The Intensive Mobilization to Promote AIDS Awareness through Community-based Technologies (IMPAACT) initiative is a NJ initiated city-by-city community mobilization initiative designed to galvanize and support African-American Leaders in reducing the spread of HIV/AIDS in cities with the highest prevalence of HIV/AIDS.[24] These cities include Atlantic City, Camden, Jersey City, Elizabeth, New Brunswick, Plainfield, Paterson, Newark, Asbury Park and Trenton. An additional binary geographic variable was created: IMPAACT city (yes, no). The category “Yes” signifies designation as an IMPAACT city and “No” includes residence outside of an IMPAACT city. Models with county residence were also estimated. Other variables were AIDS diagnosis (yes, no), number of years since initial HIV/AIDS diagnosis (0-4, $\geq$ 5), and funding (public, private, and unknown). Funding or insurance source is collected at the time of HIV/AIDS diagnosis when available. Data on public funding sources are updated via yearly matches between the NJ Medicaid utilization review database and eHARS and identified all HIV-infected persons who received ART through publicly funded programs in the respective year. Unknown included HIV-infected persons without any reported funding source.

Data Analysis

Eligible HIV-infected persons were diagnosed at aged $\geq$ 13 years, had $\geq$ one CD4+ count or VL during 2009 and were alive as of 12/31/2011. They were NJ residents at the time of the initial positive HIV test and as of 12/31/2012. Engagement and retention in medical care were evaluated by demographic, transmission risk and geographic characteristics. Differences between groups were tested using $\chi 2$ tests of association with a p-value < 0.05 being statistically significant. Percentages and 95% confidence intervals (CI) were calculated for engagement in medical care. The relative risks (RR), adjusted RR (aRR) and 95% CI were calculated for engagement and retention in medical care by exponentiating the coefficients from a generalized linear model with a log link and binomial outcome distribution. For the retention in care analysis, three models were estimated: one for each comparison between optimal retention and the three other retention categories (suboptimal, sporadic and dropout). For the aRR evaluation for retention in care, all variables were included in the model as they were statistically significant or deemed to be epidemiologically significant. All statistical analyses were performed using SAS version 9.4 (SAS Institute, Cary NC, USA).

Results

A total of 36,763 living HIV-infected persons, diagnosed at ≥13 years of age were reported to NJDOH as of December 31, 2009. HIV-infected persons excluded from this analysis were incarcerated (n=579) or had a viral load > 20 million (n=6) (Figure 3.1). Of 36,178 HIV-infected persons, (2,336, 6.5%) were non-NJ residents at the time of diagnosis, or as of December 31st 2012 (1,340, 3.7%) or were not residents at either time (1,201, 3.3%) (Table 2.1a). When compared to NJ residents, they were more likely to be male, white, not in medical care in 2009, and to reside in an unknown county on 12/31/2012; in addition, they represented 13.5% of all HIV-infected persons in 2009.

Independent predictors for dying in 2010-2011were older age (45-54 or ≥ 55 years), IDU, diagnosed five or more years prior, residence in an IMPAACT city, and receipt of medical care in 2009 (Table 2.1b). Hispanic or other race/ethnicity and those with a non-AIDS diagnosis were less likely to die during 2010-2011. Those dying during 2010 or 2011were also excluded (n=1,407) (Table 2.1b, Figure 2.1). The population analyzed included 29,894 living HIV-infected persons whose initial positive HIV test was in NJ and who were residents as of 12/31/2012.

Engagement in Medical Care, 2009

Viral loads (VL) and CD4+ counts were available for 14,221 (47.6%, 95% CI: 47.0, 48.1) HIV-infected persons in 2009 (Table 2.2). Higher percentages of HIV-infected persons with public funding were engaged in medical care compared to overall, (63.3% vs. 47.6%). They were more likely to be engaged in medical care regardless of the number of years since diagnosis compared to those with public funding. HIV-infected persons less likely to be engaged in medical care were non-Hispanic black, Hispanic, older (25-34, 35-44, 45-54, > 55 years), with reported IDU, who resided in an IMPAACT city or had a non-AIDS diagnosis. Stratifying by number of years since diagnosis revealed additional relationships. Among HIV-infected persons diagnosed 0-4 years ago, females, non-Hispanic blacks, those aged 35-44 years, IDU, heterosexuals, and with a non-AIDS diagnosis were less likely to be in care. However, among those diagnosed ≥ 5 years, females, non-Hispanic blacks, IDU and heterosexuals were more likely to be in engaged in medical care. In comparison, Hispanics, those older (25-34, 35-44, 45-54, > 55 years) and those with a non-AIDS diagnosis were less likely to be in engaged in medical care.

Retention in care from 2010-2011

At least one-third of HIV-infected persons, engaged in medical care in 2009, were optimally retained in 2010-2011, and included more than 40% of HIV-infected persons living in the following IMPAACT cities: Atlantic City, Paterson, or Trenton (Table 2.3a). Higher percentages of Hispanics, those aged 45-54 or ≥ 55 years, with a reported risk of IDU or heterosexual contact, diagnosed ≥ 5 years ago, with public funding, and resident in an IMPAACT city were optimally retained in medical care. Higher percentages of HIV-infected persons, aged 13-24 or 25-34, those diagnosed 0-4 years ago, resident in Camden-an IMPAACT city, or with a non-AIDS diagnosis dropped out of care (did not have any medical visits during 2010-2011).

When compared to optimal retention, those who reported IDU or heterosexual contact or had a non-AIDS diagnosis were more likely to dropout of medical care. (Table 2.3b). HIV-infected persons more likely to be sporadic or sub-optimally retained in care were diagnosed 0-4 years ago and did not have an AIDS diagnosis compared to those optimally retained in medical care. Those less likely to dropout were older (aged 45-54 or ≥ 55) and had public funding.

In models adjusted for gender, race/ethnicity, age-group, transmission risk, number of years since diagnosis, funding, IMPAACT City, and AIDS, HIV-infected persons more likely to dropout of medical care were non-Hispanic blacks, diagnosed 0-4 years ago, with a non-AIDS diagnosis (Table 2.3c). Those who were older (aged 35-44,45-54, and ≥ 55), with reported heterosexual sex and public funding were less likely to dropout of medical care. Sporadic retention in medical care was more likely among those with a non-AIDS diagnosis. Those less likely to be sporadic compared to optimally retained were Hispanics, older 25-34, 35-44,45-54, and ≥ 55), heterosexual, had public funding and resided in an IMPAACT city. Suboptimal retention was associated with non-Hispanic blacks and those with a non-AIDS diagnosis. Those with reports of heterosexual sex were less likely to be suboptimally retained.

Discussion

Overall

Of 29,894 NJ HIV-infected persons living with HIV/AIDS in 2009, 14,221 (47.6%) were engaged in medical care. This is lower than reported by CDC for HIV-infected persons in thirteen U.S areas (58.6%) but similar to estimated results using combined data from the National HIV Surveillance System and the Medical Monitoring Project (45.0%). [25-26] Optimal retention in medical care in the two-year follow up interval, 2010-2011, was similar to previous reports in South Carolina; among HIV-infected persons in medical care in 2003 and followed from 2004-2006, 34.7% were retained across all three years.[14] Among HIV-infected persons who initiated care during 2005-2007, 49.7% were optimally retained in care over a two-year follow up interval in North Carolina.[12] Similarly in NYC, among those diagnosed in 2005 who initiated care, 45.5% were retained in medical care up to 2009.[15]

HIV-infected persons who died in 2010-2011 were likely to be engaged in medical care in 2009. They were older (45-54 or $\geq$ 55 years) and reported a transmission risk of IDU. The most current report from NJDOH, in June 2013, identified 20% of living HIV-infected persons with a transmission risk of IDU and almost 80% were at least 40 years old.[27] They represent HIV-infected persons who may be engaged and retained in medical care at present and can benefit from close monitoring, screening, and preventive health measures.[28]

Engagement in Medical Care

HIV-infected persons least likely to be engaged in medical care were non-Hispanic blacks, Hispanics, IDU, residents in an IMPAACT city, and those with a non-AIDS diagnosis similar to previous reports.[29-31] HIV-infected persons diagnosed 0-4 years ago were more likely to be engaged in medical care while HIV-infected persons diagnosed $\geq$ 5 years were less likely to be engaged in medical care. This suggests that despite linkage to care initially, HIV-infected persons are not staying in care over longer time intervals. When stratified by year of diagnosis, those less likely to be in engaged in medical care among those diagnosed 0-4 years were women, non-Hispanic blacks and those with a non-AIDS diagnosis. Among those diagnosed $\geq$ 5 years, Hispanics or those with a non-AIDS diagnosis were less likely to be engaged in medical care. This suggests that focused engagement interventions in these groups are needed at clinical care sites.

When compared to MSM, all other transmission risk groups were less likely to be engaged in medical care if they were diagnosed 0-4 years ago. However, among HIV-infected persons diagnosed five years ago or longer this relationship was reversed and all transmission risk groups were more likely than MSM to be in engaged in medical care. One previous study identified receipt of program services and feeling respected in the clinic as associated with improved engagement in medical care for young MSM.[29]

HIV-infected persons with a non-AIDS diagnosis may not be engaged in medical care for a variety of reasons: they may feel well, they may feel that they do not require medical care, or they may not have been offered ART in line with treatment recommendations in 2009.[32] One recent study suggests that although most HIV-infected persons had recommended biannual care visits, some of those who were ART-naïve may require additional interventions to remain in care; promptly initiating ART may facilitate engagement in care.[33] Adhering to current treatment recommendations that all HIV-infected persons receive antiretroviral therapy may prevent poor engagement in medical care.[3]

Retention in Medical Care

Tripathi's study found that males were less likely to be optimally retained which differs from this study and from a more recent publication.[12, 31]The reason for this difference is unknown. Non-Hispanic blacks were more likely to dropout of medical care, similar to previous reports.[12, 33-34] In NJ, this may be influenced by residence in IMPAACT cities, which are plagued by socio economic factors including poverty, lower education, and income.[35] Other factors contributing to this difference include prior experiences with racism, conspiracy beliefs and the quality of provider relationships that impact engagement in medical care.[36]

Older HIV-infected persons were less likely to have sporadic retention or to dropout from medical care compared to those aged 13-24 years. This is similar to previous reports indicating that HIV-infected persons aged 13-24 years require interventions to improve adherence to medical appointments and engagement in care.[37] Clinic services designed to meet the needs of younger HIV-infected persons, including centralizing and expanded youth-specific care, may assist with retention in care.[38] Additional interventions include having a designated day and time for appointments when other peers are present and frequent interventions for adherence and education provided in an age-appropriate and culturally competent manner by clinic staff.[39]

Public funding was a protective factor for retention in care. HAART is very expensive and most HIV-infected persons in NJ are unable to pay out of pocket; even if they have private insurance, many will incur high copays. As the Affordable Care Act (ACA) is implemented, a higher number of HIV-infected persons will be enrolled in health insurance and expanded Medicaid that will increase access and retention in medical care for HIV-infected persons, thereby fulfilling the goals of NHAS.[40-41]

The differences for retention by IMPAACT city residence is minimal and reflects the allocation of federal, state and local resources into community 'hot-spot' areas with high incidence and prevalence in NJ, which should be continued into the future.[24]

Interventions to facilitate retention in care

Initial entry into care in NJ is facilitated at some medical sites by a designated patient navigator or case manager who encourages adherence to follow up medical appointments. One recently published multi-center study targeting both new and HIV-infected persons with a history of missed visits reported that enhanced personal contact improved retention in care over a 12-month interval.[42] Interventions to facilitate engagement and retention in medical care may be implemented in specific time intervals. These interventions may occur prior to the actual medical visit (telephone reminders, scheduling based on HIV-infected persons preferences) or at the actual visit (provider attitudes, special population foci-MSM, youth, IDU, women). Additional outreach for missed appointments should occur in a timely manner.

Case management may be beneficial for HIV-infected persons with a new diagnosis or unmet needs. The case manager coordinates health and social services in order to decrease mortality, improve health status, expand linkage to and retention in care, address unmet needs, and reduce risky behaviors.[43] A study conducted in DC compared retention of HIV-infected persons receiving care at medical case managers (MCM) funded and non-funded facilities. Those receiving care in MCM-funded facilities were four times more likely to be retained in care than HIV-infected persons receiving care in non-funded facilities.[44]

A recent review of strategies to improve retention in care identified strengths-based case management as a significant strategy that allowed HIV-infected persons to recognize and use their internal abilities to access resources and solve problems.[45] Other evidence-informed strategies include peer navigation, reducing structural- and system-level barriers, including peers as part of a health care team, displaying posters and brochures in waiting rooms, having medical providers present brief messages to HIV-infected persons, and having clinics stay in closer contact with HIV-infected persons across time. Opportunities for additional intervention strategies include using community-based organizations as a setting for engaging HIV-infected persons, providing education about the importance of regular care, and involving their significant others in retention interventions.

New Jersey provides support services for Ryan White eligible HIV-infected persons to minimize barriers to engagement and retention in care. These services include transportation and housing. NJ also provides clinical services including access to medical care, medications through publically funded pharmaceutical benefits and programs, health insurance premium assistance, mental health services, substance use services, and medical case management. Medication adherence counseling and home healthcare make it easier to remain in care.

Health departments are attempting to increase the number of HIV-infected persons in medical care through innovative use of surveillance data. In 2008, the NYC Department of Health and Mental Hygiene began to use reported HIV-related laboratory tests to identify and contact HIV-infected persons apparently not receiving care.[46] From July 2008 to December 2010, of 409 HIV-infected persons identified as not in care, 77 percent received clinic appointments, with 57 percent confirmed as having returned to care. Among the 161 who provided reasons for not being in medical care, the most commonly reported was ‘felt well’ (41%). The Louisiana Public Health Information Exchange (LaPHIE) is a novel secure bi-directional public health information exchange, linking statewide public health surveillance data with the electronic medical record.[47] LaPHIE alerted medical providers when HIV-infected persons with HIV/AIDS have not received HIV care for at least twelve months and were seen at any ambulatory or inpatient facility. Between 2/1/2009 and 1/31/2011, 488 alerts identified 345 HIV-positive HIV-infected persons. Among those identified, 82% had at least one CD4+ or VL over the follow-up period. Beginning in 2009, the DC Department of Health launched a recurrent, time-limited collaboration with providers of care to reengage HIV-infected persons who did not have a recent care visit.[48] HIV-infected persons who received this intervention kept appointments with their medical provider in 2009 and 2010, 186 (46%) and 109 (54%) respectively. These interventions can potentially be implemented by the NJDOH to improve engagement and retention in medical care among HIV-infected persons.

The results of this analysis are generalizable to HIV-infected persons of NJ as data were available on all cases reported to eHARS. Name-based HIV reporting, collection of CD4+ counts, and HIV VL have been ongoing in NJ since 2001, which has allowed for data collection to stabilize and to enable monitoring of NJ trends.

We restricted our analysis to HIV-infected persons who were residents of NJ at diagnosis and as of 12/31/2012. Churn which results from HIV-infected persons moving in and out of NJ, leading to disruption of medical care and impacting local prevalence data, was minimized by this exclusion.[49-50] However, as those who moved in and out (INNJ, OUTNJ, and NEITHER in our data) were disproportionately male and white, it is possible that our data underrepresent white MSM who may have greater access to care, in which case their exclusion would result in a minimum estimate for our study parameters of engagement and retention in medical care.

We attempted to evaluate the effect of public funding on retention in care. However, we were limited as funding source was infrequently reported at the time of diagnosis. It was updated only for HIV-infected persons who subsequently received public funding. We are confident that the public funding category reflects HIV-infected persons who were receiving this funding source in NJ as eHARS is routinely matched to the Medicaid drug utilization data. The private funding category reflects status at diagnosis and is likely accurate because these HIV-infected persons did not later match to a publicly funded program database. “Unknown” includes those without any reported insurance type that did not later match to a publicly funded source. It is possible that this category included HIV-infected persons with private insurance that would blunt the effect of not having any insurance on retention in care. Nevertheless, we did observe that public funding appears to be protective for retention in medical care.

This analysis is subject to the following limitations. CD4+ and HIV viral load were used as surrogate markers for engagement and retention in medical care and this could actually underestimate these results as HIV-infected persons may have medical care visits without having specimens drawn for testing. Approximately 52 % of HIV-infected persons did not have HIV VL or CD4+ counts reported to eHARS by December 2009,which may indicate either that they truly were not linked to medical care, that they may have been linked to medical care in another state and their test results were not forwarded to NJDOH, or they declined testing. Despite this limitation, we feel confident that our results for engagement in medical care is accurate, as states routinely share data on cases that appear in multiple jurisdictions and apply uniform national criteria to minimize the risks of over counting in the national database and to minimize duplication. In addition, our results were similar to previous population-based and national reports.

Information on the mode of transmission is not complete for all HIV-infected persons due to failure to report behavioral risks on lab and provider reports to eHARS, which likely accounts for increased reports of unreported risk in the database. HIV-infected persons without these reports may reflect risks that are less likely to be reported by HIV-infected persons or providers, like IDU and MSM. Therefore engagement and retention in medical care will most likely be underestimated in these groups. Another variable with an unknown category was test-site, but this was a small number and the results were approximately between that of clinical and non-clinical sites; either way, this is not likely to affect our outcome, linkage to medical care.

Similar to Tripathi et al in South Carolina, this study excluded HIV-infected persons ineligible to be retained in care during our study period, i.e., those who died in 2010-2011.[12] This would lead to an overestimation of the percentage of HIV-infected persons retained in medical care in this study. Future studies should use survival methods for analysis, specifically competing risks models, so that data on HIV-infected persons who died during 2010-2011 (n=1,407 in our study) can be included in the analysis. Ordinal logistic regression was considered for this analysis; however, the proportional odds assumption was not satisfied. The use of a polytomous log-binomial model would have been more efficient; compared to individual binomial outcomes the parameter estimates would have smaller standard errors and increased precision.

Approximately sixty-five percent of HIV-infected persons in 2009 were not retained in medical care in 2010-2011. Poor retention was noted among younger age groups, IDU and heterosexuals, HIV-infected persons diagnosed 0-4 years ago, and with a non-AIDS diagnosis. Interventions should aim to keep these HIV-infected persons continuously engaged in their medical care. Case managers utilizing a strength-based approach with multiple points of enhanced patient contact will positively impact current and future retention.

Table 2.1a: Characteristics of HIV-infected persons, by residence at diagnosis and as of 12/31/2012, New Jersey, 2009 **

Variable	NJ N (%)	OUTNJ N (%)	INNJ N (%)	Neither N (%)	Total N (%)
Gender					*
Female	11,071 (35.4)	421 (31.4)	565 (24.2)	232 (19.3)	12,289 (34.0)
Male	20,230 (64.6)	919 (68.6)	1,771 (75.8)	969 (80.7)	23,889 (66.0)
Race/ethnicity					*
Non-Hispanic black	16,505 (52.6)	643 (48.0)	1,039 (44.5)	497 (41.4)	18,684 (51.6)
White, Non- Hispanic	6,750 (21.6)	395 (29.5)	683 (29.2)	491 (40.9)	8,319 (23.0)
Hispanic[a]	6,998 (22.4)	276 (20.6)	546 (23.4)	195 (16.2)	8,015 (22.2)
Other[b]	1048(3.4)	26 (1.9)	68 (2.9)	18 (1.5)	1,160 (3.2)
Age group (in years)					*
13-24	677 (2.2)	14 (1.0)	81 (3.5)	29 (2.4)	801 (2.2)
25-34	3,036 (9.7)	116 (8.6)	312 (13.4)	116 (9.7)	3,580 (9.9)
35-44	8,201 (26.2)	396 (29.6)	745 (31.9)	321 (26.7)	9,663 (26.7)
45-54	12,467 (39.8)	557 (41.6)	868 (37.2)	477 (39.7)	14,369 (39.7)
≥55	6,920 (22.1)	257 (19.2)	330 (14.0)	258 (21.5)	7,765 (21.5)
Transmission Risk					*
Male-to-Male sex[c]	7,540 (24.1)	488 (36.4)	852 (36.5)	425 (35.4)	9,305 (25.7)
Injection drug use	7,349 (23.5)	319 (23.8)	398 (17.0)	194 (16.1)	8,260 (22.8)
Heterosexual sex	6,486 (20.7)	305 (22.8)	354 (15.2)	127 (10.6)	7,272 (20.1)
Unknown[d]	9,926 (31.7)	228 (17.0)	732 (31.3)	455 (37.9)	11,341 (31.4)
Number of years since diagnosis					*
0-4	5,234 (16.8)	119 (8.9)	345 (14.8)	267 (22.2)	5,985 (16.5)
5-9	7,670 (24.5)	323 (24.1)	597 (25.6)	373 (31.0)	8,963 (24.8)
10-14	8,341 (26.7)	347 (26.0)	684 (29.3)	262 (21.8)	9,634 (26.7)
≥15	10,036 (32.0)	551 (41.0)	710 (30.3)	299 (25.0)	11,596 (32.0)
City					*
Atlantic City	641 (2.1)		64 (2.7)		705 (2.0)
Camden	658 (2.1)		70 (3.0)		728 (2.0)
East Orange	1,193 (3.8)		61 (2.6)		1,254 (3.4)
Elizabeth	957 (3.1)		55 (2.4)		1,012 (2.8)
Irvington	879 (2.8)		29 (1.2)		908 (2.5)
Jersey City	2,484 (7.9)		194 (8.3)		2,678 (7.4)
Newark	5,382 (17.2)		254 (10.9)		5,636 (15.6)
Paterson	1,434 (4.7)		73 (3.1)		1,557 (4.3)
Plainfield	437 (1.4)		19 (0.8)		456 (1.3)
Trenton	1,016 (3.3)		83 (3.6)		1,099 (3.0)
Other[e]	16,170 (51.6)	1,340 (100)	1,434 (61.4)	1,201 (100)	20,245 (55.7)
County					*
Atlantic	1,236 (4.0)		114 (4.9)		1,350 (3.7)
Bergen	1,353 (4.3)		109 (4.7)		1,462 (4.0)
Burlington	633 (2.0)		110 (4.7)		743 (2.0)
Camden	1,385 (4.4)		188 (8.3)		1,573 (4.5)
Cape May	149 (0.5)		17 (0.7)		166 (0.5)
Cumberland	487 (1.6)		61 (2.6)		548 (1.5)
Essex	8,773 (28.0)		420 (18.0)		9,193 (25.4)
Gloucester	319 (1.0)		34 (1.5)		353 (1.0)
Hudson	3,968 (12.8)		319 (13.7)		4,287 (11.5)
Hunterdon	165 (0.5)		17 (0.7)		182 (0.5)
Mercer	1,262 (4.0)		108 (4.6)		1,370 (3.8)
Middlesex	1,633 (5.2)		130 (5.6)		1,763 (4.9)
Monmouth	1,449 (4.6)		116 (5.0)		1,565 (4.3)
Morris	635 (2.0)		53 (2.5)		688 (1.9)
Ocean	545 (1.7)		61 (2.6)		606 (1.7)
Passaic	2,252 (7.2)		112 (4.8)		2,364 (6.5)
Salem	135 (0.4)		9 (0.5)		144 (0.5)
Somerset	415 (1.3)		36 (1.5)		451(1.3)
Sussex	148 (0.5)		10 (0.4)		158 (0.4)

Union	2,342 (7.5)		119 (5.3)		2,461 (6.8)
Warren	99 (0.4)		18 (0.8)		117 (0.5)
Unknown[f]	1,918(6.1)	1,340 (100)	175 (7.5)	1,201(100)	4,635 (12.8)
AIDS					*
Yes	16,695 (53.3)	742 (55.4)	1,456 (62.3)	526 (43.8)	19,419 (53.7)
No	14,606 (46.7)	598 (44.6)	880 (37.7)	675 (56.2)	16,759 (46.3)
Monitored HIV Viral Load					*
Yes	11,599 (37.0)	220 (16.4)	715 (30.6)	113 (9.4)	12,647 (35.0)
No	19,702 (63.0)	1,120 (83.6)	1,621 (69.4)	1,088 (90.6)	23,531 (65.0)
CD4+ count					*
Yes	10,982 (35.0)	189 (14.0)	702 (30.0)	84 (7.0)	11,957 (33.0)
No	20,319 (65.0)	1,151 (86.0)	1,634 (70.0)	1,117 (93.0)	24,221(65.0)
Engaged in Medical Care					*
Yes	15,092 (48.2)	293 (21.9)	920 (39.4)	145 (12.1)	16,450 (45.5)
No	16,209 (51.8)	1,047 (78.1)	1,416 (60.6)	1,056 (87.9)	19,728 (54.5)
Total	31,301 (86.5)	1,340 (3.7)	2,336 (6.5)	1,201(3.3)	36,178

Legend for Table 2.1a

Abbreviations
AIDS: Acquired Immune Deficiency Syndrome
CD4+: CD4+ count (cells/*u*l)
HIV: Human Immunodeficiency Virus
N: Number
VL: Viral load
INNJ: First Positive HIV test not in NJ, but a resident as of 12/31/2012,
OUTNJ: First Positive HIV test in NJ, but not a resident as of 12/31/2012
NJ: First Positive HIV test in NJ and a resident as of 12/31/2012
Neither: First Positive HIV test not in NJ, nor a resident as of 12/31/2012
Engaged in Medical Care: HIV-infected persons with at least 1 CD4+ count or HIV VL reported in 2009.
**** $\geq$ 13 years of age at HIV diagnosis, excluded perinatally infected persons, diagnosed at any age, incarcerated (n=579) and with a HIV VL > 20,000,000 (n=6).**
*** Chi-square statistically significant at p <0.05**
[a] Hispanics can be of any race
[b] Other includes: Asian, American Indian/Alaska native, Native Hawaiian, Multiple Races and unknown race/ethnicity
[c] Male-to male sex includes HIV-infected persons with Male-to-male sex and injection drug use as these were small in number (n=859, 2.4 %)
[d] Includes HIV-infected persons with unreported risk
[e] Includes HIV-infected persons with unreported and/or unknown city
[f] Includes HIV-infected persons with unreported and/or unknown county

Table 2.1b: Characteristics of HIV-infected persons dying in New Jersey, 2010-2011. RR and aRR for dying

Variable	NJ Total	Died N (%)	RR 95% CI	aRR 95% CI
Gender				
Female	11,061	501 (4.5)	1.01 (0.91, 1.12)	
Male	20,230	906 (4.5)	1.00	
Race/ethnicity		*		
Non-Hispanic black	16,505	850 (5.2)	1.20 (1.06, 1.37)	1.01 (0.87, 1.16)
White, Non- Hispanic	6,750	289 (4.3)	1.00	1.00
Hispanic[a]	6,998	230 (3.3)	0.77 (0.65, 0.91)	0.72 (0.61, 0.86)
Other[b]	1048	38 (3.6)	0.85 (0.61, 1.18)	0.77 (0.55, 1.07)
Age group (in years)		*		
13-24	677	9 (1.3)	1.00	1.00
25-34	3,036	68 (2.2)	1.68 (0.85, 3.36)	1.49 (0.75, 2.97)
35-44	8,201	262 (3.2)	2.40 (1.24, 4.65)	1.82 (0.94, 3.53)
45-54	12,467	530 (4.3)	3.20 (1.66, 6.15)	2.10 (1.09, 4.05)
≥55	6,920	538 (7.8)	5.85 (3.04, 11.25)	3.59 (1.86, 6.94)
Transmission Risk		*		
Male-to-Male sex[c]	7,540	240 (3.2)	1.00	1.00
Injection drug use	7,349	548 (7.5)	2.34 (2.02, 2.72)	1.86 (1.59, 2.17)
Heterosexual sex	6,486	241 (3.7)	1.17 (0.98, 1.39)	1.10 (0.93, 1.29)
Unknown[d]	9,926	378 (3.8)	1.20 (1.02, 1.40)	1.11 (0.94, 1.30)
Number of years since diagnosis		*		
0-4	5,234	183 (3.5)	1.00	1.00
≥5	26,047	1,224 (4.7)	1.35 (1.16, 1.57)	1.19 (1.10, 1.20)
Funding		*		
Public	16,220	1,029 (6.3)	2.92 (2.14, 4.00)	
Private	1,844	40 (2.2)	1.00	
Unknown	13,237	338 (2.6)	1.18 (0.85,1.63)	
IMPAACT		*		
Yes	15,131	787 (5.2)	1.36 (1.22, 1.50)	1.30 (1.17, 1.45)
No	16,170	620 (3.8)	1.00	1.00
City		*		
Atlantic City	641	38 (5.9)	0.93 (0.61, 1.42)	
Camden	658	42 (6.4)	1.00	
East Orange	1,193	51 (4.3)	0.67 (0.45, 0.99)	
Elizabeth	957	44 (4.6)	0.72 (0.48, 1.09)	
Irvington	879	50 (5.7)	0.89 (0.60, 1.33)	
Jersey City	2,484	99 (4.0)	0.62 (0.44, 0.89)	
Newark	5,382	333 (6.2)	0.97 (0.71, 1.32)	
Paterson	1,434	68 (4.8)	0.72 (0.49, 1.04)	
Plainfield	437	13 (0.9)	0.47 (0.25, 0.86)	
Trenton	1,016	49 (3.5)	0.76 (0.51, 1.13)	
Other[e]	16,170	620 (3.4)	0.60 (0.44, 0.81)	
AIDS		*		
Yes	16,695	1,036 (6.2)	1.00	1.00
No	14,606	371 (2.5)	0.41(0.36, 0.46)	0.45 (0.40, 0.51)
Engaged in Medical Care, 2009		*		
Yes	15,092	871 (5.8)	1.75 (1.57, 1.84)	1.58 (1.42, 1.75)
No	16,209	536 (3.3)	1.00	
Total	31,301	1,407 (4.5)		

Legend for Table 2.1b

Abbreviations: AIDS-Acquired Immune Deficiency Syndrome
HIV-Human Immunodeficiency Virus
N:Number
NJ: New Jersey
RR: Relative Risks
aRR: Adjusted relative risks
CI: Confidence Interval
*** Chi-square statistically significant at p <0.05**
[a] Hispanics can be of any race
[b] Other includes: Asian, American Indian/Alaska native, Native Hawaiian, Multiple Races and unknown race/ethnicity
[c] Male-to male sex includes HIV-infected persons with Male-to-male sex and injection drug use
[d] Includes HIV-infected persons with unreported risk
[e] Includes HIV-infected persons with unreported and/or unknown city

Table 2.2: Percentage of HIV-infected persons Engaged in Medical Care, by Demographic and Geographic Characteristics, New Jersey, 2009. RR and aRR for Engagement in Medical Care by Number of Years since diagnosis.

Variable	NJ N	Engaged in Medical Care % (95% CI)	RR for Engagement in Medical Care (95% CI)	Years since diagnosis 0-4[§] aRR (95% CI)	Years since diagnosis ≥ 5[§] aRR (95% CI)
Gender				*	*
Female	10,570	51.3 (50.3, 52.2)	1.13 (1.10, 1.15)	0.83 (0.79, 0.88)	1.20 (1.13, 1.27)
Male	19,324	45.5 (44.8, 46.3)	1.00	1.00	1.00
Race/ethnicity				*	*
Non-Hispanic black	15,655	47.2 (46.4, 48.0)	0.93 (0.91, 0.96)	0.92 (0.87, 0.99)	1.08 (1.01, 1.16)
White, Non-Hispanic	6,461	50.6 (49.4, 51.9)	1.00	1.00	1.00
Hispanic[a]	6,768	44.5 (43.3, 45.7)	0.88 (0.85, 0.91)	1.11 (1.03, 1.20)	0.90 (0.83, 0.97)
Other[b]	1,010	54.1 (51.0, 57.1)	1.07 (1.00, 1.14)	0.95 (0.83, 1.08)	1.06 (0.93, 1.20)
Age group (in years)				*	*
13-24	668	55.7 (51.9, 59.5)	1.00	1.00	1.00
25-34	2,968	49.8 (48.0, 51.6)	0.89 (0.83, 0.97)	0.85 (0.72, 1.00)	0.83 (0.69, 1.01)
35-44	7,939	46.0 (44.9, 47.1)	0.83 (0.77, 0.89)	0.82 (0.70, 0.97)	0.76 (0.63, 0.91)
45-54	11,937	48.1 (47.2, 49.0)	0.86 (0.81, 0.93)	0.90 (0.76, 1.05)	0.82 (0.68, 0.98)
≥55	6,382	46.7 (45.4, 47.9)	0.84 (0.78, 0.90)	0.87 (0.74, 1.02)	0.81 (0.67, 0.98)
Transmission Risk				*	*
Male-to-Male sex[c]	7,300	48.0 (46.9, 49.2)	1.00	1.00	1.00
Injection drug use	6,801	44.4 (43.3, 45.6)	0.93 (0.89, 0.96)	0.89 (0.81, 0.99)	1.12 (1.01, 1.24)
Heterosexual sex	6,245	52.3 (51.0, 53.5)	1.09 (1.05, 1.13)	0.88 (0.81, 0.94)	1.14 (1.06, 1.23)
Unknown[d]	9,548	46.4 (45.4, 47.4)	0.97 (0.94, 0.99)	0.94 (0.88, 0.99)	1.07 (1.00,1.14)
Funding				*	*
Public	15,423	63.3 (62.5, 64.1)	1.03 (0.99, 1.07)	1.45 (1.41, 1.50)	1.06 (1.04, 1.09)
Unknown	12,756	26.7 (26.0, 27.5)	0.44 (0.42, 0.46)	1.02 (0.97, 1.08)	0.40 (0.38, 0.42)
Private	1,715	61.3 (59.0, 63.7)	1.00	1.00	1.00
IMPAACT City					
Yes	14,344	46.2 (45.4, 47.0)	0.95 (0.93, 0.97)	1.00 (0.95, 1.06)	1.00 (0.95, 1.05)
No	15,550	48.8 (48.0, 49.6)	1.00	1.00	1.00
City					
Atlantic City	603	45.4 (41.5, 49.4)	1.37 (1.19, 1.58)	0.77 (0.57, 1.06)	1.29 (0.95, 1.77)
Camden	616	33.1 (29.4, 36.8)	1.00	1.00	1.00
East Orange	1,142	46.7 (43.8, 49.6)	1.41 (1.24, 1.60)	0.80 (0.60, 1.09)	1.27 (0.97, 1.67)
Elizabeth	913	37.6 (34.4, 40.7)	1.13 (0.99, 1.31)	0.81 (0.60, 1.09)	1.24 (0.92, 1.68)
Irvington	829	45.1 (41.7, 48.5)	1.36 (1.19, 1.56)	0.71 (0.54, 0.95)	1.40 (1.05, 1.87)
Jersey City	2,385	49.4 (47.4, 51.4)	1.49 (1.32, 1.68)	0.87 (0.68, 1.11)	1.15 (0.90, 1.47)
Newark	5,049	43.1 (41.8, 44.5)	1.30 (1.16, 1.46)	0.79 (0.62, 1.01)	1.27 (0.99, 1.62)
Paterson	1,416	56.4 (53.8, 58.9)	1.70 (1.51, 1.92)	0.80 (0.62, 1.03)	1.26 (0.97, 1.62)
Plainfield	424	46.0 (41.3, 50.7)	1.39 (1.19, 1.62)	0.80 (0.58, 1.10)	1.26 (0.91, 1.74)
Trenton	967	57.2 (54.1, 60.3)	1.73 (1.52, 1.96)	0.75 (0.58, 0.98)	1.33 (1.02, 1.72)
Other[e]	15,550	48.8 (48.0, 49.6)	1.47 (1.32, 1.65)	0.80 (0.63, 1.01)	1.25 (0.99, 1.58)
County					
Atlantic	1,170	49.0 (46.1, 51.8)	1.37 (1.25 1.50)	1.45 (1.30, 1.62)	1.24 (1.01, 1.52)
Bergen	1,306	51.8 (49.1, 54.6)	1.45 (1.32, 1.58)	1.55 (1.39, 1.72)	1.33 (1.10, 1.61)
Burlington	601	40.8 (36.8, 44.7)	1.14 (1.01, 1.28)	1.15 (0.99, 1.33)	1.09 (0.85, 1.39)
Camden	1,318	35.8 (33.2, 38.4)	1.00	1.00	1.00
Cape May	142	49.3 (41.1, 57.5)	1.38 (1.15, 1.65)	1.42 (1.14, 1.77)	1.19 (0.82, 1.74)
Cumberland	470	50.0 (45.5, 54.5)	1.40 (1.24, 1.57)	1.41 (1.23, 1.62)	1.04 (0.83, 1.32)
Essex	8,296	45.3 (44.3, 46.4)	1.27 (1.17, 1.37)	1.33 (1.22, 1.46)	1.22 (1.04, 1.43)
Gloucester	303	39.6 (34.1, 45.1)	1.11 (0.95, 1.29)	1.19 (0.99, 1.43)	1.40 (0.98, 2.00)
Hudson	3,829	49.8 (48.3, 51.4)	1.39 (1.29, 1.51)	1.44 (1.31, 1.58)	1.10 (0.94, 1.30)
Hunterdon	162	50.0 (42.3, 57.7)	1.40 (1.18, 1.66)	1.43 (1.18, 1.75)	1.02 (0.72, 1.44)
Mercer	1,208	57.8 (55.0, 60.6)	1.61 (1.48, 1.76)	1.70 (1.54, 1.88)	1.26 (1.05, 1.51)

Middlesex	1,579	42.3 (39.9, 44.7)	1.18 (1.08, 1.30)	1.25 (1.12, 1.40)	1.24 (1.01, 1.52)
Monmouth	1,389	43.7 (41.1, 46.3)	1.22 (1.11, 1.34)	1.27 (1.14, 1.42)	1.18 (0.97, 1.44)
Morris	615	56.1 (52.2, 60.0)	1.57 (1.42, 1.73)	1.67 (1.48, 1.88)	1.29 (1.04, 1.60)
Ocean	515	56.5 (52.2, 60.8)	1.58 (1.42, 1.75)	1.71 (1.52, 1.93)	1.41 (1.11, 1.80)
Passaic	2,161	56.3 (54.2, 58.4)	1.57 (1.45, 1.71)	1.65 (1.50, 1.82)	1.18 (0.99, 1.39)
Salem	124	39.5 (30.9, 48.1)	1.10 (0.87, 1.39)	1.23 (0.95, 1.57)	1.62 (0.85, 3.08)
Somerset	402	51.0 (46.1, 55.9)	1.42 (1.26, 1.61)	1.54 (1.34, 1.76)	1.37 (1.04, 1.81)
Sussex	143	57.3 (49.2, 65.5)	1.60 (1.37, 1.88)	1.72 (1.44, 2.05)	1.25 (0.86, 1.82)
Union	2,251	45.9 (43.8, 48.0)	1.29 (1.18, 1.40)	1.36 (1.23, 1.50)	1.27 (1.06, 1.53)
Warren	93	51.6 (41.5, 61.8)	1.44 (1.17, 1.78)	1.65 (1.33, 2.08)	2.56 (0.98, 6.66)
Unknown[f]	1,817	46.0 (43.7, 48.3)	1.29 (1.18, 1.40)	1.28 (1.16, 1.43)	0.93 (0.76, 1.11)
AIDS				*	*
Yes	15,659	56.7 (55.9, 57.5)	1.00	1.00	1.00
No	14,235	37.5 (36.7, 38.3)	0.66 (0.65, 0.68)	0.61 (0.59, 0.63)	0.71 (0.68, 0.74)
Number of years since diagnosis					
0-4	5,071	60.2 (58.8, 61.5)	1.34 (1.30, 1.37)		
>5	24,823	45.0 (44.4, 45.6)	1.00		
Overall	29,894	47.6 (47.0, 48.1)		60.2 (58.8, 61.5)	45.0 (44.4, 45.6)

Legend for Table 2.2

Abbreviations: AIDS-Acquired Immune Deficiency Syndrome
CI: Confidence Interval,
HIV: Human Immunodeficiency Virus
Engaged in Medical Care: At least 1 CD4+ or HIV Viral load reported in 2009.
N: Number
NJ: New Jersey
RR: Relative Risks
aRR: Adjusted relative risks
CI: Confidence Interval
IMPAACT: Intensive Mobilization to Promote AIDS Awareness through Community based Technologies,
*** Chi-square statistically significant at p <0.05 for Number of Years since diagnosis**
[a] Hispanics can be of any race
[b] Other includes: Asian, American Indian/Alaska native, Native Hawaiian, Multiple Races and unknown race/ethnicity
[c] Male-to male sex includes HIV-infected persons with Male-to-male sex and injection drug use
[d] Includes HIV-infected persons with unreported risk
[e] Includes HIV-infected persons with unreported and/or unknown city
[f] Includes HIV-infected persons with unreported and/or unknown county
§ A generalized linear model with a log link and binomial outcome distribution was used to adjust for Number of Years since diagnosis (0-4, > 5).

Table 2.3a: Percentage of HIV-infected persons, Retained in Medical Care, by Demographic and Geographic Characteristics, Number of Visits in each Six-month period, 2010-2011

Variable	Engaged in Medical Care in 2009	Dropout (0 visits) N (%)	Sporadic (1-2 visits) N (%)	Suboptimal (3 visits) N (%)	Optimal (4 visits) N (%)
Gender					
Female	5,420	449 (8.3)	1,712 (31.6)	1,293 (23.9)	1,966 (36.3)
Male	8,801	901 (10.2)	2,762 (31.4)	2,052 (23.3)	3,086 (35.1)
Race/ethnicity					*
Non-Hispanic black	7,393	718 (9.7)	2,289 (31.0)	1,786 (24.2)	2,600 (35.2)
White, Non-Hispanic	3,272	284 (8.7)	1,134 (34.7)	718 (21.9)	1,136 (34.7)
Hispanic[a]	3,010	297 (9.9)	862 (28.6)	716 (23.8)	1,135 (37.7)
Other[b,]	546	51(9.3)	189 (34.6)	125 (22.9)	181(33.2)
Age group (in years)					*
13-24	372	74 (19.9)	150 (40.3)	71 (19.1)	77 (20.7)
25-34	1,477	238 (16.1)	477 (32.3)	351 (23.8)	411 (27.8)
35-44	3,649	395 (10.8)	1,223 (33.5)	840 (23.0)	1,191 (32.6)
45-54	5,745	442 (7.7)	1,710 (29.8)	1,387 (24.1)	2,206 (38.4)
>55	2,978	201 (6.8)	914 (30.7)	696 (23.4)	1,167 (39.2)
Transmission Risk					*
Male-to-Male sex[c]	3,504	396 (11.3)	1,147 (32.7)	824 (23.5)	1,137 (32.5)
Injection drug use	3,022	216 (7.2)	782 (25.9)	729 (24.1)	1,295 (42.9)
Heterosexual sex	3,264	238 (7.3)	999 (30.6)	798 (24.5)	1,229 (37.7)
Unknown[d]	4,431	500 (11.3)	1,546 (34.9)	994 (22.4)	1,391 (31.4)
Number of years since diagnosis					*
0-4	3,052	487 (16.0)	1,010 (33.1)	673 (22.1)	882 (29.0)
>5	11,169	863 (7.7)	3,464 (31.0)	2,672 (23.9)	4,170 (37.3)
Funding					*
Public	9,763	721 (7.4)	2,843 (29.1)	2,421 (24.8)	3,778 (38.7)
Private	1,052	128 (12.2)	405 (38.5)	233 ((22.2)	286 (27.2)
Unknown	3,406	501 (14.7)	1,226 (36.0)	691 (20.3)	988 (29.0)
IMPAACT City					*
Yes	6,630	638 (9.6)	1,942 (29.3)	1,575 (23.8)	2,475 (37.3)
No	7,591	712 (9.4)	2,532 (33.4)	1,770 (23.3)	2,577 (34.0)
City					*
Atlantic City	274	24 (8.8)	56 (20.4)	64 (23.4)	130 (47.5)
Camden	204	47 (23.1)	60 (29.4)	35 (17.2)	62 (30.4)
East Orange	533	60 (11.3)	186 (34.9)	130 (24.4)	157 (29.5)
Elizabeth	343	30 (8.8)	123 (35.9)	77 (22.5)	113 (32.9)
Irvington	374	43 (11.5)	123 (32.9)	87 (23.3)	121 (32.4)
Jersey City	1,178	122 (10.4)	369 (31.3)	305 (25.9)	382 (32.4)
Newark	2,178	212 (9.7)	659 (30.3)	533 (24.5)	774 (35.5)
Paterson	798	36 (4.5)	154 (19.3)	159 (19.9)	449 (56.3)
Plainfield	195	16 (8.2)	83 (42.6)	55 (28.2)	41 (21.0)
Trenton	553	48 (8.7)	129 (23.3)	130 (23.5)	246 (44.5)
Other[e]	7,591	712 (9.4)	2,532 (33.4)	1,770 (23.3)	2,577 (34.0)
County					*
Atlantic	573	48 (8.4)	110 (19.2)	132 (23.0)	283 (49.4)
Bergen	677	59 (8.7)	277 (40.9)	168 (24.8)	173 (25.6)
Burlington	245	47 (19.2)	77 (31.4)	43 (17.6)	78 (31.8)
Camden	472	99 (21.0)	145 (30.7)	86 (18.2)	142 (30.1)
Cape May	70	7 (10.0)	17 (24.3)	16 (22.9)	30 (42.9)
Cumberland	235	29 (12.3)	59 (25.1)	60 (25.5)	87 (37.0)
Essex	3,761	388 (10.3)	1,210 (32.2)	910 (24.2)	1,253 (33.3)
Gloucester	120	21 (17.5)	34 (28.3)	27 (22.5)	38 (31.7)
Hudson	1,908	174 (9.1)	636 (33.3)	498 (26.1)	600 (31.5)

Hunterdon	**81**	**4 (5.0)**	**17 (21.0)**	**21 (25.9)**	**39 (48.2)**
Mercer	**698**	**58 (8.3)**	**173 (24.8)**	**164 (23.5)**	**303 (43.4)**
Middlesex	**668**	**63 (9.4)**	**228 (34.1)**	**147 (22.0)**	**230 (34.4)**
Monmouth	**607**	**56 (9.2)**	**182 (30.0)**	**156 (25.7)**	**213 (35.0)**
Morris	**345**	**26 (7.5)**	**97 (28.1)**	**82 (23.8)**	**140 (40.6)**
Ocean	**291**	**22 (7.6)**	**112 (38.5)**	**61 (21.0)**	**96 (33.0)**
Passaic	**1,217**	**58 (4.8)**	**260 (21.4)**	**258 (21.2)**	**641 (52.7)**
Salem	**49**	**3 (6.1)**	**20 (40.8)**	**12 (24.5)**	**14 (28.6)**
Somerset	**205**	**19 (9.3)**	**71 (34.6)**	**44 (21.5)**	**71 (34.6)**
Sussex	**82**	**2 (2.4)**	**29 (35.4)**	**16 (19.5)**	**35 (42.7)**
Union	**1,033**	**91(8.8)**	**391 (37.9)**	**246 (23.8)**	**305 (29.5)**
Warren	**48**	**5 (10.4)**	**17 (35.4)**	**9 (18.8)**	**17 (35.4)**
Unknown[f]	**836**	**71(8.5)**	**312 (37.3)**	**189 (22.6)**	**264 (31.6)**
AIDS					*****
Yes	**8,881**	**680 (7.7)**	**2,672 (30.1)**	**2,131 (24.0)**	**3,398 (38.3)**
No	5,340	**670 (12.6)**	**1,802 (33.8)**	**1,214 (22.7)**	**1,654 (31.0)**
Overall	**14,221**	**1,350 (9.5)**	**4,474 (31.5)**	**3,345 (23.5)**	**5,052 (35.5)**

Legend for Table 2.3a

Abbreviations
AIDS: Acquired Immune Deficiency Syndrome
Medical Care: At least 1 CD4+ count or HIV Viral load
N: Number
IMPAACT: Intensive Mobilization to Promote AIDS Awareness through Community based Technologies
Dropout: Did not have any medical care visits in 2010 - 2011.
Sporadic: Had 1 or 2 medical care visits in 2010 -2011.
Sub-optimal: Had 3 medical care visits in 2010-2011.
Optimal: Had 4 medical care visits in 2010-2011.
*** Chi-square statistically significant at $p < 0.05$**
[a] Hispanics can be of any race
[b] Other includes: Asian, American Indian/Alaska native, Native Hawaiian, Multiple Races and unknown race/ethnicity
[c] Male-to male sex includes HIV-infected persons with Male-to-male sex and injection drug use
[d] Includes HIV-infected persons with unreported risk
[e] Includes HIV-infected persons with unreported and/or unknown city
[f] Includes HIV-infected persons with unreported and/or unknown county

Table 2.3b: Predictors for Retention in Medical Care, by Dropout, Sporadic and Suboptimal vs. Optimal Retention, 2010-2011.

Variable	Dropout vs. Optimal		Sporadic vs. Optimal		Suboptimal vs. Optimal	
	N	RR 95% CI	N	RR 95% CI	N	RR 95% CI
Gender						
Female	449	0.82 (0.74, 0.91)	1,712	0.99 (0.94, 1.03)	1,293	0.99 (0.94, 1.05)
Male	901	1.00	2,762	1.00	2,052	1.00
Race/ethnicity						
Non-Hispanic black[c]	718	1.08 (0.96, 1.22)	2,289	0.94 (0.89, 0.99)	1,786	1.05 (0.98, 1.13)
White, Non- Hispanic	284	1.00	1,134	1.00	718	1.00
Hispanic[a]	297	1.04 (0.90, 1.20)	862	0.86 (0.81, 0.92)	716	0.99 (0.92, 1.08)
Other[b]	51	1.10 (0.84, 1.43)	189	1.02 (0.92, 1.14)	125	1.06 (0.91, 1.22)
Age group (in years)						
13-24	74	1.00	150	1.00	71	1.00
25-34	238	0.75 (0.62, 0.91)	477	0.81 (0.73, 0.91)	351	0.96 (0.80, 1.16)
35-44	395	0.51 (0.42, 0.61)	1,223	0.77 (0.69, 0.85)	840	0.86 (0.72, 1.03)
45-54	442	0.34 (0.28, 0.41)	1,710	0.66 (0.60, 0.73)	1,387	0.81 (0.68, 0.96)
≥55	201	0.30 (0.24, 0.37)	914	0.67 (0.60, 0.74)	696	0.78 (0.65, 0.93)
Transmission Risk						
Male-to-Male sex[c]	396	1.00	1,147	1.00	824	1.00
Injection drug use	216	1.16 (1.12, 1.20)	782	0.75 (0.70, 0.80)	729	0.86 (0.79, 0.93)
Heterosexual sex	238	1.13 (1.09, 1.17)	999	0.89 (0.84, 0.95)	798	0.94 (0.87, 1.01)
Unknown[d]	500	0.99 (0.95, 1.03)	1,546	1.05 (0.99, 1.11)	994	0.99 (0.92, 1.06)
Number of years since diagnosis						
0-4	487	0.78 (0.75, 0.81)	1,010	1.18 (1.12, 1.24)	673	1.11 (1.04, 1.18)
≥5	863	1.00	3,464	1.00	2,672	1.00
Funding						
Public	721	0.52 (0.44, 0.61)	2,843	0.74 (0.69, 0.79)	2,421	0.86 (0.79, 0.95)
Private	128	1.00	405	1.00	233	1.00
Unknown	501	1.09 (0.93, 1.27)	1,226	0.95 (0.88-1.02)	691	0.90 (0.81, 1.04)
IMPAACT City						
Yes	638	0.95 (0.86, 1.04)	1,942	1.13 (1.08, 1.18)	1,575	0.96 (0.91, 1.01)
No	712	1.00	2,532	1.00	1,770	1.00
City						
Atlantic City	24	0.36 (0.24, 0.55)	56	0.61 (0.46, 0.81)	64	0.91 (0.66, 1.28)
Camden	47	1.00	60	1.00	35	1.00
East Orange	60	0.64 (0.47, 0.87)	186	1.10 (0.90, 1.35)	130	1.26 (0.94, 1.68)
Elizabeth	30	0.49 (0.33, 0.72)	123	1.06 (0.85, 1.32)	77	1.12 (0.82, 1.54)
Irvington	43	0.61 (0.44, 0.85)	123	1.03 (0.82, 1.28)	87	1.16 (0.85, 1.58)
Jersey City	122	0.56 (0.43, 0.73)	369	0.99 (0.82, 1.21)	305	1.23 (0.93, 1.62)
Newark	212	0.50 (0.39, 0.64)	659	0.94 (0.77, 1.13)	533	1.13 (0.86, 1.49)
Paterson	36	0.17 (0.12, 0.25)	154	0.52 (0.41, 0.65)	159	0.73 (0.54, 0.98)
Plainfield	16	0.65 (0.41, 1.04)	83	1.36 (1.09, 1.69)	55	1.59 (1.16, 2.18)
Trenton	48	0.38 (0.27, 0.53)	129	0.70 (0.56, 0.88)	130	0.96 (0.71, 1.29)
Other[e]	712	0.50 (0.40, 0.63)	2,532	1.01 (0.84, 1.21)	1,770	1.13 (0.86, 1.47)
AIDS						
Yes	680	1.00	2,672	1.00	2,131	1.00
No	670	1.73 (1.57, 1.90)	1,802	1.19 (1.14, 1.24)	1,214	1.10 (1.04, 1.16)
Overall	1,350		4,474		3,345	

<u>Legend for Table 2.3b</u>
Abbreviations: AIDS-Acquired Immune Deficiency Syndrome
CI: Confidence Interval
RR: Relative Risks
N: Number
IMPAACT: Intensive Mobilization to Promote AIDS Awareness through Community based Technologies
Medical Care: At least 1 CD4+ count or HIV Viral Load
Dropout: Did not have any medical care visits in 2010 - 2011.
Sporadic: Had 1 or 2 medical care visits in 2010 -2011.
Sub-optimal: Had 3 medical care visits in 2010-2011.
Optimal: Had 4 medical care visits in 2010-2011.
[a] Hispanics can be of any race
[b] Other includes: Asian, American Indian/Alaska native, Native Hawaiian, Multiple Races and unknown race/ethnicity
[c] Male-to male sex includes HIV-infected persons with Male-to-male sex and injection drug use
[d] Includes HIV-infected persons with unreported risk
[e] Includes HIV-infected persons with unreported and/or unknown city
§ A generalized linear model with a log link and binomial outcome distribution was used to evaluate the RR and aRR for Retention in Medical Care, 2010-2011

Table 2.3c: aRR for Predictors of Retention in Medical Care, by Dropout, Sporadic and Suboptimal vs. Optimal Retention, New Jersey, 2010-2011

Variable	Dropout vs Optimal[§] aRR (95% CI)	Sporadic vs Optimal[§] aRR (95% CI)	Suboptimal vs. Optimal[§] aRR (95% CI)
Gender			
Female	0.91 (0.81, 1.01)	1.01 (0.96, 1.07)	1.00 (0.94, 1.06)
Male	1.00	1.00	1.00
Race/ethnicity			
Non-Hispanic black, Non-Hispanic	1.18 (1.04, 1.34)	1.01 (0.95, 1.06)	1.10 (1.02, 1.18)
White, Non- Hispanic	1.00	1.00	1.00
Hispanic[a]	1.04 (0.90, 1.20)	0.90 (0.84, 0.96)	1.01 (0.93, 1.11)
Other[b]	1.11 (0.86, 1.42)	1.06 (0.95, 1.17)	1.08 (0.93, 1.25)
Age group (in years)			
13-24	1.00	1.00	1.00
25-34	0.94 (0.79, 1.12)	0.86 (0.77, 0.95)	0.99 (0.83, 1.20)
35-44	0.78 (0.65, 0.94)	0.83 (0.75, 0.92)	0.92 (0.77, 1.10)
45-54	0.57 (0.47, 0.69)	0.73 (0.66, 0.81)	0.87 (0.73, 1.04)
≥55	0.50 (0.40, 0.62)	0.73 (0.65, 0.81)	0.84 (0.70, 1.01)
Transmission Risk			
Male-to-Male sex[c]	1.00	1.00	1.00
Injection drug use	0.87 (0.74, 1.02)	0.89 (0.83, 1.01)	0.94 (0.86, 1.03)
Heterosexual sex	0.82 (0.70, 0.95)	0.84 (0.78, 0.91)	0.89 (0.82, 0.97)
Unknown[d]	1.14 (1.01, 1.27)	1.07 (1.01, 1.13)	0.99 (0.92, 1.07)
Number of years since diagnosis			
0-4	1.35 (1.21, 1.50)	1.00 (0.94, 1.05)	1.01 (0.94, 1.09)
≥5	1.00	1.00	1.00
Funding			
Public	0.75 (0.63, 0.88)	0.83 (0.77, 0.89)	0.95 (0.85, 1.07)
Private	1.00	1.00	1.00
Unknown	1.31 (1.12, 1.53)	1.00 (0.93, 1.07)	1.00 (0.93, 1.04)
IMPAACT City			
Yes	1.01 (0.92, 1.11)	0.94 (0.89, 0.98)	0.95 (0.89, 1.00)
No	1.00	1.00	1.00
AIDS			
Yes	1.00	1.00	1.00
No	1.27 (1.15, 1.40)	1.08 (1.04, 1.13)	1.06 (1.00, 1.12)

Legend for Table 2.3c

Abbreviations: AIDS-Acquired Immune Deficiency Syndrome
CI: Confidence Interval
RR: Relative Risks
Medical Care: At least 1 CD4+ count or HIV Viral load reported in 2009.
N: Number
NJ: New Jersey
IMPAACT: Intensive Mobilization to Promote AIDS Awareness through Community based Technologies
Dropout: Did not have any medical care visits in 2010 - 2011.
Sporadic: Had 1 or 2 medical care visits in 2010 -2011.
Sub-optimal: Had 3 medical care visits in 2010-2011.
Optimal: Had 4 medical care visits in 2010-2011.
[a] Hispanics can be of any race
[b] Other includes: Asian, American Indian/Alaska native, Native Hawaiian, Multiple Races and unknown race/ethnicity
[c] Male-to male sex includes HIV-infected persons with Male-to-male sex and injection drug use
[d] Includes HIV-infected persons with unreported risk
§ A generalized linear model with a log link and binomial outcome distribution was used to evaluate the RR and aRR for Retention in Medical Care in 2010-2011.

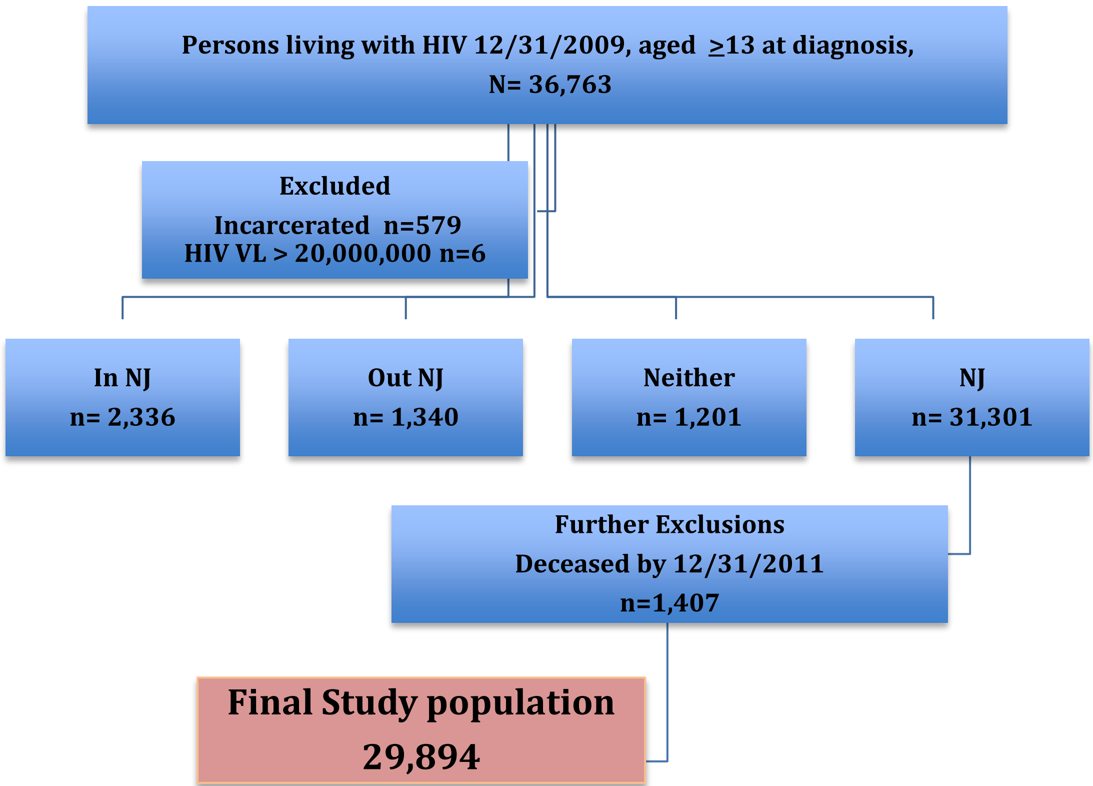

Figure 2.1: HIV-infected persons, age greater than or equal to 13 years at diagnosis, by residence at diagnosis and as of 12/31/2012, New Jersey, 2009.

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HIV VIRAL LOAD MEASURES (2010)

Background

Since the initial reports of opportunistic infections in previously healthy young men, the subsequent discovery of a retrovirus which compromises the immune system by depleting CD4+ counts led to identification of the Human Immunodeficiency Virus (HIV) and the sequelae manifested as an Acquired-Immunodeficiency Syndrome (AIDS).[1-2] HIV transmission or the likelihood that an infected person will transmit the virus to others has declined by 89% since the mid-1980's reflecting the combined impact of testing, prevention and treatment efforts.[3] HIV incidence increased in the mid-1990s, declined slightly after 1999 and has been stable since then with an estimated 50,000 new cases in 2010 among adolescents and adults.[4]

In 2011, there was an estimated 1.2 million living HIV-infected persons in the *U*nited States (U.S.); an estimated 86% were diagnosed, 40% were engaged in medical care, 37% were prescribed antiretroviral therapy (ART), and 30% achieved viral suppression (viral load (VL) $\leq$ 200 copies/ml).[5] Viral suppression was significantly lower among HIV-infected persons aged 18-24 years (13%), 25-34 years (23%), and 35-44 years (27%) compared with those aged ≥65 years (37%). An estimated 28% of blacks achieved viral suppression, compared with 32% of whites, a difference that was not statistically significant.

After diagnosis, HIV-infected persons are referred into medical care for evaluation and treatment with ART. Adherence to ART leads to a suppressed VL (SVL), decreased morbidity and mortality, prevention of opportunistic infections, and reduction in the transmission of infection perinatally and to sexual and injection drug using (IDU) partners.[6-9] A systematic meta-analysis of eleven cohort studies showed that no episodes of HIV transmission were found in discordant heterosexual couples if the HIV-infected partner was treated with ART and had a VL less than 400 copies/ml.[10] In British Columbia, increased use of ART was associated with a decrease in the HIV-infected population's VL and new infections.[11] In another study among a cohort of injecting drug users (IDU) in Vancouver, Canada, decreases in VL to < 20,000 copies/ml was no longer statistically associated with HIV incidence.[12] Similarly in San Francisco, declines in the population-level mean VL were associated with declining incidence in new diagnoses from 2004-2008.[13] Reductions in VL and the potential for decreased transmission has led to the development of treatment as prevention (TasP) and the recommendation of universal ART to all HIV-infected persons.[14-15] ART enables HIV-infected persons to have a normal life expectancy.[16] It is estimated that a 20-year-old HIV-infected person on ART in the U.S. can live into their early 70's, similar to the general population.

The VL used to monitor the number of viral particles in a person's blood before and during ART and performed every 3-4 months in stable infected persons, can be utilized to calculate the community viral load (CVL), a measure that describes the mean, median, or total VL of all HIV-infected persons in a given population.[15,17] The use of the CVL may provide both an indicator of the burden of disease (e.g., higher proportions of patients virally suppressed by antiretroviral treatment (ART) will lower CVL, thus tracking treatment benefit) and as an indicator of potential epidemic propagation (e.g., more persons in a population with high VL point to increased likelihood of onward transmission for a given level of risky behavior).[11,13,18]

More recently, limitations of using the CVL were described including issues with selection, measurement, the role of prevalence in determining ongoing HIV transmission, the interpretation of the CVL and the ecologic fallacy.[19] The authors posit that CVL underestimates the proportion of HIV-infected persons with a high VL as it does not take into account that the highest VLs are in those who have only just acquired HIV - who are also the least likely to be diagnosed. Some studies have tried to estimate the VL in undiagnosed HIV-infected persons. However, this is dependent on the viral load in diagnosed people being related in some degree to VL in the community. Undiagnosed HIV-infected persons may be a very different group of people from those who are diagnosed. Additionally, those who have been diagnosed but then dropped out of care may have a high VL. Even though the CVL may not vary by behavior, the group's 'infectiousness' varies widely according to whether one member with a high VL takes risks or not. The ecologic fallacy is an erroneous conclusion that occurs when the association observed between variables on an aggregate level is applied to individuals, but does not accurately represent what occurs on an individual level.[20] Therefore our study analyzed instead the mean monitored viral load (MMVL) in HIV-infected persons with an available viral load (AVL). This approach accounts for selection bias when measuring CVL as defined in Centers for Disease Control (CDC) Guidance on Community Viral Load for surveillance systems.[17] Additionally the percentage of HIV-infected persons with a SVL was also calculated.

Previous population based studies with reports of the MMVL and SVL include New York City (NYC), San Francisco and the District of Columbia (DC). In 2008, NYC evaluated the mean monitored viral load (MMVL) among HIV-infected persons.[21] The MMVL was 44,749 copies/ml among HIV-infected persons (N=28,366). Higher MMVLs were observed in males, those aged 20-49 years, with reports of male-to-male sex

(MSM), an AIDS diagnosis, a CD4+ cell count of 200 cells or less and diagnosed after 2006. Overall, 54.7% of HIV-infected persons had a SVL (VL < 400 copies/ml). A MMVL of 23,348 copies/ml among 2,512 HIV-infected persons was reported using data from the San Francisco HIV/AIDS surveillance case registry for 2005-2008, which contains an estimated 95% of all diagnoses in the city.[13] The percentage of HIV-infected persons with an undetectable VL (< 75 copies/ml) increased from 45% in 2004 to 78% in 2008. At the end of 2008, the District of Columbia reported a MMVL of 33,847 copies/ml with 57.4% of HIV-infected persons having undetectable VLs.[18]

On July 13, 2010, the White House released the first National HIV/AIDS Strategy (NHAS) for prevention and care in response to a directive from President Obama.[22] Among HIV-infected persons in the U.S., the roadmap set clear and measurable targets to be achieved by 2015. The percentages of HIV-infected persons with an undetectable VL are expected to increase by 20%, from baseline measures in 2010, among specific population groups: blacks, Hispanics and MSM.

This study presents a cross sectional analysis of viral load measures in New Jersey (NJ), in 2010, specifically:

1) The percentage of living HIV-infected persons with an AVL, by demographic, transmission risk and geographic factors.
2) Among HIV-infected persons with an AVL, calculated the MMVL levels, by demographic, transmission risk and geographic factors.
3) Among HIV-infected persons with an AVL, calculated the percentage with a SVL, by demographic, transmission risk and geographic factors.

As part of addressing the goals of the NHAS, baseline measurements of the MMVL and SVL are required. These evaluations will ensure that resources will be allocated to geographic areas with the highest need and to subpopulations disproportionately impacted by the epidemic.

Methods

Ethics Statement

Approval for this study was obtained from Rutgers University and the NJ Department of Health (NJDOH) Institutional Review Boards.

Data Sources

Data for this study were obtained from the NJDOH Enhanced HIV/AIDS Reporting System (eHARS). AIDS has been a reportable condition since 1981, in all 50 states, DC, U.S. dependencies and possessions in free association with the U.S. (American Samoa, Guam, the Northern Mariana Islands, Puerto Rico, and the U.S. Virgin Islands).[23] Initially, AIDS cases were reported to the CDC using a uniform case definition that included indicator diseases. However, with greater understanding of the natural history of HIV/AIDS and technological developments in testing and monitoring of HIV-infected persons, the definition was changed in 1993 to reflect those with severely compromised immune function.[24-26] HIV case reporting has been part of several states' comprehensive surveillance systems since 1985 and as of April 2008, all states, dependent territories and DC have successfully implemented name-based HIV case reporting as an extension of their AIDS case reporting system.[27] Of note, NJ was the first high volume state to implement name-based HIV reporting in 1992 and began collecting VL results in 2000.[28]

eHARS is a secure, relational database accessed by a web browser that facilitates monitoring, review, and analysis of discrete events over time and is appropriate for surveillance of HIV infection. CDC calls this “document-based surveillance”.[29] Laboratory reporting complements case reports submitted by hospitals and health care providers. The NJDOH submits de-identified data electronically on a monthly basis to CDC’s national database through a secure data network. Vital status is updated through quarterly matches to the NJ Death Registry and yearly to the National Death Index. Data for this analysis is current as of December 31st 2012. Case reports from eHARS were de-identified and assigned a random unique identifying number by staff at NJDOH. The link between data from eHARS and the de-identified database was kept in a secure location inaccessible to the researchers. Data were analyzed at a secure NJDOH site on a computer that did not have an Internet access.

Eligibility Criteria

Of all HIV-infected persons reported to NJDOH, those eligible were alive, diagnosed $\geq$ 13 years of age, by December 31st 2009, and residents as of December 31st 2012. Residence in NJ was determined by a) state of initial HIV test and b) state of last known residence, as of 12/31/2012. We excluded those incarcerated in 2009 due to small numbers, limited generalizability and as prevention and medical care were managed by the Department of Corrections. Other HIV-infected persons excluded had a VL > 20,000,000 as these were extreme outliers and those with perinatally acquired HIV regardless of the age at diagnosis. HIV-infected persons reported as deceased prior to December 2009 were excluded, and those dying during 2010 contributed data up to the time of death.

Analytic Variables

Outcome Variables: The outcome variables for this study are: AVL, SVL and MMVL. AVL is the presence of at least one VL report in eHARS in 2010, and if more than one was available, the most recent VL for 2010 was selected. This was converted to a binary variable (Yes, No) with “Yes” signifying that there was an available result. SVL was determined by an AVL of $\leq$ 200 copies/ml with “Yes” signifying that the VL was suppressed, “No” meant that the VL was not suppressed. The MMVL was calculated based on guidelines provided by CDC.[17]

Covariates: These included demographic, transmission risks and geographic factors. Demographic variables included age as of 12/31/2009 (13-24, 25-34, 35-44, 45-54, $\geq$55 years), gender at birth (male, female), and race/ethnicity (non-Hispanic black, white, Hispanic (any race) and other which included Asian, American Indian/Alaska Native, Native Hawaiian, unknown and multiple races). Transmission risk factors were classified based on CDC’s hierarchy of risk: MSM, IDU, heterosexual and unknown.[30] Men who inject drugs and have sex with men were combined with MSM in our analysis, as their numbers were small in our population, (859 (2.4% of prevalent cases in 2009)).

Residence as of December 31st 2012 was used to determine the geographic and city variables. The Intensive Mobilization to Promote AIDS Awareness through Community-based Technologies (IMPAACT) is a city-by-city community mobilization initiative, designed to galvanize and support African-American leaders in reducing the spread of HIV/AIDS in cities with the highest prevalence of HIV/AIDS in NJ (Table 3.1a)[31]. The ten cities with the highest prevalence of HIV were Atlantic City, Camden City, Jersey City, Elizabeth, New Brunswick, Plainfield, Paterson, Newark, Asbury Park and Trenton. Other included any HIV-infected persons not residing in these cities as well as missing or unknown. County included Atlantic, Bergen, Burlington, Camden County, Cape May, Cumberland, Essex, Gloucester, Hudson, Hunterdon, Mercer, Middlesex, Monmouth, Morris, Ocean, Passaic, Salem, Somerset, Sussex, Union, Warren and other (included missing and unknown HIV-infected persons). An additional binary geographic variable was created: IMPAACT city (Yes, No) where "Yes" denoted residency in any of the aforementioned cities. Other variables were AIDS diagnosis (yes, no) and number of years since initial HIV/AIDS diagnosis (0-4, 5-9, 10-14, $\geq$15).

Data Analysis

Eligible HIV-infected persons reported to NJDOH were diagnosed at $\geq$ 13 years of age, alive on December 31st 2009, and residents of NJ at the time of initial positive HIV testing and as of 12/31/2012. They were assessed for differences in AVL by demographic, transmission risk and geographic characteristics. Differences between groups were tested using $\chi 2$ tests of association with a p-value of < 0.05 being statistically significant. The relative risks (RR), adjusted RR (aRR) and 95% Confidence Interval (CI) for AVL and SVL were calculated using exponentiated coefficients from a generalized linear model with a log link and binomial outcome distribution. This regression method directly estimates risk ratios. RR was chosen as the effect measure as the rare disease assumption was not valid and the odds ratios were likely to overestimate the effect.[32] Model selection was based on clinical and epidemiological relevance as well as the Akaike Information Criterion (AIC), an approach that allows direct comparison of non- nested models.[33] In calculation of the MMVL, values of VL reported below the lower limit of detection (LLD), < 20 copies/ml, was multiplied by 0.5 to provide a continuous number. VL values were log transformed and the $\log_{10}$ and geometric mean

(GM) were calculated for each category, as recommended by the CDC.[17] A z-test to evaluate differences between two categories in each covariate was calculated and statistical significance was determined by a p-value of < 0.05. Calculations were performed using an Excel spreadsheet provided by the CDC to the NJDOH, (personal communication, Abdel Ibrahim, PhD, NJDOH). All other statistical analyses were performed using SAS version 9.3 (SAS Institute, Cary NC, USA).

Results

Study Population

Data were obtained from the NJDOH eHARS database reported through 12/31/2012 to allow for lags in reporting of cases, lab reports and vital status updates. A total of 36,763 HIV-infected persons, alive and diagnosed by 12/31/2009, at ≥13 years of age were reported to NJDOH as of December 31st 2012. HIV-infected persons excluded from this analysis were not NJ residents at the time of diagnosis (2,336, 6.5%), or as of December 31st 2012 (1340, 3.7%) or were not residents at either time (1,201, 3.3%) (See Table 3.1b, Figure 3.1). Overall, the excluded HIV-infected persons were more likely to be males, white and to have an unknown county as their last residence. When compared to NJ residents, those moving in were younger (13-24, (3.5%vs. 2.2%) and 25-34 (13.4% vs. 9.7%), whereas those moving out were older (35-44 (29.6% vs. 26.7%) and 45-54 (41.6% vs. 39.8%). The population analyzed included 31,301 (86.5%) living HIV-infected persons whose initial positive test was in NJ and who were residents as of 12/31/2012.

Availability of Viral Load

Among NJ HIV-infected persons, alive by 12/31/2009, VLs were available for 12,692 (40.6%) in 2010 (Table 3.2a). Higher percentages of females, ‘other’ race/ethnicities, those aged 13-24 years, with a report of heterosexual sex, diagnosed 0-4 years ago or with an AIDS diagnosis had an AVL. AVL was present for more than 40% of HIV-infected persons in the IMPAACT cities of Elizabeth, Jersey City, Paterson, Plainfield, and Trenton and in the following counties: Bergen, Hudson, Hunterdon, Mercer, Middlesex, Monmouth, Ocean, Passaic, Somerset, Sussex and Union. Relative risks and ARR for AVL are presented in Table 3.2a. In an adjusted model that included gender, race/ethnicity, risk and IMPAACT city, females were more likely to have an AVL than males. An AVL was less likely among Hispanics, IDU, and residents in an IMPAACT city.

Mean Monitored Viral Load

The 2010 overall $\log_{10}$ VL among HIV-infected persons was 2.5, (MMVL: 316 copies/ml , 95% CI: 300, 333), (Table 3.3). Higher MMVLs were noted in blacks, those aged 13-24, 25-34, and 35-44 years, IDU, diagnosed 0-4 years ago, or residing in an IMPAACT city. Compared to the overall MMVL, three cities in high prevalence areas had lower reports, Jersey City (251 copies/ml), Paterson (199 copies/ml) and Trenton (251 copies/ml). Higher MMVLs were observed in counties located in the southern area of NJ, Atlantic (398 copies/ml), Burlington (501 copies/ml), Cumberland (631 copies/ml), Gloucester (398 copies/ml), Mercer (398 copies/ml) and Salem (631 copies/ml). Essex County, which has the highest prevalence of HIV in NJ had a MMVL of 398 copies/ml.

Suppressed HIV Viral load

Overall, 7,323 (57.7% (95% CI: 56.8, 58.6)) HIV-infected persons had a SVL (Table 3.4a). Lower percentages of SVL was observed among females, non-Hispanic blacks, other race/ethnicities, those aged 13-24, 25-34, 35-44, 35-44, reporting IDU or heterosexual contact, diagnosed 0-4 years ago, residing in an IMPAACT city or with a non-AIDS diagnosis. Only one high prevalence city, Jersey City (60.4%, (95% CI: 57.3, 63.4) had a higher percentage of HIV-infected persons with SVL compared to findings overall. Lower SVLs were observed in counties located in the southern area of NJ, Atlantic (51.6%), Burlington (49.7%), Cumberland (38.6%), Gloucester (52.5%) and Mercer (51.9%). Essex County, which has the highest prevalence of HIV in NJ had a SVL of 51.6%. Table 3.4a presents the RR and aRR for having a SVL in NJ. In an adjusted model which included gender, race/ethnicity and risk, HIV-infected persons less likely to have SVL included females, non-Hispanic blacks, Hispanics other race/ethnicities and IDU compared to males, whites and heterosexuals.

Discussion

Overall, in 2010, at least 40% of HIV-infected persons in NJ, had an AVL, which was lower than national reports (53.4%-69.4%%) and local reports in New York City (81.8%).[34-36] One study evaluated data from fourteen jurisdictions and reported AVLs ranging from 28.5% in Delaware to 69.4% in Iowa.[34] Among HIV-infected persons with an AVL, MMVL (316 copies/ml) was at least 1.5 times higher compared to national reports (198 copies/ml) and the Bronx (207 copies/ml).[36-38] Among HIV-infected persons with an AVL, approximately 58% had SVL, lower than national reports in 2009 (69.4%), 2010 (72.7%), NYC (59.8%) or the Bronx (65.0%)[34-36,38].

Differences in VL measures were evident when demographic, geographic and transmission factors were evaluated similar to a previous report.[35] Women and HIV-infected persons diagnosed 0-4 years ago were more likely to have AVL, but a higher MMVL and less likely to have SVL. These women were likely to be in their childbearing years and many were probably diagnosed during the antepartum period of pregnancy.

Despite successful engagement in medical/prenatal care women may be less likely to start and continue ART and to experience more HIV-related or AIDS-defining events.[39] Socio-economic factors contributing to these differences may include drug use with crack/cocaine/heroin, a history of abuse, food insecurity, and homelessness.[40-41] In HIV-infected persons with lesser years since diagnosis this may be attributed to difficulty staying engaged in the healthcare system due to non-acceptance of their HIV status or not feeling ill, substance use, poor mental health, stigma, the relationship with their healthcare provider, poor social support, inability to address external barriers to care, and insurance status.[42-44]

Both non-Hispanic blacks and Hispanics were less likely to have AVL, non-Hispanic blacks had higher MMVLs and were less likely to have SVL, similar to reports nationally, in the Bronx and Oregon.[35,37-38] In NJ, this may be influenced by residence in IMPAACT cities, with the highest burden of HIV, plagued by adverse socio economic factors including poverty, lower education and income (Table 3.1a).[45] Additionally, this may indicate differences in receipt, response, and adherence to ART.[46-47] Other factors contributing to this difference include prior experiences with racism, conspiracy beliefs and the quality of provider relationships that impact engagement in medical care.[48]

When age was evaluated lower percentages of those aged 35-44 and $\geq$ 55 years had AVL. Among those aged 13-24 and 25-34 years, higher percentages had an AVL, however they had higher MMVLs and lower percentages with SVL. Increasing age was associated with decreased MMVL and increased SVL. These results are similar to previous reports and indicate that younger HIV-infected persons may benefit from interventions to improve adherence to ART, medical appointments and engagement in care.[35-36,49] These interventions may prevent deterioration to poor health, decrease rates of transmission and incidence of new HIV infections.

HIV-infected persons reporting MSM or IDU were less likely to have AVL and had higher MMVLs compared to heterosexuals. Injection drug users were least likely to have SVL. This may be attributed to poor engagement in the medical care system, active drug use and socio-economic factors like stigma, marginalization in society and lower education levels.[45, 50] However, in a national study based on the levels of risk behavior among MSM, IDU and heterosexuals, service needs were projected to be greatest among MSMs as high percentages with unsuppressed VL were engaged in unprotected discordant sex.[51] Compared to male heterosexuals, this behavior was 8 times higher and at least 2 times higher than among female heterosexuals with high-risk transmission potential. A previous study reported that young MSM who partner with older MSM are more likely to encounter partners infected with HIV and young MSM of color are more likely to encounter MSM with unsuppressed VL or undiagnosed HIV.[52-53] To eliminate differences in SVL, increased numbers of MSM would need to be on treatment to raise viral suppression rates and prevent transmission of disease among youth. Current HIV treatment guidelines lend support to treatment of HIV-infected persons including MSM regardless of CD4+ counts or VL levels.[15]

HIV-infected persons without an AIDS-diagnosis were less likely to have an AVL, have a higher MMVL and less likely to have SVL than those with an AIDS diagnosis. They may feel healthy and not access medical care in a timely and regular manner and be less likely to practice safe sex and use clean needles thereby transmitting infections to their partners. It is possible that HIV-infected persons with a non-AIDS diagnosis were not offered HAART based on the guidelines from 2010 which recommended starting therapy when CD4+ counts were $\leq$ 350 cells.[54] As the recommendation for treating all HIV-infected persons regardless of CD4+ counts becomes standard practice, efforts to engage and retain these individuals in medical care will need to be increased.[15]

HIV-infected persons in the ten cities most impacted by HIV/AIDS in NJ had poor outcomes for viral load measures (Table 3.5). AVL ranged from 21.7% to 50.5% (Camden and Paterson respectively), MMVL ranged from 200-794 copies/ml in Paterson and Atlantic City respectively, and SVL ranged from 43.6% - 60.4% (Atlantic City and Jersey City, respectively). IMPAACT cities are located in urban areas of NJ where HIV-infected persons have a lower socio-economic status reflected in income, poverty, and education levels.[45] Continued funding and programmatic support are needed in these areas. Counties with the highest MMVL (Burlington, Cumberland, Salem) are located in rural areas of NJ. Engagement in care may be challenging as specialty HIV providers may be located at great distances, available on an intermittent basis and transport may be a barrier to accessing services for these HIV-infected persons. As local providers may not currently treat HIV-infected persons, educational opportunities may be provided to diverse groups of providers to improve their knowledge and skill in treating HIV infection. Another potential intervention that may meet the need for qualified medical providers is the utilization of telehealth, a billable service for medical providers that uses electronic information and telecommunications technologies to support long-distance clinical health care, patient and professional health-related education, public health and health administration.[55]

The results of this analysis are generalizable to HIV-infected persons engaged in medical care in NJ. Name-based HIV reporting, collection of CD4+ counts and HIV VL has been ongoing since 2001in NJ that has allowed for data collection to stabilize. We restricted our analysis to HIV-infected persons who were residents of NJ at diagnosis and as of 12/31/2012. This would minimize the effects of in and out migration; future evaluations may include these HIV-infected persons to compare the impact on AVL, MMVL and SVL.[56-57]. However, as those who moved in and out (INNJ, OUTNJ, and NEITHER in our data) were disproportionately male and white, it is possible that our data underrepresent white MSM who may have greater access to care, in which case their exclusion would result in a minimum estimate for our study parameters of MMVL and SVL.

These analyses are subject to multiple limitations. Firstly, approximately 60% of HIV-infected persons did not have a reported VL suggesting that HIV-infected persons may not be receiving medical care. However, they may be receiving medical care in nearby jurisdictions including Philadelphia, New York and New York City. Although large institutions and commercial laboratories, for example, Labcorp, cooperate with public health authorities and report relevant test results across state lines, results may not be transmitted electronically from some out of state sources, including private providers. We feel confident in our estimated MMVL and SVL as states routinely share data on cases that appear in multiple jurisdictions and apply uniform national criteria to minimize the risks of over counting in the national database. NJDOH is in the process of streamlining the electronic reporting system from laboratories to eHARS. Future studies are expected to reflect increased numbers of NJ HIV-infected persons with AVL.

Incomplete reporting would result in underestimates of our outcomes; that is, the actual percentages of HIV-infected persons with AVL may be even higher than estimated. Future evaluations of VL measures could exclude HIV-infected persons in eHARS without any reports of CD4+ counts or VL for the past 5 years on the premise that they have most likely moved out of NJ, especially those diagnosed with AIDS, those meeting the changing federal thresholds for initiation of ART, and others needing care because of advancing disease.[36]

Secondly, we did not have access to the percentage of HIV-infected persons on anti-retroviral therapy (ART). Although this data are needed to measure the success of ART, they were not needed for this analysis, as the focus was on population viral suppression. This data would be available from in-depth personal interviews and medical records from HIV-infected persons in selected representative practices and the ongoing Medical Monitoring Project to which the researchers did not have access. Under current federal guidelines to treat all HIV-infected individuals, regardless of CD4+ count, many in care after 2012 will likely be offered ART compared with those analyzed in this report.[15]

Thirdly, in the calculation of MMVL only a minimum estimate is possible as HIV-infected persons who do not have AVL reported are most likely not in medical care and may have elevated levels of the virus. These results cannot be generalized to HIV-infected persons living with HIV/AIDS without an AVL as we had access to VLs for HIV-infected persons engaged in medical care only. We did not have access to those HIV-infected persons unaware of their infections or acutely infected. Results will not be generalizable to those not yet diagnosed. The VLs in these HIV-infected persons may be very high. This could result in an underestimate of MMVLs and overestimate in SVL.

Fourthly, information on the mode of transmission is not complete for all HIV-infected persons due to failure to report behavioral risks on lab and provider reports to eHARS which likely accounts for increased reports of unreported risk in the database.. HIV-infected persons without these reports may reflect risks that are less likely to be reported by HIV-infected persons or providers, like IDU and MSM. Therefore, this would result in underestimates of viral load measures in these groups.

This study was cross-sectional and did not evaluate trends in AVL, MMVL and SVL in recent time periods (2011-2014), however, this may be done in future studies as the data becomes available. Additionally HIV-infected persons who were infected at < 13 years of age, including perinatally infected and who are now young adults and adolescents are a unique population and warrant future evaluation.

Based on this analysis, future interventions in NJ based on 2015 NHAS goals, would include

a) Increasing ascertainment of AVL for HIV-infected persons living with HIV/AIDS by improved electronic laboratory data submission and follow up by field staff of missing AVL. This would ensure that program priorities for outreach to selected populations will increase linkage, engagement and retention in care and treatment and future evaluations would be based on more complete VL data.
b) Decreasing VLs greater than 2.5 Log_{10}, among high risk populations, including females, non-Hispanic blacks, those aged 13-24, 25-34 and 35-44, IDU, MSM, those diagnosed less than 4 years ago, HIV-infected persons in IMPAACT cities and rural counties.

c) Concentrated interventions for retention and engagement in medical care with ART provided regardless of CD4+ counts and HIV VL that may increase SVL to 85% by 2015.

Differences in viral load measures by demographic, transmission risk and geographic areas are apparent in this analysis of data in NJ for 2010. Attempts to decrease MMVL and improve SVL can be accomplished by unfettered access to medical care including ART, regardless of CD4+ count, for all HIV-infected persons as recommended in the latest treatment guidelines.[15] Lastly, focused tailored interventions in populations with high MMVL and low SVL should be implemented and evaluated on a yearly basis in tandem with national goals.

Table 3.1a: HIV-infected Adolescent and Adult Non-Hispanic Blacks, Top Ten IMPAACT Cities, New Jersey, 2009

City	Number	Non-Hispanic blacks*	Prevalence of HIV/AIDS!
Newark	4,551	142,083	3.2
Atlantic City	499	17,168	2.9
Jersey City	1,512	64,389	2.3
Elizabeth	516	22,329	2.3
Paterson	983	46,882	2.1
East Orange	1,222	61,604	2.0
Irvington	919	48,852	1.9
Trenton	798	43,497	1.8
Plainfield	389	28,698	1.4
City of Camden	424	39,753	1.1

Legend for Table 3.1a
Adapted from New Jersey HIV/AIDS Annual Report. Available:
http://www.state.nj.U.S./health/aids/documents/qtr1209.pdf

Abbreviations:
AIDS: Acquired Immunodeficiency Syndrome
HIV: Human Immunodeficiency Virus
IMPAACT- Intensive Mobilization to Promote AIDS Awareness through Community based Technologies,
***Based on 2000 census**
! - per 100 Non-Hispanic black HIV-infected persons

Table 3.1b: Demographic and Geographic Characteristics of HIV-infected persons, alive as of 12/31/2009, by residence at the time of diagnosis and as of 12/31/2012**

Variable	NJ N (%)	OUTNJ N (%)	INNJ N (%)	Neither N (%)	Total N (%)
Gender					*
Female	11,071 (35.4)	421 (31.4)	565 (24.2)	232 (19.3)	12,289 (34.0)
Male	20,230 (64.6)	919 (68.6)	1,771 (75.8)	969 (80.7)	23,889 (66.0)
Race/ethnicity					*
Non-Hispanic black, Non-Hispanic	16,505 (52.6)	643 (48.0)	1,039 (44.5)	497 (41.4)	18,684 (51.6)
White, Non- Hispanic	6,750 (21.6)	395 (29.5)	683 (29.2)	491 (40.9)	8,319 (23.0)
Hispanic[a]	6,998 (22.4)	276 (20.6)	546 (23.4)	195 (16.2)	8,015 (22.2)
Other[b]	1048(3.4)	26 (1.9)	68 (2.9)	18 (1.5)	1,160 (3.2)
Age group (in years)					*
13-24	677 (2.2)	14 (1.0)	81 (3.5)	29 (2.4)	801 (2.2)
25-34	3,036 (9.7)	116 (8.6)	312 (13.4)	116 (9.7)	3,580 (9.9)
35-44	8,201 (26.2)	396 (29.6)	745 (31.9)	321 (26.7)	9,663 (26.7)
45-54	12,467 (39.8)	557 (41.6)	868 (37.2)	477 (39.7)	14,369 (39.7)
>55	6,920 (22.1)	257 (19.2)	330 (14.0)	258 (21.5)	7,765 (21.5)
Transmission Risk					
Male-to-Male sex[c]	7,540 (24.1)	488 (36.4)	852 (36.5)	425 (35.4)	9,305 (25.7)
Injection drug use	7,349 (23.5)	319 (23.8)	398 (17.0)	194 (16.1)	8,260 (22.8)
Heterosexual sex	6,486 (20.7)	305 (22.8)	354 (15.2)	127 (10.6)	7,272 (20.1)
Unknown[d]	9,926 (31.7)	228 (17.0)	732 (31.3)	455 (37.9)	11,341 (31.4)
Number of years since diagnosis					*
0-4	5,234 (16.8)	119 (8.9)	345 (14.8)	267 (22.2)	5,985 (16.5)
5-9	7,670 (24.5)	323 (24.1)	597 (25.6)	373 (31.0)	8,963 (24.8)
10-14	8,341 (26.7)	347 (26.0)	684 (29.3)	262 (21.8)	9,634 (26.7)
>15	10,036 (32.0)	551 (41.0)	710 (30.3)	299 (25.0)	11,596 (32.0)
City					*
Atlantic City	641 (2.1)		64 (2.7)		705 (2.0)
Camden	658 (2.1)		70 (3.0)		728 (2.0)
East Orange	1,193 (3.8)		61 (2.6)		1,254 (3.4)
Elizabeth	957 (3.1)		55 (2.4)		1,012 (2.8)
Irvington	879 (2.8)		29 (1.2)		908 (2.5)
Jersey City	2,484 (7.9)		194 (8.3)		2,678 (7.4)
Newark	5,382 (17.2)		254 (10.9)		5,636 (15.6)
Paterson	1,434 (4.7)		73 (3.1)		1,557 (4.3)
Plainfield	437 (1.4)		19 (0.8)		456 (1.3)
Trenton	1,016 (3.3)		83 (3.6)		1,099 (3.0)
Other[e]	16,170 (51.6)	1,340 (100)	1,434 (61.4)	1,201 (100)	20,245 (55.7)
County					
Atlantic	1,236 (4.0)		114 (4.9)		1,350 (3.7)
Bergen	1,353 (4.3)		109 (4.7)		1,462 (4.0)
Burlington	633 (2.0)		110 (4.7)		743 (2.0)
Camden	1,385 (4.4)		188 (8.3)		1,573 (4.5)
Cape May	149 (0.5)		17 (0.7)		166 (0.5)
Cumberland	487 (1.6)		61 (2.6)		548 (1.5)
Essex	8,773 (28.0)		420 (18.0)		9,193 (25.4)
Gloucester	319 (1.0)		34 (1.5)		353 (1.0)
Hudson	3,968 (12.8)		319 (13.7)		4,287 (11.5)
Hunterdon	165 (0.5)		17 (0.7)		182 (0.5)
Mercer	1,262 (4.0)		108 (4.6)		1,370 (3.8)
Middlesex	1,633 (5.2)		130 (5.6)		1,763 (4.9)
Monmouth	1,449 (4.6)		116 (5.0)		1,565 (4.3)
Morris	635 (2.0)		53 (2.5)		688 (1.9)
Ocean	545 (1.7)		61 (2.6)		606 (1.7)
Passaic	2,252 (7.2)		112 (4.8)		2,364 (6.5)
Salem	135 (0.4)		9 (0.5)		144 (0.5)

Somerset	415 (1.3)		36 (1.5)		451(1.3)
Sussex	148 (0.5)		10 (0.4)		158 (0.4)
Union	2,342 (7.5)		119 (5.3)		2,461 (6.8)
Warren	99 (0.4)		18 (0.8)		117 (0.5)
Unknown[f]	1,918(6.1)	1,340 (100)	175 (7.5)	1,201(100)	4,635 (12.8)
AIDS					*
Yes	16,695 (53.3)	742 (55.4)	1,456 (62.3)	526 (43.8)	19,419 (53.7)
No	14,606 (46.7)	598 (44.6)	880 (37.7)	675 (56.2)	16,759 (46.3)
Monitored HIV Viral Load					*
Yes	11,599 (37.0)	220 (16.4)	715 (30.6)	113 (9.4)	12,647 (35.0)
No	19,702 (63.0)	1,120 (83.6)	1,621 (69.4)	1,088 (90.6)	23,531 (65.0)
CD4+ T-lymphocyte count					
Yes	10,982 (35.0)	189 (14.0)	702 (30.0)	84 (7.0)	11,957 (33.0)
No	20,319 (65.0)	1,151 (86.0)	1,634 (70.0)	1,117 (93.0)	24,221(65.0)
Total	31,301 (86.5)	1,340 (3.7)	2,336 (6.5)	1,201(3.3)	36,178

Legend for Table 3.1b

Abbreviations
AIDS: Acquired Immune Deficiency Syndrome
CD4+: CD4+ count
HIV: Human Immunodeficiency Virus
N: Number
VL: Viral load
INNJ: First Positive HIV test not in NJ, but resident as of 12/31/2012
OUTNJ: First Positive HIV test in NJ, but not resident as of 12/31/2012
NJ: First Positive HIV test in NJ and a resident as of 12/31/2012
Neither: First Positive HIV test not in NJ, not a resident as of 12/31/2012
**** Aged $\geq$ 13 years at HIV diagnosis, excluded perinatally infected persons diagnosed at any age, excluded those incarcerated (n=579) and with a HIV VL > 20,000,000 (n=6).**
*** Chi-square statistically significant at p <0.05**
[a] Hispanics can be of any race
[b] Other includes: Asian, American Indian/Alaska native, Native Hawaiian, Multiple Races and unknown race/ethnicity
[c] Male-to male sex includes Male-to-male sex and injection drug use as these were small in number (n=859, 2.4 %)
[d] Includes HIV-infected persons with unreported risk
[e] Includes HIV-infected persons with unreported and/or unknown city
[f] Includes HIV-infected persons with unreported and/or unknown county

Table 3.2a: Percentage of Available HIV Viral Loads, New Jersey, 2010. RR and aRR for Available Viral Load.**

Variable	NJ N	AVL N (%)	RR (95% CI)	aRR[1] (95% CI)
Gender		[2]		
Female	11,071	4,841 (43.7)	1.13 (1.10, 1.16)	1.13 (1.09, 1.16)
Male	20,230	7,851 (38.8)	1.00	1.00
Race/ethnicity				
Non-Hispanic black,	16,505	6,750 (40.9)	1.00 (0.96, 1.03)	1.01 (0.97, 1.05)
White, Non-Hispanic	6,750	2,773 (41.1)	1.00	1.00
Hispanic[a]	6,998	2,703 (38.6)	0.94 (0.90, 0.98)	0.95 (0.91, 0.99)
Other[b]	1048	466 (44.5)	1.08 (1.01, 1.17)	1.09 (1.02, 1.18)
Age group (in years)		*		
13-24	677	306 (45.2)	1.00	
25-34	3,036	1,256 (41.4)	0.91 (0.83, 1.00)	
35-44	8,201	3,211 (39.2)	0.87 (0.79, 0.95)	
45-54	12,467	5,183 (41.6)	0.92 (0.84, 1.00)	
≥55	6,920	2,736 (39.5)	0.87 (0.80, 0.95)	
Transmission Risk		*		
Male-to-Male sex[c]	7,540	3,069 (40.7)	0.90 (0.86, 0.93)	0.97 (0.93, 1.02)
Injection drug use	7,349	2,915 (39.7)	0.88 (0.84, 0.91)	0.91 (0.87, 0.95)
Heterosexual sex	6,486	2,941 (45.3)	1.00	1.00
Unknown[d]	9,926	3,767 (38.0)	0.84 (0.81, 0.87)	0.86 (0.83, 0.90)
Number of years since diagnosis		*		
0-4	5,254	2,480 (47.2)	1.31 (1.26, 1.37)	
5-9	7,670	3,125 (40.7)	1.16 (1.12, 1.20)	
10-14	8,341	3,479 (41.7)	1.13 (1.09, 1.18)	
≥15	10,036	3,608 (36.0)	1.00	
City		*		
Atlantic City	641	195 (30.4)	1.40 (1.16, 1.69)	
Camden	658	143 (21.7)	1.00	
East Orange	1,193	460 (38.6)	1.77 (1.51, 2.09)	
Elizabeth	957	395 (41.3)	1.90 (1.61, 2.24)	
Irvington	879	337 (38.3)	1.76 (1.49, 2.09)	
Jersey City	2,484	1,014 (40.8)	1.88 (1.61, 2.19)	
Newark	5,382	2,035 (37.8)	1.74 (1.50, 2.02)	
Paterson	1,484	749 (50.5)	2.32 (2.00, 2.71)	
Plainfield	437	196 (44.9)	2.06 (1.73, 2.47)	
Trenton	1,016	481 (47.3)	2.17 (1.86, 2.55)	
Other[e]	16,170	6,687 (41.4)	1.90 (1.64, 2.20)	
IMPAACT City		*		
Yes	15,131	6,005 (39.7)	0.98 (0.97, 0.99)	0.95 (0.93, 0.98)
No	16,170	6,687 (41.4)	1.00	1.00
County		*		
Atlantic	1,236	434 (35.1)	1.40 (1.24, 1.57)	
Bergen	1,353	600 (44.4)	1.77 (1.58, 1.97)	
Burlington	633	189 (29.9)	1.19 (1.02, 1.38)	
Camden	1,385	348 (25.1)	1.00	
Cape May	149	59 (39.6)	1.57 (1.27, 1.96)	
Cumberland	487	179 (36.8)	1.46 (1.26, 1.70)	
Essex	8,773	3,399 (38.7)	1.54 (1.40, 1.70)	
Gloucester	319	101 (31.7)	1.26 (1.05, 1.52)	
Hudson	3,968	1,673 (42.2)	1.68 (1.52, 1.85)	

[1] A generalized linear model with a log link and binomial outcome distribution was adjusted for Race, Gender and Transmission Risk. The AIC was used in model selection with the lowest value indicating the best fitting model.
[2] Row percent

Hunterdon	165	74 (44.9)	1.79 (1.47, 2.16)	
Mercer	1,262	601 (47.6)	1.89 (1.70, 2.11)	
Middlesex	1,633	709 (43.4)	1.73 (1.56, 1.92)	
Monmouth	1,449	623 (43.0)	1.71 (1.54, 1.91)	
Morris	635	254 (40.0)	1.59 (1.40, 1.82)	
Ocean	545	226 (41.5)	1.65 (1.44, 1.89)	
Passaic	2,252	1,128 (50.1)	2.00 (1.80, 2.20)	
Salem	135	51 (37.8)	1.50 (1.19, 1.90)	
Somerset	415	184 (44.3)	1.76 (1.53, 2.03)	
Sussex	148	63 (42.6)	1.69 (1.38, 2.09)	
Union	2,342	1,041 (44.5)	1.77 (1.60, 1.96)	
Warren	99	37 (37.4)	1.49 (1.13, 1.95)	
Unknown[f]	1,918	719 (37.5)	1.49 (1.34, 1.66)	
AIDS		*		
Yes	16,695	7,917 (47.4)	1.00	
No	14,606	4,775 (32.7)	0.69 (0.67, 0.71)	
Total	**31,301**	**12,692 (40.6)**		

Legend for Table 3.2a

AIDS: Acquired Immuno-Deficiency Syndrome
AVL: Available HIV Viral Load
CI: Confidence Interval
HIV: Human Immunodeficiency Virus
IMPAACT: Intensive Mobilization to Promote AIDS Awareness through Community based Technologies
VL: Viral load
RR: Relative Risks
aRR: Adjusted Relative Risks
*** Chi-square statistically significant at p <0.05**
[a] Hispanics can be of any race
[b] Other includes: Asian, American Indian/Alaska native, Native Hawaiian, Multiple Races and unknown race/ethnicity
[c] Male-to male sex includes Male-to-male sex and injection drug use as these were small in number
[d] Includes HIV-infected persons with unreported risk
[e] Includes HIV-infected persons with unreported and/or unknown city
[f] Includes HIV-infected persons with unreported and/or unknown county
**** $\geq$ 13 years of age at HIV diagnosis, excluded perinatally infected persons diagnosed at any age**

Table 3.3: Mean Monitored Viral Load, New Jersey, 2010 **

Characteristic	N	Mean Log_{10}	SD Log_{10}	GM	L95 GM	U95 GM	Z-score	p-value
Gender								
Female	4,841	2.5	1.4	316	269	372	2.2	<0.001
Male	7,851	2.4	1.3	251	222	284	Referent	
Race/ethnicity								
Non-Hispanic black, Non-Hispanic	6,750	2.6	1.4	398	369	430	17.2	<0.001
White, Non- Hispanic	2,773	2.1	1.2	129	117	143	Referent	
Hispanic[a]	2,703	2.4	1.3	251	224	281	8.5	<0.001
Other[b]	466	2.5	1.3	316	241	415	6.0	<0.001
Age group (in years)								
13-24	306	2.9	1.3	794	568	1,111	Referent	
25-34	1,256	2.8	1.4	631	528	754	-1.2	0.23
35-44	3,211	2.6	1.4	398	356	445	-3.8	<0.001
45-54	5,183	2.4	1.3	251	232	273	-6.5	<0.001
$\geq$55	2,736	2.2	1.2	158	143	176	-9.0	<0.001
Risk								
Male-to-Male sex[c]	3,069	2.3	1.3	200	179	222	-5.7	<0.001
Injection drug use	2,915	2.6	1.3	398	357	444	2.8	<0.001
Heterosexual sex	2,941	2.5	1.4	316	281	355	Referent	
Unknown[d]	3,767	2.4	1.3	251	228	276	-3.0	<0.001
AIDS								
Yes	7,917	2.4	1.4	251	234	270	Referent	
No	4,775	2.5	1.3	316	290	344	4.1	<0.001
Number of years since diagnosis								
0-4	2,480	2.6	1.3	398	354	448	Referent	
5-9	3,125	2.4	1.3	251	226	279	-5.7	<0.001
10-14	3,479	2.5	1.3	316	286	349	-3.1	<0.001
$\geq$15	3,608	2.4	1.3	251	228	277	-6.3	<0.001
City								
Atlantic City	195	2.9	1.4	794	505	1,249	1.3	0.19
Camden	143	2.7	1.4	501	295	850	Referent	
East Orange	460	2.6	1.4	398	297	534	-0.8	0.46
Elizabeth	395	2.7	1.3	501	373	673	0	1.00
Irvington	337	2.8	1.4	631	447	890	0.7	0.47
Jersey City	1,014	2.4	1.4	251	206	306	-2.4	<0.001

Newark	**2,035**	**2.7**	**1.4**	**501**	**436**	**577**	**0**	**1.00**
Paterson	**749**	**2.3**	**1.3**	**199**	**161**	**247**	**-3.2**	**<0.001**
Plainfield	**196**	**2.5**	**1.3**	**316**	**208**	**481**	**-1.3**	**0.18**
Trenton	**481**	**2.4**	**1.1**	**251**	**200**	**315**	**-2.4**	**<0.001**
Other[e]	**6,687**	**2.7**	**1.2**	**501**	**469**	**536**	**0**	**1.00**
IMPAACT City								
Yes	**6005**	**2.6**	**1.4**	**398**	**367**	**432**	**11.7**	**<0.001**
No	**6687**	**2.3**	**1.3**	**199**	**186**	**214**	**Referent**	
County								
Atlantic	**434**	**2.6**	**1.4**	**398**	**294**	**539**	**1.0**	**0.30**
Bergen	**600**	**2.2**	**1.1**	**158**	**129**	**194**	**-3.6**	**<0.001**
Burlington	**189**	**2.7**	**1.4**	**501**	**317**	**794**	**1.6**	**0.11**
Camden	**348**	**2.5**	**1.3**	**316**	**231**	**433**	**Referent**	
Cape May	**59**	**2.5**	**1.4**	**316**	**139**	**720**		**1.00**
Cumberland	**179**	**2.8**	**1.1**	**631**	**435**	**914**	**2.8**	**<0.001**
Essex	**3,399**	**2.6**	**1.4**	**398**	**357**	**444**	**1.4**	**0.17**
Gloucester	**101**	**2.6**	**1.4**	**398**	**212**	**747**	**0.6**	**0.52**
Hudson	**1,673**	**2.3**	**1.3**	**199**	**173**	**230**	**-2.6**	**<0.001**
Hunterdon	**74**	**2.2**	**1.3**	**158**	**80**	**313**	**-1.8**	**0.07**
Mercer	**601**	**2.6**	**1.2**	**398**	**319**	**497**	**1.2**	**0.24**
Middlesex	**709**	**2.2**	**1.2**	**158**	**129**	**194**	**-3.6**	**<0.001**
Monmouth	**623**	**2.4**	**1.3**	**251**	**199**	**318**	**-1.2**	**0.25**
Morris	**254**	**2.3**	**1.2**	**199**	**142**	**280**	**-2.0**	**<0.001**
Ocean	**226**	**2.3**	**1.4**	**199**	**131**	**304**	**-1.7**	**0.09**
Passaic	**1,128**	**2.4**	**1.2**	**251**	**214**	**295**	**-1.3**	**0.20**
Salem	**51**	**2.8**	**1.5**	**631**	**245**	**1,628**	**1.4**	**0.18**
Somerset	**184**	**2.1**	**1.2**	**125**	**84**	**188**	**-3.6**	**<0.001**
Sussex	**63**	**2.3**	**1.2**	**199**	**101**	**395**	**-1.2**	**0.20**
Union	**1,041**	**2.4**	**1.3**	**251**	**209**	**301**	**-1.2**	**0.21**
Warren	**37**	**2.4**	**1.2**	**251**	**89**	**894**		**1.00**
Other[f]	**719**	**2.5**	**1.4**	**316**	**205**	**307**	**-1.2**	**0.23**
Overall	**12,692**	**2.5**	**1.3**	**316**	**300**	**333**		

Legend for Table 3.3
AIDS: Acquired Immuno-Deficiency Syndrome
CD4+: CD4+ count
HIV: Human Immunodeficiency Virus
IMPAACT: Intensive Mobilization to Promote AIDS Awareness through Community based Technologies
VL: Viral load
SD: Standard Deviation
GM: Geometric Mean
L95: Lower value for 95% Confidence Interval
U95: Upper value for 95% Confidence Interval
[a] Hispanics can be of any race
[b] Other includes: Asian, American Indian/Alaska native, Native Hawaiian, M*ul*tiple Races and unknown race/ethnicity
[c] Male-to male sex includes Male-to-male sex and injection drug use as these were small in number
[d] Includes HIV-infected persons with unreported risk
[e] Includes HIV-infected persons with unreported and/or unknown city
[f] Includes HIV-infected persons with unreported and/or unknown county
**** Aged $\geq$ 13 years at HIV diagnosis, excluded perinatally infected persons diagnosed at any age**

Table 3.4a: Percentage of Suppressed Viral Loads, New Jersey 2010. RR and aRR for Suppressed Viral Load

Variable	AVL	SVL % (95 % CI)	RR 95% CI	aRR[1] 95% CI
Gender				
Female	4,841	54.4 (53.0, 55.8)	0.91 (0.88, 0.94)	0.96 (0.94, 0.99)
Male	7,851	59.7 (58.7, 60.8)	1.00	1.00
Race/ethnicity				
Non-Hispanic black	6,750	51.6 (50.4, 52.8)	0.73 (0.70, 0.75)	0.74 (0.72, 0.77)
White, Non- Hispanic	2,773	71.0 (69.3, 72.7)	1.00	1.00
Hispanic[a]	2,703	59.7 (57.9, 61.6)	0.84 (0.81, 0.87)	0.85 (0.81, 0.88)
Other[b]	466	55.4 (50.9, 59.9)	0.78 (0.72, 0.85)	0.79 (0.73, 0.86)
Age group (in years)				
13-24	306	38.2 (32.8, 44.0)	1.00	
25-34	1,256	45.2 (42.5, 48.0)	1.18 (1.01, 1.38)	
35-44	3,211	54.0 (52.2, 55.6)	1.41 (1.22, 1.63)	
45-54	5,183	58.9 (57.6, 60.3)	1.54 (1.33, 1.78)	
≥55	2,736	67.7 (65.9 69.4)	1.77 (1.53, 2.05)	
Transmission Risk				
Male-to-Male sex[c]	3,069	63.3 (61.6, 65.0)	1.12 (1.07, 1.17)	1.02 (0.97, 1.07)
Injection drug use	2,915	48.8 (47.0, 50.6)	0.86 (0.82, 0.91)	0.85 (0.81, 0.89)
Heterosexual sex	2,941	56.6 (54.8, 58.3)	1.00	1.00
Unknown[d]	3,767	60.9 (59.3, 62.5)	1.08 (1.03, 1.12)	1.06 (1.01, 1.10)
Number of years since diagnosis				
0-4	2,480	54.1 (52.1, 56.1)	0.91 (0.87, 0.96)	
5-9	3,125	58.0 (56.3, 59.7)	0.99 (0.95, 1.03)	
10-14	3,479	58.5 (56.8, 60.1)	0.98 (0.94, 1.02)	
≥15	3,608	59.2 (57.6, 60.7)	1.00	
City				
Atlantic City	195	43.6 (36.6, 50.6)	0.83 (0.72, 0.97)	
Camden	143	52.5 (44.3, 60.6)	1.00	
East Orange	460	52.6 (48.1, 57.2)	1.01 (0.93, 1.10)	
Elizabeth	395	49.1 (44.2, 54.0)	0.94 (0.85, 1.03)	
Irvington	337	48.4 (43.0, 53.7)	0.93 (0.83, 1.03)	
Jersey City	1,014	60.4 (57.3, 63.4)	1.15 (1.09, 1.22)	
Newark	2,035	48.5 (46.3, 50.6)	0.93 (0.88, 0.98)	
Paterson	749	53.1 (49.6, 56.7)	1.01 (0.95, 1.09)	
Plainfield	196	57.1 (50.2, 64.1)	1.09 (0.98, 1.23)	
Trenton	481	49.9 (45.4, 54.4)	0.95 (0.88, 1.04)	
Other[e]	6,687	63.0 (61.9, 64.2)	1.21 (1.17, 1.25)	
IMPAACT City				
Yes	6005	51.7 (50.5, 53.0)	0.91 (0.89, 0.92)	
No	6687	63.0 (61.9, 64.2)	1.00	
County				
Atlantic	434	51.6 (46.9, 56.3)	0.89 (0.78, 1.01)	
Bergen	600	66.2 (62.4, 70.0)	1.14 (1.03, 1.27)	
Burlington	189	49.7 (42.6, 56.9)	0.86 (0.72, 1.02)	
Camden	348	58.1 (52.9, 63.2)	1.00	
Cape May	59	62.7 (50.4, 75.1)	1.08 (0.87, 1.34)	
Cumberland	179	38.6 (31.4, 45.7)	0.66 (0.54, 0.82)	
Essex	3,399	51.6 (50.0, 53.3)	0.89 (0.81, 0.98)	

Gloucester	101	52.5 (42.7, 62.2)	0.90 (0.74, 1.11)	
Hudson	1,673	64.0 (61.7, 66.3)	1.10 (1.00, 1.21)	
Hunterdon	74	66.2 (55.4, 77.0)	1.14 (0.95, 1.37)	
Mercer	601	51.9 (47.9, 56.0)	0.89 (0.79, 1.01)	
Middlesex	709	67.4 (64.0, 70.9)	1.16 (1.05, 1.29)	
Monmouth	623	64.0 (60.3, 67.8)	1.10 (0.99, 1.23)	
Morris	254	64.2 (58.3, 70.1)	1.11 (0.97, 1.26)	
Ocean	226	68.1 (62.1, 74.2)	1.17 (1.04, 1.33)	
Passaic	1,128	55.9 (53.0, 58.8)	0.96 (0.87, 1.07)	
Salem	51	56.9 (43.3, 70.5)	0.98 (0.76, 1.26)	
Somerset	184	69.6 (62.9, 76.2)	1.20 (1.05, 1.37)	
Sussex	63	69.8 (58.5, 81.2)	1.20 (1.00, 1.45)	
Union	1,041	57.5 (54.5, 60.5)	0.99 (0.89, 1.10)	
Warren	37	59.5 (43.6, 75.3)	1.02 (0.77, 1.36)	
Unknown[f]	719	57.7 (54.1, 61.3)	0.99 (0.89, 1.11)	
AIDS		*		
Yes	7,917	59.1 (58.0, 60.2)	1.00	
No	4,775	55.4 (54.0, 56.8)	0.94 (0.91, 0.97)	
Total	**12,692**	**57.7 (56.8, 58.6)**		

<u>Legend for Table 3.4a</u>
AIDS: Acquired Immuno-Deficiency Syndrome
AVL: Available HIV Viral Load
CD4+: CD4+ count
HIV: Human Immunodeficiency Virus
IMPAACT: Intensive Mobilization to Promote AIDS Awareness through Community based Technologies
VL: Viral load
SVL: Suppressed Viral loads were ≤ 200 copies/ml / *u*l
CI: Confidence Interval
RR: Relative Risks
aRR: Adjusted Relative Risks
*** Chi-square statistically significant at p <0.05**
[a] Hispanics can be of any race
[b] Other includes: Asian, American Indian/Alaska native, Native Hawaiian, Multiple Races and unknown race/ethnicity
[c] Male-to male sex includes Male-to-male sex and injection drug use as these were small in number
[d] Includes HIV-infected persons with unreported risk
[e] Includes HIV-infected persons with unreported and/or unknown city
[f] Includes HIV-infected persons with unreported and/or unknown county
**** Aged ≥ 13 years at HIV diagnosis, excluded perinatally infected persons diagnosed at any age**

Table 3.5: Summary Table of AVL, MMVL and SVL for HIV-infected persons in Ten IMPAACT Cities, Ranked by Log_{10} VL, New Jersey, 2010.

City	HIV-infected persons	AVL		Log_{10} VL	MMVL	SVL	
		N	%			N	%
Atlantic City	641	195	30.4	2.9	794	85	43.6
Irvington	879	337	38.3	2.8	631	163	48.4
Newark	5,382	2,035	37.8	2.7	501	987	48.5
Elizabeth	957	395	41.3	2.7	501	194	49.1
City of Camden	658	143	21.7	2.7	501	75	52.5
East Orange	1,193	460	38.6	2.6	398	242	52.6
Plainfield	437	196	44.9	2.5	316	112	57.1
Jersey City	2,484	1,014	40.8	2.4	251	612	60.4
Trenton	1,016	481	47.3	2.4	251	240	49.9
Paterson	1,484	749	50.5	2.3	200	398	53.1
Total	15,131	6,005	39.2	2.6	434	3,108	51.5

Legend for Table 3.4b
AIDS: Acquired Immuno-Deficiency Syndrome
AVL: Available HIV Viral Load
HIV: Human Immunodeficiency Virus
IMPAACT: Intensive Mobilization to Promote AIDS Awareness through Community based Technologies
MMVL: Mean Monitored Viral Load
N: number
SVL: Suppressed Viral loads were $\leq$ 200 copies/ml / *u*l
VL: Viral load
Totals are slightly different to previous tables due to rounding

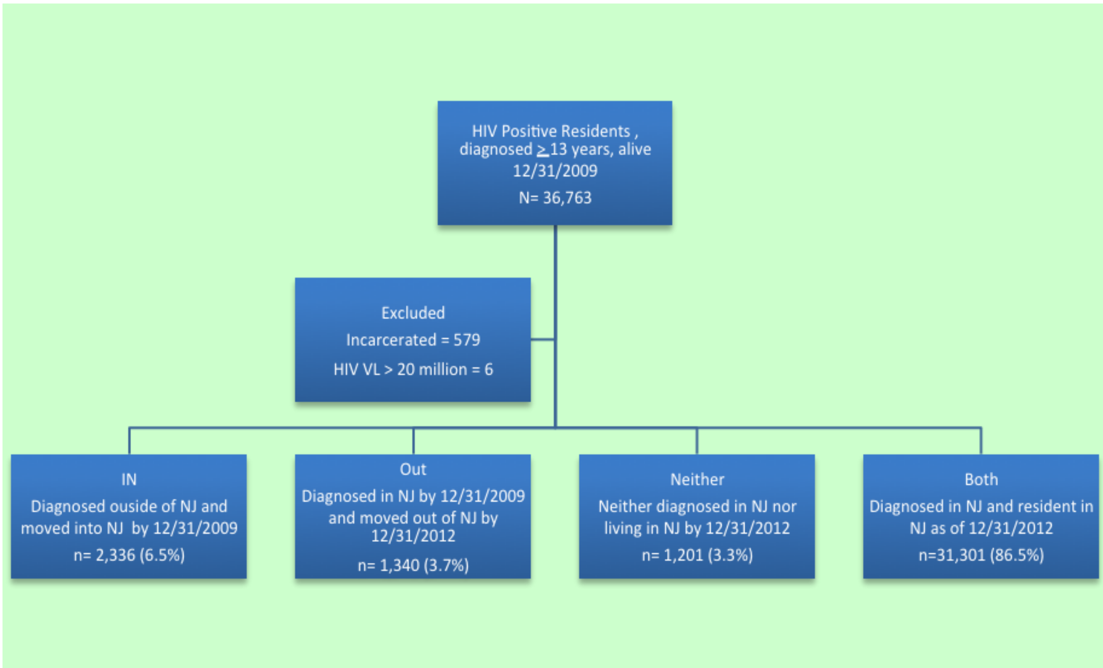

Figure 3.1: HIV-infected persons, aged greater than or equal to 13 years at diagnosis, by residence at diagnosis and as of 12/31/2012, New Jersey, 2009.

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CONCLUSION

The goals of the National HIV/AIDS Strategy (NHAS) include reducing new human immunodeficiency virus (HIV) infections, increasing access to medical care and improving health outcomes for those living with HIV, and reducing HIV-related health disparities.[1] In 2013, President Obama signed an executive order establishing the HIV Care Continuum Initiative to increase federal efforts for HIV testing, care and treatment.[2] Measurable outcomes for these goals include increasing the percentages a) of HIV-infected persons linked to clinical care $\leq$ 90 days after their diagnosis, from 65% to 85% b) of HIV-infected persons retained in care to 80 percent and c) with an undetectable viral load (VL) overall and among specific population groups (non-Hispanic blacks, Hispanics, and males who have sex with males (MSM).[1,3] The findings of this evaluation present the earliest reports of the HIV Care Continuum Initiative in New Jersey (NJ), and may serve as baseline measures for future evaluations. This includes linkage to care (2007-2011), retention in care (2010-2011) and viral load measures (the mean monitored viral load, (MMVL) and suppressed viral load (SVL), 2010).

Since 2003, NJ has increased testing in areas where the epidemic was concentrated among persons most at-risk for acquiring an infection. Newly diagnosed persons from 2007-2011 reflect efforts to increase testing among minority populations, young adults, MSM, and through outreach to at-risk populations without symptoms of HIV infection. Non-Hispanic blacks, those aged 13-24 and 25-34 years, MSM, and those diagnosed in non-clinical sites account for a higher percentage of new cases compared to those diagnosed in clinical sites.

In 2007-2011, the percentage of HIV-infected persons linked to medical care in $\leq$ 90 days was 71.6% (95% Confidence Interval (CI): 70.4-72.8), in a median time of 20 days (Interquartile range (IQR): 3-135). From 2007-2011, this improved from 64.0% to 75.0%, with the median time decreasing by 50%, from 31 to 15 days. A higher percentage of HIV-infected persons tested in clinical sites were linked to medical care $\leq$ 90 days compared to non-clinical sites (75.9% vs. 61.0%). However, among those tested in non-clinical sites, a higher percentage tested by rapid, followed by a second rapid test or a Western Blot (WB) for confirmation, linked to medical care in $\leq$ 90 days (62.3% vs. 54.0%), in a shorter time (32 vs. 60 days), compared to an enzyme immunoassay (EIA) followed by WB. By 2011 there were no statistically significant differences in linkage to care in $\leq$ 90 days based on test-type*test-site. This represents a significant accomplishment in this time period, however, there remains the potential for improving linkage rates to 85% in $\leq$ 90 days overall and in both clinical and non-clinical sites.

Early access to anti-retrovirals (ART) with all HIV-infected persons starting therapy in a timely manner will decrease the community viral load, HIV transmission and deaths.[4-5] Currently access to care may be defined as meeting with a linkage coordinator, a case manager or nurse at which time baseline laboratory testing may be conducted, including CD4+ counts and VL. However, the wait time for an appointment with a medical provider can be as long as one month. Access to medications for the prevention or treatment of opportunistic infections is delayed, and at some sites baseline laboratory testing may not occur until the medical visit. ART is therefore delayed until results of these baseline tests are available. During this waiting period, HIV-infected persons may fail to return for follow up medical visits.[6]

Challenges remain in facilitating linkage to medical care from non-clinical test sites. Enhancing partnerships between non-clinical test-sites and local medical providers may help to further decrease the time to linkage for medical care. NJ recently implemented a statewide patient navigator program for HIV-infected persons with the expectation that linkage to medical care occurs within 24-48 hours of initial contact/diagnosis.[7] Ideally, HIV-infected persons would receive medical care by a clinician on the same day as the receipt of presumptive positive test results. A systems analysis could be conducted to determine the capacity of clinical sites to receive HIV-infected persons and provide medical care.

Among HIV-infected persons, diagnosed and alive by December 31st 2009, 47.6% was engaged in medical care in 2009 (had at least one CD4+ or VL reported). Of these HIV-infected persons, 35.5% were optimally retained in medical care (had four visits, one in each of four six month intervals) in 2010-2011. Additionally, 23.5% had three out of four visits and 31.5% had two out of four visits and almost 10% did not have any visits. These latter groups represent at-risk populations for poor viral suppression and increased mortality.[5-6] Almost 50% of HIV-infected persons in 2009 were not engaged in medical care and of those who were the percentage subsequently optimally retained in care for two years was only 35.5%. Thus, in NJ there remains the potential for improving to 80% the percentage of HIV-infected persons engaged and retained in medical care over subsequent time periods.

HIV-infected persons with public funding were more likely to be engaged in medical care in 2009, and were less likely to dropout during 2010-2011. This may reflect that payment was made for medical services, case management and medications by public insurance sources including Medicaid, Pharmaceutical Assistance for the Aged and Disabled, AIDS Drug Distribution Program or other Ryan White Funding. This supports the need for continued public funding for HIV-infected persons in NJ. In 2009-2010, the District of Columbia (DC) reported higher rates of engagement (56.7%) and retention (76.2%) in medical care at sites that received publicly funded medical case management (MCM) services.[8] Services delivered by medical case managers, per DC regulations, were licensed social workers or registered nurses with the exception of individuals who did not hold these degrees but were previously providing these services and had been grandfathered into this category. Efforts in NJ by appropriately educated and trained medical case managers will contribute to retention and ultimately to viral suppression.

The majority of HIV-infected persons in NJ in 2009 were not engaged or retained in medical care during 2010-2011 making them susceptible to increases in VL, decreases in CD4+ counts, the development of opportunistic illnesses and possibly death.[5] In 2010, the death rate among HIV-infected persons in NJ was higher than the national average (27.2% vs. 21.7%).[9] HIV-infected persons who died in 2010-2011 were likely to be older (45-54, $\geq$55 years), to have a reported transmission risk of injection drug use, to have been diagnosed for $\geq$ 5 years, to reside in a one of the ten cities most impacted by the HIV epidemic in NJ and to have been engaged in medical care in 2009. The Intensive Mobilization to Promote AIDS Awareness through Community-based Technologies (IMPAACT) is a city-by-city community mobilization initiative, designed to galvanize and support African-American leaders in reducing the spread of HIV/AIDS in the ten cities with the highest prevalence of HIV in NJ.[10] Staff at clinical sites in IMPAACT cities could ensure that HIV-infected persons with these characteristics who are currently in care are retained and receive appropriate antiretroviral therapy, case management services and age appropriate preventive services.[11]

The 2010 overall mean monitored viral load (MMVL) among NJ HIV-infected persons was 316 copies/ml. HIV-infected persons in IMPAACT cities had a higher MMVL (398 copies/ml) and included cities clustered in Essex and Union counties (Irvington, Newark, East Orange, Elizabeth), Atlantic City and Camden. The percentage of HIV-infected persons with a suppressed viral load (SVL) overall was 57.7% and was lower in IMPAACT cities (51.7%), except for Jersey City (60.4%). A detectable VL places HIV-infected persons at risk for increased morbidity and mortality and is an indicator of increased potential for transmission of infection to IDU and sex partners or unborn children.[12-13] In tandem with focused retention interventions, staff at clinical-sites in IMPAACT cities can do comprehensive assessments to determine the reasons for detectable VLs, for example, poor treatment adherence, drug resistance and substance use and ensure that these barriers are minimized.

Differences in linkage to care, retention, mean monitored viral load (MMVL) and SVL were noted among population groups. Females were about 10% less likely to be linked to medical care in ≤ 90 days compared to males. However, they were more likely to be engaged and as likely to be retained in medical care as males. They had a higher MMVL (316 vs. 251 copies/ml) and were 4% less likely to have a SVL than males. A previous reported reason was a lack of social support from their partners suggesting that sero-concordant couples-focused intervention that enhances mutual support of ART adherence may be an effective approach to improving women's adherence and reducing U.S. gender disparities in HIV health outcomes.[14] The use of a single tablet containing three different medications has been associated with improved adherence and virologic suppression among women and may be considered when appropriate in the treatment of HIV infection.[15] Other factors associated with having poor viral suppression include living with others, current substance abuse, and fair/poor health.[16] This suggests that the reasons influencing retention and viral suppression are multi-factorial and can provide foci for interventions.

Non-Hispanic blacks account for 13.7% of NJ population but were disproportionately represented among newly diagnosed persons from 2007-2011 (52.5%).[17] A lower percentage of non-Hispanic blacks, 68.0% vs. 71.6% overall were linked to medical care in ≤ 90 days. When compared to whites, they were less likely to be engaged in care and 18% more likely to dropout of medical care. Their MMVL was at least three times higher and they were 26% less likely to have a SVL than whites. Therefore, prevention and care interventions among non-Hispanic blacks are needed to ensure that they are linked, engaged and retained in care to achieve decreases in MMVL and increases in SVL, leading to decreased transmission of HIV and improved health. One recent community-based study among non-Hispanic black heterosexual males reported improvement after a three-session intervention in barbershops, in attitudes and self-efficacy toward consistent condom use, lower levels of sexual risk behavior from baseline to follow-up, and increased perceptions of community empowerment.[18] This intervention could be replicated and evaluated among different groups in NJ.

Hispanics account for 17.7% of NJ population but were disproportionately represented among newly diagnosed persons in NJ from 2007-2011 (25.8%).[17] A higher percentage of Hispanics, 74.3 % vs. 71.6% overall, linked to medical care in ≤ 90 days.

When compared to whites, Hispanics were less likely to be engaged in medical care and as likely to drop out of medical care. Their MMVL was almost two times higher and they were 15% less likely to have a SVL than whites.

From 2007-2011, 6.5% of newly diagnosed HIV-infected persons reported a transmission risk of injection drug use (IDU) that likely represents an underestimate of IDU associated infections due to the high percentage with unknown/unreported risk.. Compared to MSM, a lower percentage of IDU was engaged in care in 2009, 44.4% vs. 48.0% and they were as equally to dropout of medical care. Compared to MSMs in 2010, their MMVL was almost two times higher (398 vs.200 copies/ml) and they were 15% less likely to have a SVL. Consequently, they experienced higher mortality in 2010-2011 and were about two times more likely to die than MSMs. Reports from California and South Carolina report decreasing death rates overall among HIV-infected persons, but higher proportions are non-AIDS related, highlighting that these HIV-infected persons need age appropriate preventive interventions as well as anti-retrovirals to remain healthy to prevent the development of concurrent illnesses and morbidity.[4,11,20-21]

Younger HIV-infected persons aged 13-24, were 14% less likely to link into medical care in ≤ 90 days, compared to those ≥ 55 years. However, this difference disappeared when stratified by year of diagnosis. A higher percentage were engaged in medical care in 2009, 55.7% vs. 46.7% overall. Increasing age was associated with being less likely to drop out of medical care. Compared to those ≥ 55 years old, the MMVL for 13-24 year olds was higher (794 vs. 158 copies/ml) and a lower percentage had a SVL, 38.2% vs. 67.7%. Despite effective linkage and engagement in medical care, a high percentage of HIV-infected persons aged 13-24 were not retained in medical care, had high MMVLs and did not achieve a SVL. They may need to have ongoing interactions with clinic staff to identify barriers to achieving these outcomes with implementation of appropriate interventions. One possible intervention at the clinic level would be to have designated clinic hours separate from other HIV-infected persons. Interventions should be readily available to prevent transmission of infection to uninfected drug and sex partners including behavioral interventions, condom use, and pre-exposure prophylaxis.

HIV-infected persons with a non-AIDS diagnosis were more likely to have poor linkage, retention and viral suppression. Clinicians should adhere to the most recent guidelines that recommend all HIV-infected persons be treated regardless of CD4+ count.[4] Among HIV-infected persons with poor retention or a detectable VL, enhanced contact with staff may be required including more frequent monitoring of CD4+ counts and VL which may lead to viral suppression.[22]

Reasons for poor linkage, retention in medical care and viral suppression may include lack of health insurance. Enrollment is underway for Expanded Medicaid and the Marketplace in NJ. Medicaid is available for those with incomes at < 133% of the federal poverty level ($11,670). For those with incomes up to $46,680, insurance is available on the Marketplace exchange. As of January 2015, 1.7 million NJ residents were enrolled in Medicaid, and an additional 254,316 people enrolled in the NJ exchange during the second open enrollment period, from November 15 to February 22 2015.[23-24] Additionally Ryan White funding is in place as payment of last resort for HIV infected persons who did not qualify for one of these insurance types.[25] Continued enrollment in these insurance programs will mitigate the associated costs of primary and HIV related care. Among non HIV-infected persons, enrollment in one of these insurance programs will facilitate receipt of primary medical care. Routine HIV testing was recommended for adolescents and adults aged 13-64, since 2006, and HIV testing is now reimbursable by these insurance sources.[26] We expect that routine HIV testing will identify HIV-infected persons earlier and prevent the development of opportunistic infection, HIV associated morbidity and mortality, transmission of disease and health care expenditures associated with advanced illness.[6,12-13]

The testing technologies used during the time period of this study were able to detect an antibody that develops in three to five weeks after infection with HIV. The EIA is able to detect a HIV antibody in three weeks and the WB in five weeks. Recent developments in HIV testing technology will allow for earlier identification of HIV infection during the acute phase of illness, before the body develops an antibody to the virus. The Alere Determine HIV-1/2 Ag/Ab Combo test is the first FDA-approved point of care test (POCT) that independently distinguishes results for HIV-1 p24 antigen and HIV antibodies in a single test and can detect the antigen as early as two weeks after infection.[27] This POCT is being implemented at NJDOH funded test sites in NJ and will facilitate earlier identification of HIV infection and linkage to medical care. Laboratory testing is also now able to identify the HIV antigen, approximately 3-4 days before the POCT and is available at some clinical sites in NJ.

Name-based HIV reporting, collection of CD4+ counts and HIV VL have been ongoing for at least one decade in NJ that has allowed for data collection to stabilize. In addition, the analyses included all eligible HIV-infected persons for the time periods studied. Therefore results are generalizable to HIV-infected persons in NJ. However, as those who moved in and out (INNJ, OUTNJ, and NEITHER in our data) were disproportionately male and white, it is possible that our data underrepresented white MSM who may have greater access to care, in which case their exclusion would result in a minimum estimate for our study parameters of linkage, engagement and retention, and viral load measures.

These analyses were performed on data from NJ enhanced HIV/AIDS Reporting System (eHARS) but represent three slightly different sub-populations, therefore, the results cannot be directly compared. Linkage results were based on data from newly diagnosed persons from 2007-2011, and the retention and viral load measures were based on data from 2009 that included the cumulative number of living HIV-infected persons. The final study populations for the retention in care analysis and the viral load measures were based on slightly different inclusion/exclusion criteria as those who died from 2010-2011 were excluded from the retention in care analysis. Despite these differences, because of the generalizability of the findings we feel that we could compare results across studies to identify demographic, geographic, and other factors associated with linkage, retention in medical care and viral suppression.

Information on the mode of transmission is not complete for all HIV-infected persons due to failure to report behavioral risks on lab and provider reports to eHARS which likely accounts for increased reports of unreported risk in the database. HIV-infected persons without these reports may reflect risks that are less likely to be reported by HIV-infected persons or providers, like IDU and MSM. Therefore, this would result in underestimates of linkage, engagement, retention and viral load measures in these groups.

Another variable with an unknown category was test-site, but this was a small number and the results were approximately between that of clinical and non-clinical sites; either way, this is not likely to affect our outcome, linkage to medical care.

CD4+ counts and/or VL were not available for approximately 10-20% of HIV-infected persons in the linkage to care analysis and at least 50% of HIV-infected persons in the evaluation of retention in care and VL measures. Incomplete reporting would result in underestimates of our outcomes; the actual percentages of HIV-infected linked, retained in care and virally suppressed may be even higher than estimated. Despite this limitation, we feel confident in our estimated time to linkage to medical care as HIV-infected persons will become ill over time and seek medical care and states routinely share data on cases that appear in multiple jurisdictions and apply uniform national criteria to minimize the risks of over counting in the national database. Future evaluations of the HIV Care Continuum can exclude HIV-infected persons in eHARS without any reports of CD4+ counts or VL for the past 5 years on the premise that they have most likely moved out of NJ especially those diagnosed with AIDS, those meeting the changing federal thresholds for initiation of ART, and others needing care because of advancing disease.[28-29]

We did not have access to the percentage of HIV-infected persons on anti-retroviral therapy (ART). Although these data are needed to measure the success of ART, they were not needed for this analysis, as the focus was on population viral suppression. Under current federal guidelines to treat all HIV-infected persons, regardless of CD4+ counts, many more HIV-infected persons in care after 2012 will likely be offered ART compared with those analyzed in this report.[4]

Data on funding source may be obtained at the time of testing and diagnosis. This was updated only for HIV-infected persons who subsequently received public funding. We are confident that the public funding category reflects HIV-infected persons who were receiving this funding source in NJ as eHARS is routinely matched to public drug utilization data. The private funding category reflects status at diagnosis and is likely accurate because these HIV-infected persons did not later match to a publicly funded program database. “Unknown” includes those without any reported insurance type that did not later match to a publicly funded source. It is possible that this category included HIV-infected persons with private insurance that would blunt the effect of not having any insurance on retention in care. Therefore, we are confident that our findings reflect those HIV-infected persons with public funding, retained in medical care.

In the retention in care analysis we excluded those who died in 2010-2011 following the methods of a previous study by Tripathi et al.[30] Although this could lead to an overestimation of the percentage of HIV-infected persons retained in medical care in this study, results were similar to Tripathi’s study as well as estimates in other national studies.[31-32] Future studies could use survival methods for analysis, specifically competing risks models, so that data on HIV-infected persons who died can be included (n=1,407 in our study). Ordinal logistic regression may also be considered as the use of a polytomous log-binomial model would have been more efficient and the parameter estimates would have smaller standard errors and increased precision compared to individual binomial outcomes.

In the calculation of the mean monitored viral load (MMVL) only a minimum estimate is possible as HIV-infected persons who did not have an available VL are most likely not in medical care and may have elevated levels of the virus. These results cannot be generalized to HIV-infected persons living with HIV/AIDS without AVL as we had access to VLs for those engaged in medical care only. We also did not have access to those HIV-infected persons unaware of their infections or acutely infected. Therefore, results will not be generalizable to those not yet diagnosed. The VLs in these HIV-infected persons may be very high if they are in early stage (acute) infection or in later stages of disease.

NJ is working towards accomplishing the goals of NHAS but this initial evaluation reveals challenges and opportunities overall and among population groups. Linkage to medical care in $\leq$ 90 days improved from 2007-2011 and there were no differences among population groups by 2011 for those who were ever linked to medical care. In 2012, NJDOH implemented a HIV Patient Navigator initiative where designated patient navigators rapidly link people living with HIV to care and subsequent antiretroviral therapy.[7] The next steps of the HIV Care continuum require similar structural changes where newly diagnosed HIV-infected persons receive medical care on the same day as testing HIV-positive, antiretroviral therapy is implemented at the earliest time after diagnosis and strengthened medical case management will be provided by adequately educated and trained professionals. These efforts should be monitored and evaluated in real time with changes in care and practice reflecting current evidence.. The findings in this evaluation highlight the need for continued support in prevention and health care for linkage, retention and viral suppression overall, and in at-risk populations: females, non-Hispanic blacks, Hispanics, MSM, IDU and younger HIV-infected persons.

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CURRICULUM VITAE

Education

2008-present	Rutgers University School of Public Health New Brunswick, New Jersey. Doctoral Candidate in Public Health Concentration: Epidemiology.
2002-2007	University of Medicine and Dentistry Department of Preventive Medicine Newark, New Jersey. Masters in Public Health Concentration: Urban Health Administration
1997-2000	Rutgers University Newark, New Jersey. Masters in Science Concentration: Nursing
1993-1996	Kean College Union, New Jersey. Bachelors of Science in Nursing
1983-1986	San Fernando General Hospital School of Nursing Trinidad, West Indies Diploma in General Nursing

Clinical and Hospital Service Responsibilities

2014-present	Nurse Practitioner: HIV/AIDS Hyacinth Foundation Incorporated, Newark, New Jersey.
2010-present	Nurse Practitioner: HIV/AIDS Peter Ho Memorial Clinic, St Michael's Medical Center, Newark, New Jersey.
2013-present	Nurse Practitioner: Gynecology St Michael's Medical Center, Newark, New Jersey.
7/2013-11/2013	Nurse Practitioner, Schumacher: Emergency Department St Michael's Medical Center, Newark, New Jersey.
2004-2013	Project Director

	Rapid HIV Counseling, Testing and Referral Service University Hospital, Newark, New Jersey.
2001- 2010	Advanced Practice Nurse: HIV/AIDS Infectious Diseases Clinic University Hospital, Newark, New Jersey.
2002-2009	Faculty: New York/New Jersey AETC Center for Continuing Education University of Medicine and Dentistry, Newark, New Jersey
7/2000 - 1/2001	Nurse Clinician Infectious Diseases Clinic University Hospital, Newark, New Jersey.
1995-2000	Registered Nurse Visiting Nurses and Health Services Elizabeth, New Jersey.
1993-1995	Registered Nurse Saint Elizabeth's Hospital Elizabeth, New Jersey
1990 -1993	Registered Nurse Irvington General Hospital
1987 - 1989	Registered Nurse San Fernando General Hospital San Fernando, Trinidad, West Indies.

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