A Matter of Perspective: Comparison of the Characteristics of Persons with HIV Infection in the United States from the HIV Outpatient Study, Medical Monitoring Project, and National HIV Surveillance System

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Abstract: Comparative analyses of the characteristics of persons living with HIV infection (PLWH) in the United States (US) captured in surveillance and other observational databases are few. To explore potential joint data use to guide HIV treatment and prevention in the US, we examined three CDC-funded data sources in 2012: the HIV Outpatient Study (HOPS), a multisite longitudinal cohort; the Medical Monitoring Project (MMP), a probability sample of PLWH receiving medical care; and the National HIV Surveillance System (NHSS), a surveillance system of all PLWH. Overall, data from 1,697 HOPS, 4,901 MMP, and 865,102 NHSS PLWH were analyzed. Compared with the MMP population, HOPS participants were more likely to be older, non-Hispanic/Latino white, not using injection drugs, insured, diagnosed with HIV before 2009, prescribed antiretroviral therapy, and to have most recent CD4+ T-lymphocyte cell count ≥500 cells/mm3 and most recent viral load test <200 copies/mL. The MMP population was demographically similar to all PLWH in NHSS, except it tended to be slightly older, HIV diagnosed more recently, and to have AIDS. Our comparative results provide an essential first step for combined epidemiologic data analyses to inform HIV care and prevention for PLWH in the US.

Keywords: AIDS, cohort, epidemiology, HIV, observational study, surveillance, United States.

INTRODUCTION

For the estimated 914,000 persons living with diagnosed HIV infection in the United States (US) [1], many of whom are engaged in HIV care to various degrees [1-3], describing the epidemiology of chronic HIV infection and short- and long-term clinical outcomes warrant multifaceted approaches and data sources [4]. Owing to the reductions in morbidity and mortality following the introduction of antiretroviral therapy (ART) [5, 6], HIV infection has become a chronic condition, with individuals living longer, healthier lives and experiencing non-infectious illnesses traditionally associated with aging [7-10]. Innovative uses of cross-sectional and longitudinal data to assess patterns in medical care may guide further improvements in the clinical management of persons living with HIV infection and planning for their care and prevention services [8, 11, 12].

To this end, the Centers for Disease Control and Prevention (CDC) supports complementary data collection activities for persons living with HIV infection in the US, both research studies and routine surveillance, each with its strengths and limitations. The HIV Outpatient Study (HOPS) is a prospective cohort of HIV-infected persons receiving care at selected HIV specialty clinics in the US [5, 13]. The longitudinal nature of HOPS data enables investigation of associations between HIV disease, ART and other treatments, and a variety of clinical outcomes [5, 14-17]. Since HOPS is a convenience sample of patients at selected HIV clinics, it is unclear how the findings from HOPS reflect those for all patients in HIV care or all persons with diagnosed HIV infection. In contrast, the Medical Monitoring Project (MMP) is an ongoing, multisite, supplemental surveillance system designed to provide nationally representative data about medical care, behaviors, and health status of HIV-infected adults in the US through annual cross-sectional surveys [18]. Each year medical chart abstractions and interviews are collected for a different sample of persons, which precludes multi-year observation of individual patients. Finally, the National HIV Surveillance System (NHSS) collects information on all HIV-diagnosed...
persons in the US, for whom longitudinal HIV laboratory assessments, care patterns, and mortality are tracked [1]. However, NHSS has limited clinical information on HIV-related and unrelated conditions and treatments.

The primary objective of this paper was to compare demographic characteristics of HIV-infected persons in HOPS, MMP, and NHSS and to explore potential joint uses of these data to improve treatment and prevention services for persons living with HIV infection in the US. We also sought to address the following two research questions: (1) Do characteristics of a convenience sample of patients consenting to participation in a large longitudinal HOPS cohort approximate those of persons with HIV infection in the population-based MMP and all persons living with diagnosed HIV infection in the United States?; and (2) Are the population-based estimates derived from MMP likely applicable to all patients in HIV care in the United States, despite the fact that MMP sampling frame only includes patients having at least one clinical visit during January - April in the year?

METHODS

Data Sources

HIV Outpatient Study (HOPS)

HOPS is an ongoing, prospective, observational cohort study of HIV-infected adults (age 18 and older) seen at HIV-specialty clinics since 1993 [13]. As an open cohort, HOPS has continued enrollment of new patients, as some patients transfer to care at other locations, are lost to follow-up, or die. The nine clinics participating in HOPS in 2012 and included in this analyses comprise public, private and university-based sites and are located in six US cities: Tampa, FL; Washington, DC; Denver, CO (3 sites); Chicago, IL (2 sites); Stonybrook, NY; and Philadelphia, PA. HOPS clinicians have extensive experience treating patients living with HIV. Information is abstracted from medical records for each visit, entered electronically by trained staff (DISCOVERE®; Cerner Corporation, Kansas City, MO), compiled centrally, and reviewed and edited before being analyzed. Abstracted information includes demographic characteristics, risk factors for HIV infection, diagnoses, prescribed medications, laboratory values (including CD4+ T-lymphocyte cell (CD4) counts and plasma HIV viral loads), mortality, and hospitalization records (primarily from discharge summaries). Participants sign informed consent, and the HOPS protocol has been reviewed and approved annually by the institutional review boards of CDC (Atlanta, GA) and each local site. This analysis uses HOPS dataset available as of March 31, 2015.

Medical Monitoring Project (MMP)

MMP is an on-going HIV surveillance system designed to produce nationally representative estimates of behavioral and clinical characteristics of HIV-infected adults receiving medical care in the US [18-20]. MMP is a complex-sample, cross-sectional survey. For the 2012 data collection cycle, states and territories were sampled first, followed by facilities providing any outpatient HIV care, and then by HIV-infected adults (age 18 years and older) who had at least one medical care visit during January-April 2012 at participating facilities. Data were collected through face-to-face interviews and medical record abstractions from June 2012 through April 2013. Variables from medical records and sociodemographic and behavioral information from structured interviews were ascertained for the 12 months prior to and including the date of a participant’s interview. All sampled states and territories participated in MMP: California, Delaware, Florida, Georgia, Illinois, Indiana, Michigan, Mississippi, New Jersey, New York, North Carolina, Oregon, Pennsylvania, Puerto Rico, Texas, Virginia, and Washington.

Of 548 sampled eligible facilities, 467 participated in MMP (facility response rate, 85%). Most of the HIV care facilities sampled were private practices (51%), followed by hospital-based facilities (29%) and community health centers (17%). The remainder was clinical research facilities (8%), state or local health department clinics (8%), other community-based service organizations (5%), and other type of facilities (7%). A facility could belong to multiple categories. Of 9,394 sampled persons, 4,901 completed the interview and had their medical records abstracted (adjusted patient-level response rate, 53%). For nationally representative estimates, data were weighted to adjust for nonresponse by using predictors of response. After weighting the data for probability of selection and non-response, the 4,901 MMP participants were estimated to represent the population of 476,366 adults with HIV infection receiving medical care in the US [18, 19].

National HIV Surveillance System (NHSS)

We used data from CDC-supported NHSS to determine the prevalence of HIV infection among persons 18 years and older in the US in 2012. HIV infection is reportable in all 50 states and the District of Columbia. Cases meeting prerequisite data quality criteria (http://www.cdc.gov/hiv/guidelines/reporting.html) are reported by local health jurisdictions to CDC with demographic information, risk factors, and clinical information, including acquired immunodeficiency syndrome (AIDS) diagnoses, but without personal identifying information. We estimated the number of persons diagnosed through 2011 and alive at year-end 2012 overall, and by age, sex, race/ethnicity, transmission category, year of diagnosis (before 2009, during, or after 2009), and whether their infection had ever been classified as stage 3 (AIDS). Data were reported to CDC through December 2014 and all analyses were adjusted for reporting delays in diagnoses and deaths [1].

Analyses

Primary Analysis: Comparison of HOPS and MMP

For the primary analysis, for closest correspondence with MMP data, we included HOPS participants who met the following inclusion criteria: (A) were actively providing data to HOPS as of January 1, 2012; (B) were 18 years or older by January 1, 2012; (C) had at least one clinic visit between January 1, 2012, and April 30, 2012 (clinic visit defined as routine, initial, return to active status, event triggered, or post-hospital follow up); and (D) were alive in HOPS as of
the weighted mean patient interview date in MMP as
described below.

Although the MMP reference population is HIV-infected
adults receiving medical care in January-April 2012, MMP
participants were interviewed from June 2012 through April
2013. Their sociodemographic, behavioral and clinical
characteristics were collected (by interview or medical chart
abstraction) for the 12 months prior to the interview. To
allow for comparability of MMP and HOPS data, the
demographic and clinical variables in HOPS were defined as
of the weighted mean (i.e., average) interview date of the
MMP participants, which was calculated as November 25,
2012, and spanned the period of the previous 12 months,
when appropriate.

Sociodemographic variables were age, sex at birth,
race/ethnicity (including non-Hispanic/Latino black or
African American [referred to as black], non-
Hispanic/Latino white [referred to as white], Hispanic or
Latino of any race [referred to as Hispanic], and persons of
other race/ethnicity), HIV acquisition risk group (including
gay, bisexual and other men who have sex with men [MSM],
males and females who inject drugs [IDU], heterosexual
males and females, and persons in other risk categories
[including hemophilia, perinatal and occupational
exposures]) and health insurance coverage. Clinical and
HIV-related variables included year of HIV diagnosis,
history of AIDS diagnosis by immunologic or clinical
criteria, antiretroviral (ARV) exposure status, most recent
CD4 count in the 12 months preceding the interview date
(weighted mean interview date for HOPS), most recent viral
load (defined as most recent HIV viral load undetectable or <
200 copies/mL in the 12 months preceding the interview
date, the Department of Health and Human Services (DHHS)
recommended threshold [21]), durable viral suppression
(defined to include all viral loads in the previous 12 months
undetectable or < 200 copies/mL; if no viral loads were
measured then the patient was not considered durably
suppressed [22]), number of CD4/viral load measurements in
the 12 months prior to the interview date, at least one viral
load in each 6-month period prior to the interview date, at
least one CD4 count measurement in the 12 months prior to
the interview date, clinical visit frequency and density, and
number of clinic visits in the 12 months preceding the
interview date.

Summaries of descriptive data were performed using
SAS version 9.3 (SAS Institute Inc., Cary, NC). For the
MMP population, we report unweighted frequencies and
weighted percentages with 95% confidence intervals (CIs) to
characterize all self-reported and clinical characteristics; the
weighted estimates are designed to represent the population
of adults with HIV infection receiving medical care in the
US from January-April 2012. For continuous variables, we
report arithmetic means (and geometric means, where
indicated) and associated standard errors, and medians and
interquartile ranges (IQRs), which were weighted for MMP.
For HOPS participants, we estimated standard errors for
percentages assuming a binomial distribution and computed
95% CIs. We evaluated differences between means for
continuous variables in HOPS versus MMP using a z-
statistic; similarly, for percentages we calculated the
standard error for the difference in percentages using
established methods described by Fleiss et al. [23] and
calculated a standard z-statistic.

**Sub-Analysis A: Comparison of HOPS Participants and
MMP Population to NHSS**

NHSS collects data on all HIV-diagnosed persons living
in the US, including persons who are not receiving medical
care. We compared percentages among HOPS participants,
the MMP population, and persons in NHSS. NHSS
percentages are based on a census of all HIV-diagnosed
persons (i.e., including those not in care) who have been
reported to NHSS. Since NHSS percentages are known
population parameters, HOPS or MMP estimates were
deemed statistically significantly different from NHSS
parameters if the corresponding 95% CI for HOPS or MMP
estimates did not include the NHSS value.

**Sub-Analysis B: Comparison of HOPS Participants with at
Least One Visit in January-April 2012, at Least One Visit
in January-December 2012, and Visits Only in May-
December 2012**

Population-based cross-sectional surveillance systems,
such as MMP, need to define a reference population, which
for MMP was all HIV-diagnosed persons aged ≥18 years
who were receiving medical care between January-April
2012. The 4-month population definition period was adopted
for MMP as a compromise based on logistical considerations
(e.g., difficulty in enumerating the sampling frame, effort to
locate and recruit sampled persons who might have last
received care over one year ago, etc.) and population
representativeness (e.g., prior analyses noted that 88% of all
persons who had at least one clinical visit in the calendar
year had at least one visit in the first four months of the year)
[24]. The rationale for a 4-month population definition
period was established using one dataset and has not been re-
examined recently.

To assess the potential bias introduced by using a 4-
month population definition period in the MMP to
approximate the characteristics of persons who had at least
one clinical visit in a calendar year, we compared HOPS
participants using three different study population
definitions: A) persons who had at least one visit between
January-April 2012; B) persons who had at least one visit
between January-December 2012; and C) persons who had
visits only between May-December 2012. Note that
populations A and C are mutually exclusive and together
sum to population B. The clinic visit types included in this
sub-analysis were the same as in the primary analysis.
However, for these analyses, clinical and sociodemographic
characteristics were assessed for the twelve months of the
2012 calendar year rather than the twelve months prior to the
weighted mean interview date (November 25, 2012)
described above.

We assessed the statistical differences between HOPS
populations A and C using chi-square tests for categorical
variables, Cochran-Armitage trend tests for ordinal variables,
Student’s t-test for comparing means, and Wilcoxon rank
sum test for medians of continuous variables. Statistical
comparisons with p-values < 0.05 were considered
significant. To validate the MMP sampling strategy to obtain
estimates relevant for all patients in HIV care, we calculated
the differences in percentage estimates from HOPS population A versus B.

RESULTS

Primary Analysis

We included 1,697 HOPS and 4,901 MMP participants in the primary analysis. After the MMP data were weighted to derive national estimates, compared with the MMP population, the HOPS participants were older (mean age: 50.2 years vs 47.3 years), and a higher percentage were white (47.8% vs 35.3%) (Table 1). In both HOPS and MMP, most persons were MSM (56.2% vs 59.9%, inclusive of both MSM and MSM who used injection drugs), but HOPS had fewer participants with IDU as their sole risk factor for HIV acquisition (7.1% vs 13.2%). The percentage of non-IDU heterosexual females was similar in HOPS and MMP (20.4% vs 19.4%). Compared with the MMP population, a smaller percentage of HOPS participants were diagnosed with HIV

Table 1. Characteristics of HIV Outpatient Study (HOPS) participants, Medical Monitoring Project (MMP) population, and persons living with diagnosed HIV infection in the National HIV Surveillance System (NHSS), United States, 2012.

| Characteristic | HOPS (N=1,697) | MMP (N=4,901) | HOPS vs MMP | NHSS (N=865,102) |
|---------------|---------------|---------------|-------------|------------------|
|               | No. | % (95% CI) | No. | % (95% CI) | p value<sup>c</sup> | No. | % |
| Age category, years |     |             |     |             |                       |     |     |
| 18-24         | 14  | 0.8 (0.4 - 1.3) | 144 | 3.1 (2.3 - 3.9) | <0.001 | 35,381 | 4.1 |
| 25-34         | 131 | 7.7 (6.4 - 9.0) | 579 | 12.3 (11.2 - 13.3) | <0.001 | 122,361 | 14.1 |
| 35-44         | 324 | 19.1 (17.2 - 21.0) | 1,015 | 20.7 (19.3 - 22.1) | 0.18 | 215,173 | 24.9 |
| 45-54         | 696 | 41.0 (38.7 - 43.4) | 1,869 | 37.4 (35.6 - 39.3) | 0.02 | 309,219 | 35.7 |
| 55-64         | 410 | 24.2 (22.2 - 26.3) | 1,066 | 21.8 (20.3 - 23.3) | 0.06 | 145,202 | 16.8 |
| ≥65           | 121 | 7.1 (5.9 - 8.4) | 228 | 4.7 (3.8 - 5.6) | 0.04 | 37,766 | 4.4 |
| Mean age (SE), years | 50.2 (0.25) | 47.3 (0.20) | <0.001 | 46.1 |
| Median age [IQR], years | 50.3 [44.1, 57.0] | 47.9 [39.8, 54.5] | <0.001 | 46.8 [38.6, 53.6] |
| Sex at birth<sup>a</sup> |     |             |     |             |                       |     |     |
| Male          | 1,266 | 74.6 (72.5 - 76.7) | 3,625 | 74.5 (70.9 - 78.0) | 0.96 | 652,701 | 75.4 |
| Female        | 431  | 25.4 (23.3 - 27.5) | 1,274 | 25.5 (21.9 - 29.0) | 0.96 | 212,401 | 24.6 |
| Race/Ethnicity |     |             |     |             |                       |     |     |
| White, non-Hispanic | 811 | 47.8 (45.4 - 50.2) | 1,560 | 35.3 (27.4 - 43.2) | 0.003 | 281,397 | 32.5 |
| Black, non-Hispanic | 607 | 35.8 (33.5 - 38.1) | 2,072 | 41.6 (31.9 - 51.3) | 0.25 | 367,503 | 42.5 |
| Hispanic or Latino | 226 | 13.3 (11.7 - 14.9) | 1,060 | 18.7 (12.7 - 24.6) | 0.09 | 173,311 | 20.0 |
| Other† | 53  | 3.1 (2.3 - 4.0) | 209 | 4.5 (3.5 - 5.5) | 0.04 | 42,891 | 5.0 |
| HIV acquisition risk group |     |             |     |             |                       |     |     |
| MSM           | 931  | 54.9 (52.5 - 57.2) | 2,516 | 53.9 (49.1 - 58.7) | 0.71 | 448,696 | 51.9 |
| IDU-male      | 70   | 4.1 (3.2 - 5.1) | 422 | 7.5 (6.1 - 8.9) | <0.001 | 80,317 | 9.3 |
| IDU-female    | 50   | 3.0 (2.1 - 3.8) | 309 | 5.7 (4.3 - 7.1) | 0.001 | 51,673 | 6.0 |
| MSM-IDU       | 22   | 1.3 (0.8 - 1.8) | 321 | 6.0 (5.0 - 7.0) | <0.001 | 49,225 | 5.7 |
| Heterosexual-male | 171 | 10.1 (8.6 - 11.5) | 339 | 6.5 (5.3 - 7.7) | <0.001 | 68,590 | 7.9 |
| Heterosexual-female | 347 | 20.4 (18.5 - 22.4) | 944 | 19.4 (16.9 - 21.9) | 0.54 | 156,114 | 18.0 |
| Other         | 106  | 6.2 (5.1 - 7.4) | 51 | 1.0 (0.6 - 1.4) | <0.001 | 10,487 | 1.2 |
| Year of HIV diagnosis<sup>b</sup> |     |             |     |             |                       |     |     |
| < 2009        | 1,574 | 92.8 (91.5 - 94.0) | 4153 | 83.0 (81.5 - 84.5) | <0.001 | 737,882 | 85.3 |
| 2009 and later | 122  | 7.2 (6.0 - 8.4) | 748 | 17.0 (15.5 - 18.5) | <0.001 | 127,220 | 14.7 |
| Ever had AIDS as of end of 2012 |     |             |     |             |                       |     |     |
| Yes           | 1,088 | 64.1 (61.8 - 66.4) | 3,380 | 68.3 (66.1 - 70.5) | 0.01 | 493,497 | 57.0 |
| No            | 609  | 35.9 (33.6 - 38.2) | 1,521 | 31.7 (29.5 - 33.9) | 0.01 | 371,604 | 43.0 |

Footnotes to Table 1.
Abbreviations: CI = confidence interval; IDU = male or female injection drug user; IQR = Interquartile range; MSM = men who have sex with men; SE=Standard error.
<sup>a</sup>P-values were obtained from z-statistics.
<sup>b</sup>Characteristics for HOPS patients and MMP patients were established based on data collected in the twelve months prior to the MMP’s weighted interview date which was November 25, 2012; characteristics for NHSS were established based on data in the entire 2012 calendar year.
<sup>c</sup>Two people with intersex/ambiguous sex from MMP not shown - these people were included in all the analyses.
<sup>d</sup>MMP data are nationally representative sampling-probability weighted estimates.
<sup>e</sup>Other race groups include those of multiple race groups and other, unknown or missing race groups.
<sup>f</sup>One person had unknown year of HIV diagnosis from the HOPS.
infection in 2009 or later (7.2% vs 17.0%), and a smaller percentage had AIDS (64.1% vs 68.3%).

A higher percentage of HOPS participants had any insurance coverage compared to the MMP population (91.8% vs 81.5%) and differences by payer type, including utilization of Ryan White HIV/AIDS program, were noted (Table 2). Compared with the MMP population, a higher percentage of HOPS participants had been prescribed ART in the past year (96.5% for HOPS vs 92.7% for MMP, respectively), and specifically had been prescribed the newer classes of ART such as entry or integrase inhibitors (35.6% vs 20.4%), had a most recent CD4 count ≥500 cells/mm³ (52.8% vs 50.1%), had a most recent viral load test that was undetectable or <200 copies/mL (84.7% vs 77.3%), and had all viral loads in the past 12 months undetectable or <200 copies/mL (77.7% vs 66.2%). The mean number of HIV laboratory measurements (viral load and CD4 count tests) was significantly lower for HOPS participants than the MMP population, but HOPS patients were more likely to achieve recommended viral load monitoring (at least once in each 6-month period), and to have at least once CD4 count in the year (Table 2).

**Sub-Analysis A: Comparison of HOPS Participants and MMP Population to NHSS**

This analysis included NHSS data on 865,102 persons who were diagnosed with HIV infection by the end of 2011 and were alive at the end of 2012. Compared with HIV-diagnosed persons in NHSS, a lower percentage of HOPS participants were aged 18-24 years (0.8% HOPS vs 4.1% NHSS, respectively) and a higher percentage were aged 45-64 years (65.2% vs 52.5%, Table 1). Moreover, a higher percentage of HOPS participants compared with persons in NHSS were white (47.8% vs 32.5%) and a lower percentage were black (35.8% vs 42.5%) and Hispanic (13.3% vs 20.0%). A lower percentage of HOPS participants had HIV acquisition attributed to IDU (7.1% vs 15.3%) and a higher percentage were diagnosed before 2009 (92.8% vs 85.3%) and ever had AIDS (64.1% vs 57.0%). Compared with HIV-diagnosed persons in NHSS, the MMP population had a similar distribution by age (MMP patients were modestly older, by about one year on average, sex at birth, race/ethnicity, HIV acquisition risk group, but it had a greater percentage of persons HIV diagnosed in 2009 or later (17.0% vs 14.7%) as well as persons diagnosed with AIDS (68.3% vs 57.0%).

**Sub-Analysis B: Comparison of HOPS Participants with At Least One Visit January-April 2012, At Least One Visit January-December 2012, and Visits Only May-December 2012**

Among the 2,218 HOPS participants who had at least one visit (i.e., were “seen”) January-December 2012, 1,697 (76.5%) HOPS participants had at least one visit January-April 2012. As suggested by relatively modest differences in percentage estimates for population A vs population C for most categorical factors, HOPS participants who were seen January-April had similar demographic, behavioral, and clinical characteristics to HOPS participants who were seen January-December, except for the percentage with private insurance (49.6% vs 53.0%, Table 3). Of note, both populations had the same percentage of ART prescription (95.6%) and both had similar percentages with most recent viral load undetectable or < 200 copies/mL (84.9% vs 83.6%), but HOPS participants who were seen January-April had more visits and CD4 count and viral load tests, and were more likely to have at least one viral load in each 6-month period (Table 3).

Only 521 (23.5%) of HOPS participants who were seen in January-December had their sole visit in May-December. Persons who were seen only during May-December, and thus may have been somewhat less engaged in care, differed significantly from those seen in January-April in the following ways: they were slightly younger, more likely to be male, white, diagnosed with HIV before 2009, and privately insured, but less likely to have ever had AIDS (Table 3). Although they had nearly identical level of any health insurance coverage (91.1% vs 91.8%), the same frequency of ART prescription in the year (96.5%), used similar classes of ART regimens, and had comparable mean CD4 counts, these patients who were only seen in May-December also had fewer visits and CD4 count and viral load measurements, and fewer had their most recent viral load undetectable or < 200 copies/mL (79.5% vs 84.9%) as compared with patients with at least one visit in January-April (Table 3).

**DISCUSSION**

In-depth comparative analysis of multiple data sources describing persons living with diagnosed HIV infection is important for evidence-based decision making to guide HIV prevention and care research and programs. We found that participants in the HOPS differed by some demographic and clinical characteristics from the MMP population of persons receiving HIV medical care during January-April 2012, and likewise differed from all persons living with diagnosed HIV infection in NHSS. These findings will inform ongoing patient enrollment in HOPS to focus on under-represented subgroups, including more recently HIV-diagnosed persons, younger individuals, and persons who are black or of Hispanic/Latino race/ethnicity. The MMP and NHSS populations were demographically similar, except a greater percentage of persons in MMP were HIV-diagnosed in 2009 or later and greater percentage have ever been diagnosed with AIDS, suggesting that select findings from MMP may broadly apply to all adults living with diagnosed HIV infection in the US. Since the MMP and NHSS populations were demographically similar also suggests, by extension, that HIV-diagnosed persons who were in care (the majority) were not substantially different by age, sex and race/ethnicity from those HIV-diagnosed but not in care (the minority) captured through the NHSS; although certain differences could be masked in our comparison given that the latter group is smaller than the former [3]. Furthermore, analyses from HOPS revealed that persons seen in the first four months of the calendar year generally resemble in their characteristics persons seen for HIV care throughout the year, thus providing support for the present MMP sampling methodology.
Table 2. HIV care-related characteristics of HIV Outpatient Study (HOPS) participants and Medical Monitoring Project (MMP) population, United States, 2012.

| Characteristic† | HOPS (N=1,697) | MMP (N=4,901) | P Value‡ |
|-----------------|----------------|----------------|----------|
| Any health insurance coverage‡ | 1,558 91.8 (90.5 - 93.1) | 4,051 81.5 (77.5 - 85.5) | <0.001 |

Healthcare payer type†

| Any payer or insurance§ | 1,620 95.5 (94.5 - 96.5) | 4,787 97.7 (96.9 - 98.4) | <0.001 |
| Any private | 833 49.1 (46.7 - 51.5) | 1,422 30.5 (25.7 - 35.4) | <0.001 |
| Any Medicaid | 518 30.5 (28.3 - 32.7) | 1,909 38.7 (34.0 - 43.4) | 0.001 |
| Any Medicare | 445 26.2 (24.1 - 28.3) | 1,276 26.1 (24.7 - 27.5) | 0.94 |
| Any Ryan White | 142 8.4 (7.0 - 9.7) | 1,992 41.7 (38.9 - 44.5) | <0.001 |

Any ART prescription in the year

| Any ART prescription in a given class in year | |
| Any NNRTI | 734 43.3 (40.9 - 45.6) | 2,092 46.7 (44.9 - 48.5) | 0.35 |
| Any PI | 741 43.7 (41.3 - 46.0) | 2,441 52.5 (50.6 - 54.4) | <0.001 |
| Any entry or integrase inhibitor | 604 35.6 (33.3 - 37.9) | 935 20.4 (18.6 - 22.2) | <0.001 |

Last CD4 count, cells/mm³

| Last CD4 count, cells/mm³ | |
| Missing/unknown | 52 3.1 (2.2 - 3.9) | 257 5.9 (4.7 - 7.1) | <0.001 |
| 0-199 | 123 7.2 (6.0 - 8.5) | 477 9.4 (8.1 - 10.7) | 0.02 |
| 200-349 | 214 12.6 (11.0 - 14.2) | 694 13.6 (12.0 - 15.1) | 0.38 |
| 350-499 | 321 18.9 (17.1 - 20.8) | 1,013 21.0 (19.5 - 22.5) | 0.08 |
| ≥ 500 | 987 58.2 (55.8 - 60.5) | 2,460 50.1 (48.0 - 52.2) | <0.001 |

CD4 count, population geometric mean (SE)

| CD4 count, median [IQR] | 598.4 (7.64) | 553.4 (6.79) | <0.001 |

CD4 count, median [IQR] (MMP)

| CD4 count, median [IQR] | 564.0 [386.5, 776.7] | 520.9 [355.3, 714.7] |

Last VL undetectable or <200 copies/mL

| Last VL undetectable or <200 copies/mL | 1,438 84.7 (83.0 - 86.5) | 3,829 77.3 (75.4 - 79.2) | <0.001 |

All VLs in the year undetectable or <200 copies/mL

| All VLs in the year undetectable or <200 copies/mL | 1,318 77.7 (75.7 - 79.7) | 3,283 66.2 (64.1 - 68.3) | <0.001 |

Mean number of CD4/ VL tests in the year (SE)

| Mean number of CD4/ VL tests in the year (SE) | 2.5 (0.02) | 2.9 (0.05) | <0.001 |

Median number of CD4/ VL in the year [IQR]

| Median number of CD4/ VL in the year [IQR] | 2.0 [2.0, 3.0] | 2.4 [1.4 - 3.3] |

% with number of CD4/ VL in the year

| % with number of CD4/ VL in the year | 0 or none documented | 47 2.8 (2.0 - 3.6) | 215 4.9 (3.7 - 6.0) | 0.003 |
| 1 | 214 12.6 (11.0 - 14.2) | 519 10.6 (9.4 - 11.9) | 0.05 |
| 2 | 639 37.7 (35.3 - 40.0) | 1,131 23.4 (20.9 - 25.8) | <0.001 |
| 3 | 519 30.6 (28.4 - 32.8) | 1,471 30.4 (28.5 - 32.2) | 0.89 |
| 4+ | 278 16.4 (14.6 - 18.1) | 1,565 30.7 (27.7 - 33.7) | <0.001 |

At least one VL in each 6 month period

| At least one VL in each 6 month period | 1,265 74.5 (72.5 - 76.6) | 3,489 70.7 (68.4 - 72.9) | 0.01 |

At least one CD4 in the year

| At least one CD4 in the year | 1,645 96.9 (96.1 - 97.8) | 4,646 94.1 (92.9 - 95.4) | <0.001 |

Footnotes to Table 2.

Abbreviations: ART = Antiretroviral therapy; CD4 = CD4+ T-lymphocyte cell; CI = confidence interval; IQR = Interquartile range; MSM = men who have sex with men; NNRTI = non-nucleoside reverse transcriptase inhibitors; PI = protease inhibitors; SE = Standard error; VL = HIV viral load.

§ Characteristics for HOPS patients and MMP patients were established based on data collected in the twelve months prior to the MMP’s weighted interview date which was November 25, 2012.

† In MMP, we are relying on self-reported information on any payer(s) that patient may have in the past 12 months. In HOPS, we are relying on chart-abstracted information on any primary and secondary (if available) payers documented during HOPS clinic visits in the past 12 months.

‡ P-values were obtained from z-statistics.

§ Any Health Insurance Coverage was defined as Private, Other, Medicare, Medicaid, Ryan White and Public Insurance (excluding Self Pay and Clinical Study). Ryan White coverage was counted as any payer type but not considered insurance. Please note: Medicaid is a US government insurance program for persons of all ages whose income and resources are insufficient to pay for health care. Medicare is a US government insurance program for Americans aged 65 and older who have worked and paid into the system as well as for younger people with disabilities, end stage renal disease and amyotrophic lateral sclerosis. The Ryan White HIV/AIDS Program provides HIV-related services in the United States for those who do not have sufficient health care coverage or financial resources for coping with HIV disease. The program fills gaps in care not met by other payers.

¶ MMP data are nationally representative sampling probability-weighted estimates.
### Comparison of the Characteristics of Persons with HIV Infection

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#### Table 3. Characteristics of HIV Outpatient Study (HOPS) participants seen in the January-April 2012, compared with those seen January-December 2012, and those seen only in May-December 2012.

| Characteristic                  | HOPS A (N=1,697) One Visit January-April | HOPS B (N=2,218) One Visit January-December | %   | HOPS C (N=521) One Visit May-December But No Visit January-April | P Value† |
|--------------------------------|------------------------------------------|-------------------------------------------|------|----------------------------------------------------------------|----------|
|                                | No. | %  (95% CI) | No. | %  (95% CI) | A - B  | No. | %  (95% CI) | A vs C |
| **Age category, years**        |     |              |     |              |       |     |              |        |
| 18-24                          | 19  | 1.1 (0.6-1.6) | 26  | 1.2 (0.7-1.6) | -0.1  | 7   | 1.3 (0.4-2.3) | 0.07   |
| 25-34                          | 142 | 8.4 (7.0-9.7) | 183 | 8.3 (7.1-9.4) | 0.1   | 41  | 7.9 (5.5-10.2) |        |
| 35-44                          | 359 | 21.2 (19.2-23.1) | 484 | 21.8 (20.1-23.5) | -0.6  | 125 | 24.0 (20.3-27.7) |        |
| 45-54                          | 681 | 40.1 (37.8-42.5) | 902 | 40.7 (38.6-42.7) | -0.6  | 221 | 42.4 (38.2-46.7) |        |
| 55-64                          | 404 | 23.8 (21.8-25.8) | 513 | 23.1 (21.4-24.9) | 0.7   | 109 | 20.9 (17.4-24.4) |        |
| ≥ 65                           | 92  | 5.4 (4.3-6.5) | 110 | 5.0 (4.1-5.9) | 0.4   | 18  | 3.5 (1.9-5.0) |        |
| **Mean age (SE), years**       |     |              |     |              |       |     |              |        |
|                                | 49.3 (0.25) | 49.1 (0.22) | 48.4 (0.42) | 0.04  |
| **Median age [IQR], years**    |     |              |     |              |       |     |              |        |
|                                | 49.4 [43.2, 56.1] | 49.3 [43.0, 55.8] | 48.8 [42.8, 54.8] | 0.07  |
| **Sex at birth**               |     |              |     |              |       |     |              |        |
| Male                           | 1,266 | 74.6 (72.5-76.7) | 1,681 | 75.8 (74.0-77.6) | -1.2  | 415 | 79.7 (76.2-83.1) | 0.02   |
| Female                         | 431  | 25.4 (23.3-27.5) | 537  | 24.2 (22.4-26.0) | 1.2   | 106 | 20.3 (16.9-23.8) |        |
| **Race/ethnicity**             |     |              |     |              |       |     |              |        |
| White, non-Hispanic            | 811  | 47.8 (45.4-50.2) | 1,112 | 50.1 (48.1-52.2) | -2.3  | 301 | 57.8 (53.5-62.0) | 0.001  |
| Black, non-Hispanic            | 607  | 35.8 (33.5-38.1) | 754  | 34.0 (32.0-36.0) | 1.8   | 147 | 28.2 (24.3-32.1) |        |
| Hispanic or Latino             | 226  | 13.3 (11.7-14.9) | 287  | 12.9 (11.5-14.3) | 0.4   | 61  | 11.7 (8.9-14.5) |        |
| Other ‡                       | 53   | 3.1 (2.3-4.0) | 65  | 2.9 (2.2-3.6) | 0.2   | 12  | 2.3 (1.0-3.6) |        |
| **HIV acquisition risk group** |     |              |     |              |       |     |              |        |
| MSM                            | 931  | 54.9 (52.5-57.2) | 1,254 | 56.5 (54.5-58.6) | -1.6  | 323 | 62.0 (57.8-66.2) | 0.051  |
| IDU-male                       | 70   | 4.1 (3.2-5.1) | 92  | 4.1 (3.3-5.0) | 0.0   | 22  | 4.2 (2.5-6.0) |        |
| IDU-female                     | 50   | 2.9 (2.1-3.8) | 62  | 2.8 (2.1-3.5) | 0.1   | 12  | 2.3 (1.0-3.6) |        |
| MSM-IDU                        | 22   | 1.3 (0.8-1.8) | 23  | 1.0 (0.6-1.5) | 0.3   | 1   | 0.2 (0.0-0.6) |        |
| Heterosexual-male              | 171  | 10.1 (8.6-11.5) | 219  | 9.9 (8.6-11.1) | 0.2   | 48  | 9.2 (6.7-11.7) |        |
| Heterosexual-female            | 347  | 20.4 (18.5-22.4) | 434 | 19.6 (17.9-21.2) | 0.8   | 87  | 16.7 (13.5-19.9) |        |
| Other                          | 106  | 6.2 (5.1-7.4) | 134 | 6.0 (5.0-7.0) | 0.2   | 28  | 5.4 (3.4-7.3) |        |
| **Year of HIV diagnosis**      |     |              |     |              |       |     |              | 0.04   |
| < 2009                         | 1,574 | 92.8 (91.5-94.0) | 2071 | 93.4 (92.3-94.4) | -0.6  | 497 | 95.4 (93.6-97.2) |        |
| 2009 and later                 | 122  | 7.2 (6.0-8.4) | 146 | 6.6 (5.5-7.6) | 0.6   | 24  | 4.6 (2.8-6.4) |        |
| **Ever had AIDS as of end of 2012** | 1,088 | 64.1 (61.8-66.4) | 1,397 | 63.0 (61.0-65.0) | 1.1   | 309 | 59.3 (55.1-63.5) | 0.047  |
| **Any health insurance coverage** | 1,558 | 91.8 (90.5-93.1) | 2,037 | 91.8 (90.7-93.0) | 0.0   | 479 | 91.9 (89.6-94.3) | 0.92   |
| **Healthcare payer type**      |     |              |     |              |       |     |              |        |
| Any payer or insurance ‡       | 1,620 | 95.5 (94.5-96.5) | 2,114 | 95.3 (94.4-96.2) | 0.2   | 494 | 94.8 (92.9-96.7) | 0.54   |
| Any private                    | 841  | 49.6 (47.2-51.9) | 1,176 | 53.0 (50.9-55.1) | -3.4  | 335 | 64.3 (60.2-68.4) | <0.001  |
| Any Medicaid                   | 504  | 29.7 (27.5-31.9) | 596  | 26.9 (25.0-28.7) | 2.8   | 92  | 17.7 (14.4-20.9) | <0.001  |
| Any Medicare                   | 445  | 26.2 (24.1-28.3) | 539  | 24.3 (22.5-26.1) | 1.9   | 94  | 18.0 (14.7-21.4) | <0.001  |
| Any Ryan White                 | 143  | 8.4 (7.1-9.7) | 169  | 7.6 (6.5-8.7) | 0.8   | 26  | 5.0 (3.1-6.9) | 0.01   |
| **Any ART prescription in 2012** | 1,637 | 96.5 (95.6-97.3) | 2,140 | 96.5 (95.7-97.3) | 0.0   | 503 | 96.5 (95.0-98.1) | 0.93   |
| Characteristic | HOPS A (N=1,697) One Visit January-April | HOPS B (N=2,218) One Visit January-December | P Value |
|----------------|----------------------------------------|-------------------------------------------|---------|
| Any ART prescription in a given class in 2012 | | | |
| Any NNRTI | 738 | 43.5 (41.4-45.8) | 977 | 44.0 (42.0-46.1) | 0.5 | 239 | 45.9 (41.6-50.2) | 0.34 |
| Any PI | 735 | 43.3 (40.0-45.7) | 936 | 42.2 (40.1-44.3) | 1.1 | 201 | 38.6 (34.4-42.8) | 0.06 |
| Any entry or integrase inhibitor | 606 | 35.7 (33.4-38.0) | 783 | 35.3 (33.3-37.3) | 0.4 | 177 | 34.0 (29.9-38.1) | 0.47 |

| Last CD4 count, cells/mm² | | | |
|---------------------------|----------------------|----------------------|--------|
| Missing/unknown | 46 | 2.7 (1.9-3.5) | 72 | 3.2 (2.5-4.0) | -0.5 | 26 | 5.0 (3.1-6.9) | 0.69 |
| 0-199 | 123 | 7.2 (6.0-8.5) | 178 | 8.0 (6.9-9.2) | -0.8 | 55 | 10.6 (7.9-13.2) | |
| 200-349 | 221 | 13.0 (11.4-14.6) | 271 | 12.2 (10.9-13.6) | 0.8 | 50 | 9.6 (7.1-12.1) | |
| 350-499 | 313 | 18.4 (16.6-20.3) | 395 | 17.8 (16.2-19.4) | 0.6 | 82 | 15.7 (12.6-18.9) | |
| ≥ 500 | 994 | 58.6 (56.2-60.9) | 1,302 | 58.7 (56.7-60.8) | -0.1 | 308 | 59.1 (54.9-63.4) | |

| CD4 count, population geometric mean (SE) | | | |
|-----------------------------|----------------------|------------------------|--------|
| CD4 count, median [IQR] | 567.6 [386.0, 781.5] | 568.6 [386.0, 783.0] | 570.0 [386.0, 788.0] | 0.68 |
| Last VL undetectable or <200 copies/ml | 1,440 | 64.9 (83.1-86.6) | 1,854 | 83.6 (82.0-85.1) | 1.3 | 414 | 79.5 (76.0-82.9) | 0.004 |
| All VLs in the year undetectable or <200 copies/ml | 1,330 | 78.4 (76.4-80.3) | 1,713 | 77.2 (75.5-79.0) | 1.2 | 383 | 73.5 (69.7-77.3) | 0.02 |

| Mean number of CD4/ VL tests in the year (SE) | | | |
|-----------------------------|----------------------|------------------------|--------|
| 2.6 (0.03) | 3.2 (0.04) | 1.7 (0.04) | <0.001 |

| Median number of CD4/ VL in the year [IQR] | | | |
|-----------------------------|----------------------|------------------------|--------|
| 2 [2, 3] | 2 [2, 3] | 2 [1, 2] | <0.001 |

| Number of CD4/ VL in the year | | | |
|------------------------------|----------------------|------------------------|--------|
| 0 or none documented | 40 | 2.4 (1.6-3.1) | 62 | 2.8 (2.1-3.5) | -0.4 | 22 | 4.2 (2.5-6.0) | <0.001 |
| 1 | 207 | 12.2 (10.6-13.8) | 430 | 19.4 (17.7-21.0) | -7.2 | 223 | 42.8 (38.5-47.1) | |
| 2 | 618 | 36.4 (34.1-38.7) | 815 | 36.7 (34.7-38.8) | -0.3 | 197 | 37.8 (33.6-42.0) | |
| 3 | 571 | 33.6 (31.4-35.9) | 627 | 28.3 (26.4-30.1) | 5.3 | 56 | 10.7 (8.1-13.4) | |
| 4+ | 261 | 15.4 (13.7-17.1) | 284 | 12.8 (11.4-14.2) | 2.6 | 23 | 4.4 (2.6-6.2) | |

| At least one VL in each 6 month period (%) | | | |
|-----------------------------|----------------------|------------------------|--------|
| 1,298 | 76.5 (74.5-78.5) | 1,502 | 67.7 (65.8-69.7) | 8.8 | 204 | 39.2 (35.0-43.4) | <0.001 |

| At least one CD4 test in the year (%) | | | |
|-----------------------------|----------------------|------------------------|--------|
| 1,651 | 97.3 (96.5-98.1) | 2,146 | 96.8 (96.0-97.5) | 0.5 | 495 | 95.0 (93.1-96.9) | 0.01 |

| Clinical visit frequency and density | | | |
|-----------------------------|----------------------|------------------------|--------|
| Mean (SE) | 3.6 (0.05) | 3.2 (0.04) | 1.9 (0.05) | <0.001 |
| Median [IQR] | 3 [2, 4] | 3 [2, 4] | 2 [1, 2] | <0.001 |

| Min-Max | 1-16 | 1-16 | 1-8 |

| Number of clinical visits in the year | | | |
|-----------------------------|----------------------|------------------------|--------|
| 1 | 119 | 7.0 (5.8-8.2) | 348 | 15.7 (14.2-17.2) | -8.7 | 229 | 44.0 (39.7-48.2) | <0.001 |
| 2 | 407 | 24.0 (22.0-26.0) | 598 | 27.0 (25.1-28.8) | -3.0 | 191 | 36.7 (32.5-40.8) | |
| 3 | 466 | 27.5 (25.3-29.6) | 534 | 24.1 (22.3-25.9) | 3.4 | 68 | 13.1 (10.1-16.0) | |
| 4+ | 705 | 41.5 (39.2-43.9) | 738 | 33.3 (31.3-35.2) | 8.2 | 33 | 6.3 (4.2-8.4) | |

Footnotes to Table 3.
Abbreviations: ART= Antiretroviral therapy; CD4<CD4+ T-lymphocyte cell; CI = confidence interval; IDU = male or female injection drug user; IQR = Interquartile range; MSM = men who have sex with men; NNRTI=non-nucleoside reverse transcriptase inhibitors; PI = protease inhibitors; SE=Standard error; VL=HIV viral load.
HOPS A refers to all participant who had at least one outpatient visit during January-April, 2012 (MMPI’s current population definition period). HOPS B refers to all participant who had at least one outpatient visit during January-December, 2012. HOPS C refers to all participants who had at least one outpatient visit during May-December, 2012, but had no visit during January-April 2012 (excludes MMPI’s current population definition period).
Characteristics for HOPS patients were established based on data collected in the 2012 calendar year. Note that this time frame differs from that used in the primary analysis.
P-values for ordinal variables were calculated using Cochran-Armitage trend tests; p-values for categorical variables were calculated using chi-square tests; p-values for distributions were obtained from Wilcoxon rank sum tests; and p-values for means were obtained from Student’s t-tests.
Other race groups include those of multiple race groups and other, unknown or missing race groups.
One participant had unknown year of HIV diagnosis.
P-values for ordinal variables were calculated using Cochran-Armitage trend tests; p-values for categorical variables were calculated using chi-square tests; p-values for distributions were obtained from Wilcoxon rank sum tests; and p-values for means were obtained from Student’s t-tests.
Any Health Insurance Coverage was defined as Private, Other, Medicare, Medicaid, Ryan White and Public Insurance (excluding Self Pay and Clinical Study). Ryan White coverage was counted as any payer type but not considered insurance. Please note: Medicaid is a US government insurance program for persons of all ages whose income and resources are insufficient to pay for health care. Medicare is a US government insurance program for Americans aged 65 and older who have worked and paid into the system as well as for younger people with disabilities, end stage renal disease and amyotrophic lateral sclerosis. The Ryan White HIV/AIDS Program provides HIV-related services in the United States for those who do not have sufficient health care coverage or financial resources for coping with HIV disease. The program fills gaps in care not met by other payers.
Eligible types of clinical visits were defined as: routine, initial, return to active status, event triggered, or post-hospital follow up.
The HOPS 2012 data are based on a convenience sample of persons with HIV infection attending nine HOPS-participating clinics in six US cities, while MMP is a probability sample of persons with HIV infection receiving medical care in the US; in 2012 MMP data were collected from 467 facilities in 16 states and Puerto Rico. Although MMP is based on a large, diverse, geographically distributed probability sample of facilities, the data collected reflect only one year of follow-up time. Thus MMP is designed to make accurate estimates of the prevalence of behavioral and clinical characteristics among persons with HIV infection receiving medical care, but is ill-equipped for longitudinal analyses (e.g., estimating incidence rates of conditions and studying risk factors for their onset). The average accrued follow-up time per HOPS participant in 2012 was eight years, making HOPS well poised to assess disease incidence as well as risk factors for disease development. However, as our analyses revealed, HOPS participants enrolled at selected HIV clinics differ in some respects from the overall population of persons with HIV infection receiving medical care in the US. The HOPS cohort is growing in size with an increasing representation of older patients with long-standing HIV infection who are surviving longer due to ART. Because of resource constraints, not all newly HIV-diagnosed persons seen at participating clinics can be enrolled into observational cohorts [8] like the HOPS, posing a challenge with respect to such cohort recruitment strategies to continue to reflect characteristics of all contemporary persons in HIV care in the US.

Moving forward, a data synthesis approach that builds on the relative strengths of MMP (ability to estimate prevalence) and HOPS (ability to estimate incidence) could be developed to improve national epidemiologic data and projections needed for HIV prevention and treatment. HOPS and MMP data can be used jointly to derive population attributable fractions and other estimates for the US population. Specifically, HOPS rates can be standardized to MMP population prevalence to provide estimates that may approximate national rates. For example, HOPS was used to estimate the rates of incident cardiovascular disease (CVD) events according to patients’ baseline CD4 count and history of tobacco use [15]. Applying these HOPS rates to the distribution of CD4 count strata and tobacco use history from MMP [18] could be used to project the number of incident CVD events among these subgroups of patients nationally, and inform modeling projections of how many CVD events could be averted by earlier ART initiation to avoid low CD4 counts and by tobacco cessation interventions.

Another key consideration in interpreting data from HOPS and MMP is that both databases only include persons who are receiving medical care. A substantial proportion of HIV-infected persons in the US are not consistently engaged in HIV care [3, 12]. Some of the noted differences between HOPS and NHSS might be due to the nature of the HOPS convenience sample (e.g., types of persons who attended the nine HOPS-participating clinics in 2012, were systematically approached for study participation, and agreed to participate). In addition, differences between MMP and NHSS populations might reflect differences in care seeking; for example persons who have been diagnosed with AIDS are more likely to become enrolled in care than persons without AIDS. To better understand the needs of HIV-diagnosed persons not receiving medical care and thereby better guide HIV prevention and treatment in the US, in 2013, CDC re-designed MMP to directly sample from NHSS; thus, starting with the 2015 data collection cycle, the new MMP reference population will include all HIV-diagnosed persons in the participating jurisdictions regardless of whether they are receiving medical care (see http://www.grants.gov/web/grants/search-grants.html, CDC-RFA-PS15-1503).

Although, MMP uses a probability sample, a methodology to reduce overall bias [25], the 4-month population definition period (i.e., January-April) might skew the overall estimates obtained from MMP. In another multi-site analysis of 12,135 patients in care in 2003, 88% of patients had at least one visit in the first four months of the year [24]. In our analysis using data from 2012, we found that somewhat lower percentage, or 76.5% of MMP participants who had at least one visit January-December also had at least one visit in January-April. However, persons who had at least one visit January-April and persons who had visits only May-December were equally likely to be prescribed ART in the year with the only notable differences being the percentage with private insurance, the frequency of CD4 count and viral load testing, and the percentage achieving viral suppression. Our results suggest that persons seen in the first four months of the calendar year are a reasonable approximation of all persons engaged in care (i.e., who have at least one visit in the calendar year). However, additional validation studies using other data sources would be beneficial to further explore this issue. The estimates from the HOPS and MMP are in-line with earlier results from the North American AIDS Cohort Collaboration on Research and Design, which found that among 35,324 participants who had ≥1 HIV care visit from January-June 2008, 82% were prescribed ART, and 78% had a suppressed HIV viral load [26].

This analysis has certain limitations. Firstly, although we attempted to define variables similarly across different data sources, estimates may differ to an unknown degree due to different data collection methods for some variables (e.g., documentation of insurance type per structured interview in MMP versus medical record abstraction in the HOPS). Secondly, there is no single gold standard data collection system for care indicators for persons living with HIV infection, and so all comparisons made in this manuscript describe relative differences between data systems, each with its own unique strengths and limitations. Thirdly, due to a higher average number of viral load measurements in the year in the MMP vs the HOPS, the difference in the percentage of patients with durable viral suppression across these two populations may have been overestimated.

In conclusion, CDC currently supports complementary data collection systems to describe persons living with diagnosed HIV infection to better inform HIV prevention and treatment efforts. Understanding the comparative strengths and limitations of the individual databases, and contrasting database findings, is key to enhancing data interpretation and utility. The formal comparison presented here is an essential first step to integrating estimates produced via the different data systems needed to provide an
CONFLICT OF INTEREST

The authors confirm that this article content has no conflict of interest.

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MMP Study Group Members - 2012

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DISCLAIMER

The findings and conclusions in this report are those of the authors and do not necessarily represent the views of the Centers for Disease Control and Prevention.

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