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Evaluating patterns in retention, continuation, gaps, and re-engagement in HIV care in a Medicaid-insured population, 2006–2012, United States

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Abstract

We used the US-based MarketScan® Medicaid Multi-state Databases to determine the un-weighted proportion of publically insured persons with HIV that were retained, continued, and re-engaged in care. Persons were followed for up to 84 months. Cox proportional hazards models were conducted to determine factors associated with gaps in care. Of the 6463 HIV cases identified in 2006, 61% were retained during the first 24 months, and 53% continued in care through 78 months. Between 8% and 30% experienced a gap in care, and 59% of persons who experienced a gap in care later reengaged in care. Persons with one or more Charlson co-morbidities (HR 0.72, 95% CI 0.64–0.81), ages 40–59 (0.79, 0.71–0.88), mental illness diagnosis (0.79, 0.72–0.87), hepatitis C co-infection (0.83, 0.75– 0.93), and female sex (0.86, 0.78–0.94) were less likely to experience a gap in care. Between 27% and 38% of those not retained in care continued to receive HIV-related laboratory services. This Medicaid claims database combines features of both clinic visits-based and surveillance lab-based surrogate measures to give a more complete picture of engagement in care than single-facility-based studies.

Keywords

Retention in care; engagement in care; gap in care; HIV; Medicaid

Introduction

Retention in HIV care is critical to patient outcomes because poor retention is associated with decreased viral load suppression and increased mortality (Berg et al., 2005; Giordano et al., 2007; Mugavero et al., 2009). Evaluation of retention is complicated by the use of different definitions of retention and by limited access to both patient medical records and surveillance data. The two most common indicators of retention are medical visit frequency

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and HIV-related laboratory testing. The US Health Resources and Services Administration (HRSA) defines retention using medical visit frequency, a mixture of appointment constancy and gaps in medical care, while HIV surveillance programs generally rely on mandatory reporting of CD4 and HIV viral load tests to estimate retention.

Health services claims databases offer access to large samples of patients and include medical visits, laboratory reports, and pharmacy visits. In addition, claims databases allow tracking of individual patients over time, which facilitates longitudinal analyses. We used a multi-state database to estimate the proportion of Medicaid-insured persons with HIV who were retained, continued, and re-engaged in care, as well as the proportion not retained that met the surveillance (laboratory test based) definition of retention in care.

Methods

Parent database – Marketscan® Medicaid Multistate Databases

The MarketScan® Medicaid Multi-state Databases are commercially available databases consisting of pooled Medicaid data from 6 to 12 unidentified geographically dispersed states within the US (http://truvenhealth.com/your-healthcare-focus/analytic-research/marketscan-research-databases). Medicaid is a public healthcare insurance program for low-income individuals in the US. The databases contain paid, de-identified, patient-level healthcare claims from inpatient, outpatient, and pharmaceutical services, and include information on conditions diagnosed, services performed, and prescriptions filled. Every enrollee is assigned a unique identifier that allows tracking of individual patients across different types of claims and over multiple years. In 2006, the MarketScan® Medicaid Multi-state Database contained a total of 6,911,182 individuals and represented data from 10 states. Details on the MarketScan® database have been previously described (Hansen, 2012).

Study cohort definition

We utilized claims from the 2006–2012 MarketScan® Medicaid Multi-state Databases. Persons with HIV were identified from inpatient and outpatient service claims that listed one or more International Classification of Diseases, 9th Revision, Clinical Modification (ICD-9-CM) diagnostic codes indicating HIV diagnosis (Table 1). In 2006, 22,801 persons with HIV were identified as candidates for inclusion in the study (Figure 1).

Cohort eligibility required: (1) having an ICD-9-CM code for HIV/AIDS in 2006; (2) being aged ≥ 18 years in 2006; (3) being continuously enrolled in Medicaid for at least 10 months out of each 12-month period during the initial 24-month retention period; and (4) having ≥1 outpatient claim with a physician, nurse practitioner, or physician's assistant in the first six months of the retention period (Figure 1). After applying the eligibility criteria, 6463 individuals were included in the study (Figure 1).

Retention in care, continuation in care, gap in care, and re-engagement in care

We defined retention in care based on the HRSA's medical visit frequency definition: ≥1 medical visit in each six-month interval of the 24-month retention period, with a minimum of 60 days between the first medical visit in the prior six-month period and the last medical

visit in the subsequent six-month period (DHHS, 2013). The retention period was defined as the first 24month measurement period (months 0–24) from the date of the first service claim containing an ICD-9-CM diagnostic code for HIV/AIDS (Figure 2).

Among persons who met the 24-month definition of retained-in-care, we defined continuation in care as having ≥1 office visit claim with a physician, nurse practitioner, or physician's assistant during each six-month interval following the retention period, for up to 84 months. A gap in care was defined as having no office visit in >6 months and re-engagement in care as ≥1 office visit after a gap in care (DHHS, 2013). We considered persons to have experienced a terminal gap if they met the 10 months out of 12 continuous enrollment criteria, but had no further office visit claims for the remainder of that follow-up period (Figure 2).

To determine if persons who did not meet the clinic visit-based retention or continuation in care definitions continued to receive HIV-related services, we reviewed HIV-related laboratory test claims. Persons were considered to have had HIV-related laboratory tests if they received ≥2 CD4 and/or HIV viral load laboratory tests, with at least three months between tests in a 12month measurement period (DHHS, 2013). Due to the variable date of case identification, laboratory data were often unavailable for the last year of the analysis; thus we shortened the reporting of laboratory tests in non-retained persons to 72 months.

Cohort demographic characteristics and comorbidities

We stratified the study sample by sex, race/ethnicity, age, and by the following co-morbidities: hepatitis B, hepatitis C, mental illness, and alcohol/substance abuse. The sample was also stratified by the presence of one or more of 16 of 17 Charlson co-morbidities (Quan et al., 2005). Co-morbidities were determined at the time of HIV case identification. ICD-9-CM codes for HIV/ AIDS, all co-morbidities, and laboratory claims, used in this study, are available offline.

Statistical analysis

We calculated un-weighted proportions of the study cohort retained in care for the initial 24-month retention period, continued in care past 24 months, gaps in care, and post-gap re-engagement. Persons who were not continuously enrolled were censored at the end of the final 12 months that they satisfied the enrollment criteria.

We conducted univariate and multivariable Cox proportional hazard analyses to determine factors associated with a gap in care. We calculated hazard ratios with 95% confidence intervals; models included sex, race/ethnicity, age, and the aforementioned co-morbidities. Backward selection was used for the multivariable model (Breslow, 1975; Cox, 1972).

To account for the large number of censored observations, we conducted a Kaplan–Meier life-table analysis to estimate the overall time continued in care after the retention period, by characteristic. We compared the estimated time continued in care between selected characteristics using a log-rank test (Breslow, 1975; Cox, 1972). All analyses were performed using SAS version 9.3 (SAS Institute, Cary, NC, USA).

Results

Sample selection is described in Figure 1. The median age of the 6463 persons included in the study was 44 years (range 18–90). Fifty percent were male and the majority were non-white (78%). Persons aged 40–49 made up 41% of the sample. Twenty-three percent had a diagnosis of mental illness and 58% had no diagnoses for any Charlson co-morbidity (Table 2).

Retention, continuation, gap, and re-engagement in care

Sixty-one percent (n = 3961) of the study cohort was retained in care during the retention period (months 0–24) (Table 3). Of those who met continuous enrollment criteria, more than half (53%) continued in care in each six-month period through 78 months (Table 3). Between 8% and 30% of the cohort experienced a gap in care at some point following the initial 24-month retention period (Table 4). The median time to the first gap in care, after the retention period, was 21 months (IQR: 12–33). The median length of a gap in care was 3.5 months (IQR: 1.3–8.8), which translates to 9.5 months between the last and next clinic appointments. Fifty-nine percent re-engaged in care at some point during the 84 months of follow-up. Four to seven percent of persons who experienced a gap in care returned for ≥1 office visit in each six-month follow-up period (Table 4).

HIV-related laboratory tests for persons not in care

Of the 2502 persons who did not meet the visit-based retention definition during the retention period, 27% (n = 677) received ≥2 CD4 and/or HIV viral load laboratory tests in each 12-month interval during the retention period. After the retention period, 31% (n = 146) of those not in care in month 36, 37% (n = 218) in month 48, 29% (n = 158) in month 60, and 28% (n = 111) in month 72 received ≥2 CD4 and/or HIV viral load laboratory tests in the previous 12-month period.

Factors associated with a gap in care

On Cox model multivariable analysis, ≥1 Charlson comorbidities (HR 0.72, 95% CI 0.64–0.81), ages 40–59 (0.79, 0.71–0.88), diagnosis of mental illness (0.79, 0.72–0.87), hepatitis C co-infection (0.83, 0.75–0.93), and female sex (0.86, 0.78–0.94) were all negatively associated with experiencing a gap in care (i.e., were more likely to continue in care) (Table 5).

Kaplan–Meier life-table analysis and estimated time continued in care

Persons with ≥1 Charlson co-morbidities continued in care for 55 months compared to 43 months for persons with no Charlson co-morbidities (p < .001). Persons aged 40–59 continued in care for an estimated 56 months compared with 48 months for persons aged 18–39 and ≥60 (p < .001). Persons with a diagnosis of mental illness continued in care for 56 months compared to 50 months for those without mental illness (p < .001). Statistically significant differences were seen by sex (55 months for females compared to 54 months for males; p= .003) and race (55 months for white persons compared with 54 months for non-white persons; p = .040), although the differences are unlikely to be clinically significant. No

differences were seen by diagnosis of hepatitis B or hepatitis C co-infection, or alcohol/substance abuse disorders (data not shown) (Figure 3).

Discussion

We used the 2006–2012 MarketScan® Medicaid Multistate Databases to evaluate patterns in retention, continuation, gap, and re-engagement in care among a cohort of adults living with HIV in the US. Of the 6463 adults with HIV in the study cohort, 61% were retained in care during the first 24-month retention period, and the majority (53%), who were continuously enrolled in Medicaid, continued in care through 78 months. Our estimate of 61% of persons with HIV retained in care during the retention period is similar to national estimates from HRSA (DHHS, 2013). However, of those persons in our study who were not retained in care during the first 24 months using the HRSA medical visit frequency definition, a substantial percentage (27–38%) received ≥2 CD4 and/or HIV viral load tests during the previous 12-month period during which they were considered not in care.

Persons with ≥1 Charlson co-morbidity, a diagnosis of mental illness, or hepatitis C co-infection were less likely to experience a gap in care and persons with ≥ 1 Charlson co-morbidity or mental illness continued in care longer than persons without these co-morbidities. These findings are not surprising, given that persons with multiple co-morbidities may require closer followup than generally healthy persons. HIV/hepatitis C coinfected persons might require more frequent followup related to antiviral therapy. Similar results concerning retention among persons living with HIV with co-morbidities were seen in a large cohort study among veterans, although the authors noted poorer retention among persons co-infected with hepatitis C (Giordano, Hartman, Gifford, Backus, & Morgan, 2009).

Persons with a diagnosis of mental illness were less likely to experience a gap in care. Although it is unknown whether persons diagnosed with mental illness were receiving treatment or other mental health services, psychiatric treatment might be partially responsible for this negative association; receipt of psychiatric medications and ancillary mental health services have been shown to improve retention in care among HIV-infected persons (Cunningham et al., 2007; Lo, MacGovern, & Bradford, 2002; Sherer et al., 2002; Tominari et al., 2013).

Women and persons aged 40–59 were less likely to experience a gap in care which is congruent with other studies (Althoff et al., 2014; Giordano et al., 2009; Hall et al., 2012; Torian & Wiewel, 2011; Tripathi, Youmans, Gibson, & Duffus, 2011). The use of different study definitions for retention in previous studies might cause some of the differing associations for substance abuse seen in this study compared to other studies (Arici et al., 2002; Lo et al., 2002; Schepens, Morreel, Florence, Koole, & Colebunders, 2010). For example, other studies often use “missed clinic visits” and “kept visits” as the measure of retention. These measures may point to different aspects of the care retention problem than those measured by gaps in care and may be associated with different factors.

Medical visits as a retention indicator assumes that patients who do not attend clinic visits might not access necessary services, such as laboratory services, and that the lack of patient/clinical provider interaction inhibits receipt of antiretroviral therapy adherence support which can lead to poor outcomes (Berg et al., 2005; Giordano et al., 2007; Lucas, Chaisson, & Moore, 1999; Mugavero et al., 2009). However, proxy measures for measuring retention used by public health surveillance programs are CD4 and HIV viral load tests (Hall et al., 2012). In our study, 27–38% of those not retained in care (as measured by clinic visits) would meet the surveillance definition of retention. The large proportion of persons who did not meet the study retention definition but who continued to receive HIV-related laboratory testing may reflect stable virally suppressed patients whose providers have intentionally lengthened the time between follow-up clinic visits but who continue to monitor patients' laboratory values (Buscher et al., 2013). As more patients are placed on antiretroviral therapy and become virally suppressed, frequent clinic visit follow-ups may become less critical. As such, the use of clinic visits as the sole measure of retention may cause an underestimation of persons in care, particularly among patients whose scheduled clinic follow-ups extend beyond six months.

The study was not without limitations. Office visits claims were not necessarily associated with a claim listing an HIV ICD-9-CM code on the date of the visit; office visits, therefore, may have been for non-HIVrelated issues. Second, the MarketScan® Medicaid Multi-state Databases contain data from 6 to 12 unidentified states, and the states may change from year to year. This might account, at least in part, for the large number of persons who are no longer considered enrolled in Medicaid within the MarketScan® Medicaid Multi-state Database from year to year. The analysis may not be generalizable to the wider population of Medicaid-insured persons living with HIV in the US.

Health claims databases, with wide geographic coverage of medical clinic visits and laboratory tests, are better suited to fairly evaluate retention than single-facilitybased clinical cohorts (Gange et al., 2007; Yehia et al., 2008). This distinction from clinical cohorts is critical because in claims cohorts, determination of receipt of care outside of an individual clinical site can be assessed and the distinction between not receiving any care and being lost to care at a particular clinical site can be made, i.e., receiving care from multiple sources can be evaluated. For countries that bill or track claims for healthcare services, health claims data may be a useful tool for broadly tracking trends in various levels of engagement in care. Most persons in these data were retained in care during the initial 24-month retention period, and slightly more than half were continuously in care for 78 months. A significant minority, however, failed to have regular clinic visits throughout the study period. Nonetheless, we found that 27% of persons not retained in care (using clinic visits as the measure of retention), met the surveillance (laboratory test based) definition of retention in care. This finding illustrates why claims databases may create a more complete assessment of retention in care than that which can be derived from cohorts that are restricted to a small number of single-facility-based sites using a clinic visit measure.

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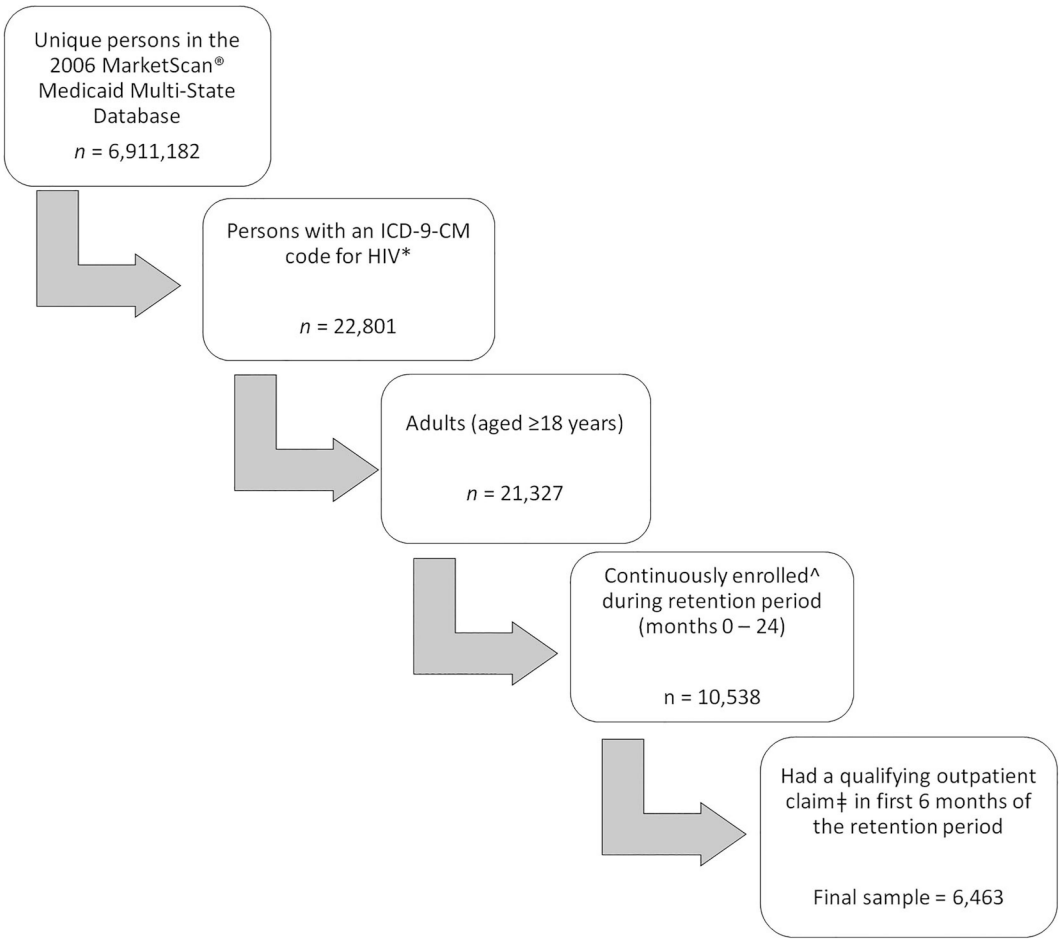

Figure 1.

Flow chart describes sample selection from the 2006 MarketScan® Medicaid Multi-State Database. The final sample of 6463 persons with HIV was followed for up to 84 months. Note: *HIV was defined as having one or more of the following ICD-9-CM codes: 042; V08; 079.53; 795.71. ^Continuous enrollment was defined as being enrolled within the MarketScan® Medicaid Multi-State Database for ≥10 months out of each 12-month measurement period. ‡A qualifying outpatient claim includes office visits with a physician, nurse practitioner or physician's assistant.

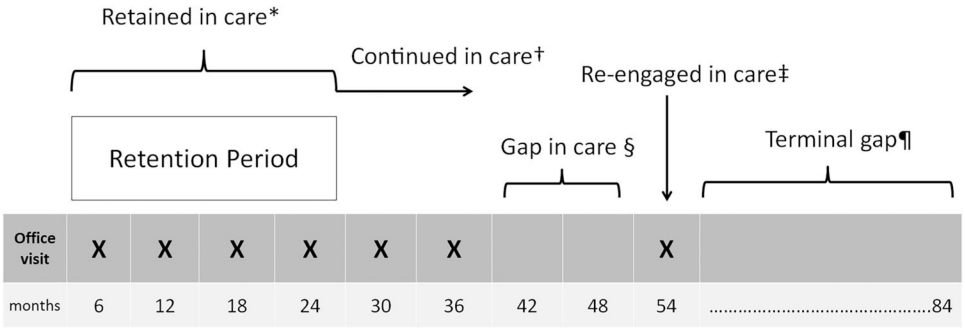

Figure 2.

An example of retention, continuation, gap, and re-engagement in care for a hypothetical patient.

Note: An “x” denotes that the patient had an office visit claim in the six-month measurement period. *Retained in care was defined as one or more office visit claim in each six-month interval of the 24-month retention measurement period (months 0–24), with a minimum of 60 days between the first medical visit in the prior six-month period and the last medical visit in the subsequent six-month period. In this example, the patient was retained in care during the retention period. †Continued in care was defined as one or more office visit claim during each six-month interval following the retention period, with a minimum of 60 days between medical visits. In this example, the patient continued in care through month 36. §Gap in care was defined as no office visit claim in more than six months. In this example, the patient had a gap in care of 12 months. ‡Re-engaged in care was defined as one or more office visits after a sixmonth gap in care. In this example, the patient re-engaged in care after month 48. ¶Terminal gap was defined as no office visit claims for the remainder of the follow-up period among persons who continued to meet the continuos enrollment criteria (i.e. continuosly enrolled in Medicaid for at least 10 months out of each 12 month period).

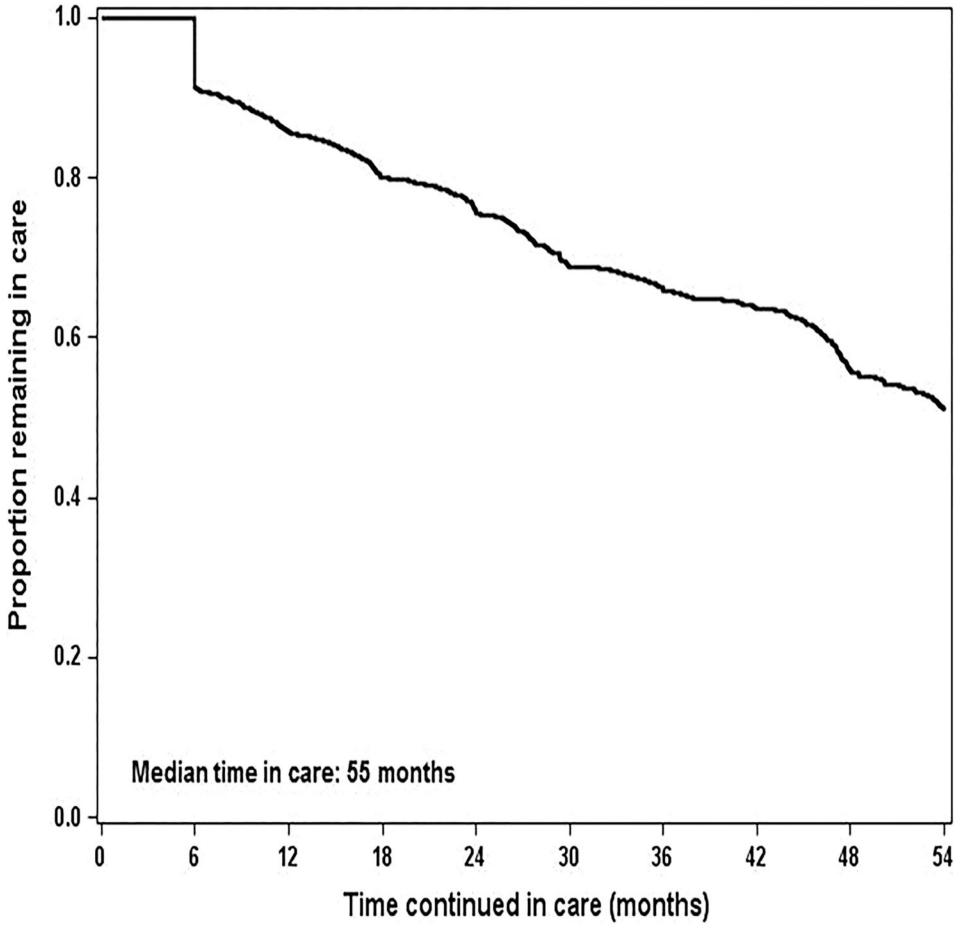

Figure 3.

Kaplan–Meier analysis of estimated time continued in care after the retention period (months 0–24) among MarketScan® Medicaid HIV cases.

Table 1.

ICD-9-CM diagnostic and CPT procedure codes for HIV and other co-morbidities and office visits.

HIV, Co-morbidity	ICD-9-CM code
HIV	042, V08, 079.53, 795.71
Hepatitis B	070.20–070.23, 070.30–070.33, V02.61
Hepatitis C	070.41, 070.44, 070.51, 070.54, 070.70, 070.71,V02.62
Mental illness	
Major depressive disorders	296.20–296.26, 296.30–296.36
Bipolar disorders	296.00–296.06, 296.40–296.46, 296.50–296.56, 296.60–296.66, 296.7, 296.80, 296.89, 301.13
Anxiety disorders	300.00–300.02, 300.09–300.16, 300.19–300.23, 300.29, 300.3, 300.4, 300.5, 300.6, 300.7, 300.81, 300.82, 300.89, 300.9
Schizophrenia	295.00–295.05, 295.10–295.15, 295.20–295.25, 295.30–295.35, 295.50–295.55, 295.80–295.85, 295.90–295.95
Other	311, 298.0, 309.0, 309.1
Alcohol and drug-related disorders	
Alcohol-related disorders	291.0–291.5, 291.81, 291.82, 291.89, 291.9, 303.00–303.03, 303.90–303.93
Drug-related disorders	292.11, 292.12, 292.83–292.85, 292.89, 292.9, 304.00–304.03, 304.10–304.13, 304.20–304.23, 304.30–304.33, 304.40–304.43, 304.50–304.53, 304.60–304.63, 304.70–304.73, 304.80–304.83, 304.90–304.93, 305.00– 305.03, 305.20–305.23, 305.30–305.33, 305.40–305.43, 305.50–305.53, 305.60–305.63, 305.70–305.73, 305.80–305.83, 305.90–305.93
Charlson co-morbidities	
Myocardial infarction	410.00–410.02, 410.10–410.12, 410.20–410.22, 410.30–410.32, 410.40–410.42, 410.50–410.52, 410.60– 410.62, 410.70–410.72, 410.80–410.82, 410.90–410.92, 412
Congestive heart failure	398.91, 402.01, 402.11, 402.91, 404.01, 404.03, 404.11, 404.13, 404.91, 404.93, 425.4–425.9, 428.0, 428.1, 428.20–428.23, 428.30–428.33, 428.40–428.43, 428.9
Peripheral vascular disease	093.0, 437.3, 440.0, 440.1, 440.20–440.24, 440.29, 440.30–440.32, 440.4, 440.8, 440.9, 441.00–441.03, 441.1– 441.7, 441.9, 443.1, 443.21–443.24, 443.29, 443.81, 443.82, 443.89, 443.9, 47.1, 557.1, 557.9, V43.4
Cerebrovascular disease	362.34, 430, 431, 432.0, 432.1, 432.9, 433.00, 433.01, 433.10, 433.11, 433.20, 433.21, 433.30, 433.31, 433.80, 433.81, 433.90, 433.91, 434.00, 434.01, 434.10, 434.11, 434.90, 434.91, 435.0–435.3, 435.8, 435.9, 436, 437.X, 438.0, 438.10–438.14, 438.19–438.22, 438.30–438.32, 438.40–438.42, 438.50–438.53, 438.6, 438.7, 438.81–438.85, 438.89, 438.9
Dementia	290.0, 290.10–290.13, 290.20, 290.21, 290.3, 290.40–290.43, 290.8, 290.9, 294.1, 331.2
Chronic pulmonary disease	416.8, 416.9, 490, 491.0, 491.1, 491.20–491.22, 491.8, 491.9, 492.0, 492.8, 493.00–493.02, 493.10–493.12, 493.20–493.22, 493.81, 493.82, 493.90–493.92, 494.0, 494.1, 495.X, 496, 500–505, 506.4, 508.1, 508.8
Rheumatic disease	446.5, 710.0–710.4, 714.0–714.2, 714.81, 714.89, 725
Peptic ulcer disease	531.00, 531.01, 531.10, 531.11, 531.20, 531.21, 531.30, 531.31, 531.40, 531.41, 531.50, 531.51, 531.60, 531.61, 531.70, 531.71, 531.90, 531.91, 532.00, 532.01, 532.10, 532.11, 532.20, 532.21, 532.30, 532.31, 532.40, 532.41, 532.50, 532.51, 532.60, 532.61, 532.70, 532.71, 532.90, 532.91, 533.00, 533.01, 533.10, 533.11, 533.20, 533.21, 533.30, 533.31, 533.40, 533.41, 533.50, 533.51, 533.60, 533.61, 533.70, 533.71, 533.90, 533.91, 534.00, 534.01, 534.10, 534.11, 534.20, 534.21, 534.30, 534.31, 534.40, 534.41, 534.50, 534.51, 534.60, 534.61, 534.70, 534.71, 534.90, 534.91
Mild liver disease	570, 571.0–571.3, 571.40–571.42, 571.49, 571.5, 571.6, 571.8, 571.9, 573.3, 573.4, 573.8, 573.9, V42.7

HIV, Co-morbidity	ICD-9-CM code
Moderate or severe liver disease	456.0, 456.1, 456.20, 456.21, 572.2–572.4, 572.8
Diabetes without chronic complication	250.00–250.03, 250.10–250.13, 250.20–250.23, 250.30–250.33, 250.70–250.73, 250.80–250.83, 250.90–250.93
Diabetes with chronic complication	250.40–250.43, 250.50–250.53, 250.60–250.63
Hemiplegia or paraplegia	334.1, 342.00–342.02, 342.10–342.12, 342.80–342.82, 342.90–342.92, 343.0–343.4, 343.8, 343.9, 344.00– 344.04, 344.09, 344.1, 344.2, 344.30–344.32, 344.40–344.42, 344.5, 344.60, 344.61, 344.9
Renal disease	403.01, 403.11, 403.91, 404.02, 404.03, 404.12, 404.13, 404.92, 404.93, 582.0–582.2, 582.4, 582.81, 582.89, 582.9, 583.0–583.2, 583.4, 583.6, 583.7, 585.1–585.6, 585.9, 586, 588.0, V42.0, V45.11,V45.12, V56.0, V56.1, V56.2, V56.31, V56.32, V56.8
Any malignancy	140.0–140.6, 140.8, 140.9, 141.0–141.6, 141.8, 141.9, 142.0–142.2, 142.8, 142.9, 143.0, 143.1, 143.8, 143.9, 144.0, 144.1, 144.8, 144.9, 145.0–145.6, 145.8, 145.9, 146.X, 147.0–147.3, 147.8, 147.9, 148.0–148.3, 148.8, 148.9, 149.0, 149.1, 149.8, 149.9, 150.0–150.5, 150.8, 150.9, 151.0–151.6, 151.8, 151.9, 152.0–152.3, 152.8, 152.9, 153.X, 154.0–154.3, 154.8, 155.0–155.2, 156.0–156.2, 156.8, 156.9, 157.0–157.4, 157.8–157.9, 158.0, 158.8, 158.9, 159.0, 159.1, 159.8, 159.9, 160.0–160.5, 160.8, 160.9, 161.0–161.3, 161.8, 161.9, 162.0, 162.2–162.5, 162.8, 162.9, 163.0, 163.1, 163.8, 163.9, 164.0–164.3, 164.8, 164.9, 165.0, 165.8, 165.9, 170.X, 171.0, 171.2–171.9, 172.X, 174.0–174.6, 174.8, 174.9, 175.0, 175.9. 176.0–176.5, 176.8, 176.9, 179, 180.0, 180.1, 180.8, 180.9, 181, 182.0, 182.1, 182.8, 183.0, 183.2–183.5, 183.8, 183.9, 184.0–184.4, 184.8, 184.9, 185, 186.0, 186.9, 187.1–187.9, 188.X, 190.X, 191.X, 192.0–192.3, 192.8, 192.9, 193, 194.0, 194.1, 194.3–194.6, 194.8, 194.9, 195.0–195.5, 195.8, 200.00–200.08, 200.10–200.18, 200.20–200.28, 200.30–200.38, 200.40–200.48, 200.50–200.58, 200.60–200.68, 200.70–200.78, 200.80–200.88, 201.00–201.08, 201.10–201.18, 201.20– 201.28, 201.40–201.48, 201.50–201.58, 201.60–201.68, 201.70–201.78, 201.90–201.98, 202.X0–202.X8, 203.00–203.02, 203.10–203.12, 203.80–203.82, 204.00–204.02, 204.10–204.12, 204.20–204.22, 204.80– 204.82, 204.90–204.92, 205.00–205.02, 205.10–205.12, 205.20–205.22, 205.30–205.32, 205.80–205.82, 205.90–205.92, 206.00–206.02, 206.10–206.12, 206.20–206.22, 206.80–206.82, 206.90–206.92, 207.00– 207.02, 207.10–207.12, 207.20–207.22, 207.80–207.82, 208.00–208.02, 208.10–208.12, 208.20–208.22, 208.80–208.82, 208.90–208.92, 238.6
Metastatic solid tumor	196.0–196.3, 196.5, 196.6, 196.8, 196.9, 197.0–197.8, 198.0–198.7, 198.81, 198.82, 198.89, 199.0–199.2
	CPT codes
Office visit	99201, 99202, 99203, 99204, 99205, 99212, 99213, 99214, 99215
HIV-related laboratory tests (HIV viral load, CD4, and T-cell tests)	86359, 86360, 86361, 87534, 87535, 87536, 87537, 87538, 87539

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Table 2.

Characteristics of persons with HIV in the MarketScan® Medicaid study cohort, 2006.[a]

	N	%
Total	6463	100
Sex		
Male	3214	50
Female	3249	50
Race/ethnicity		
White	1419	22
Non-white[b]	5044	78
Age (years)		
18–29	564	9
30–39	1424	22
40–49	2616	41
50–59	1461	23
≥60	398	6
Co-morbidities[c]		
Hepatitis B infection	191	3
Hepatitis C infection	698	11
Mental illness[d]	1484	23
Alcohol/substance disorders	609	9
Charlson co-morbidities (excluding HIV and the above listed co-morbidities)[c]		
0	3726	58
≥1	2734	42

Note: Charlson co-morbidities includes 16 co-morbidities (7) and excludes HIV, hepatitis B, hepatitis C, mental illness, and alcohol/substance abuse. There are a total of 17 Charlson co-morbidities, including HIV and mild liver disease (which includes viral hepatitis). Since the entire sample was HIV-infected and because we wanted to evaluate hepatitis B and hepatitis C co-infection separately, we removed HIV, hepatitis B, and hepatitis C from the list of Charlson co-morbidities evaluated.

[a]Eleven variables are calculated from the time of study inclusion in calendar year 2006.

[b]Includes Black, American Indian/Alaska Native, Native Hawaiian, or Other Pacific Islands, two or more races and other non-white, non-black races, and Hispanic ethnicity.

[c]Denominator is 6460 because three cases had outpatient claims within six months of case identification, but not in 2006.

[d]Mental illness includes major depressive disorders, bipolar disorders, anxiety disorders, schizophrenia, and other unspecified mental illnesses.

Table 3.

Proportion of persons with HIV in the MarketScan® Medicaid study cohort who were retained and continued in care, 2006–2012.

Retention period (0–24 mos.)	***n* (%)**	**30 mos., *n* (%)**	**36 mos., *n* (%)**	**42 mos., *n* (%)**	**48 mos., *n* (%)**	**54 mos., *n* (%)**	**60 mos., *n* (%)**	**66 mos., *n* (%)**	**72 mos., *n* (%)**	**78 mos., *n* (%)**	**84 mos., *n* (%)**
n = 6463											
Still enrolled[a]	6463 (100)	3179 (80)	3179 (80)	2519 (64)	2519 (64)	1759 (44)	1759 (44)	1208 (30)	1208 (30)	1103 (28)	1103 (28)
Retained in care/ continued in care	3961 (61)	2932 (92)	2674 (84)	1992 (79)	1858 (74)	1195 (68)	1088 (62)	721 (60)	660 (55)	589 (53)	540 (49)
Not in care[b]	-	228 (7)	468 (15)	471 (19)	589 (23)	476 (27)	537 (31)	291 (24)	219 (18)	290 (26)	232 (21)
Terminal gap[b]	-	19 (1)	37 (1)	56 (2)	72 (3)	88 (5)	134 (8)	196 (16)	329 (27)	224 (20)	331 (30)

[a]Still enrolled includes those who met continuous enrollment criteria (i.e., had ≥10 months of continuous enrollment in the MarketScan® Medicaid dataset during each 12-month measurement period).

[b]The denominator for those continued in care, not in care, and terminal gap is persons still enrolled in the MarketScan® Medicaid dataset during the specified time period.

Table 4.

Proportion of persons with HIV in the MarketScan® Medicaid study cohort who experienced a gap in care and those who reengaged in care, 2006–2012.

0–24 mos.	***n* (%)**	**30 mos., *n* (%)**	**36 mos., *n* (%)**	**42 mos., *n* (%)**	**48 mos., *n* (%)**	**54 mos., *n* (%)**	**60 mos., *n* (%)**	**66 mos., *n* (%)**	**72 mos., *n* (%)**	**78 mos., *n* (%)**	**84 mos., *n* (%)**
n = 6463											
Gap in care[a]		247 (8)	390 (12)	346 (14)	392 (16)	293 (17)	374 (21)	325 (21)	321 (20)	269 (24)	331 (30)
Re-engaged in care[a]	–	–	115 (4)	117 (5)	120 (5)	105 (6)	92 (5)	113 (7)	112 (4)	48 (4)	45 (4)

[a]The denominator for gap in care and re-engaged in care is the number of persons still enrolled in the MarketScan® Medicaid dataset during the specified time period.

Table 5.

Factors associated with a gap in care[a] among persons with HIV in the MarketScan® Medicaid study cohort, 2006–2012.

	Univariate analysis		Multivariable analysis[b]	
Characteristic	**hazard ratio (95% CI)**	***p*-value**	**hazard ratio (95% CI)**	***p*-value**
≥1 Charlson comorbidity	0.67 (0.59–0.75)	<.001	0.72 (0.64–0.81)	<.001
Age 40–59[c]	0.77 (0.70–0.85)	<.001	0.79 (0.71–0.88)	<.001
Diagnosed with mental illness	0.75 (0.68–0.82)	<.001	0.79 (0.72–0.87)	<.001
Hepatitis C coinfection	0.79 (0.71–0.88)	<.001	0.83 (0.75–0.93)	.002
Female sex	0.85 (0.77–0.94)	<.001	0.86 (0.78–0.94)	.002
White race[d]	0.91 (0.82–1.02)	.108	NS	–
Diagnosed with alcohol/substance abuse	0.89 (0.80–0.99)	.035	NS	–
Hepatitis B coinfection	0.86 (0.74–1.01)	.062	NS	–

[a] A person was considered to have experienced a gap in care if they did not have an outpatient office visit claim in more than six months.

[b] The multivariable analysis was conducted using backward selection logistic regression analysis; white race, diagnosis of alcohol/substance abuse, and hepatitis B co-infection were all removed from the model through the backward selection process.

[c] Ages 40–59 were compared to all other age groups combined.

[d] White race was compared with all “other” races/ethnicity combined.