Delayed entry into HIV medical care in a nationally representative sample of HIV-infected adults receiving medical care in the USA

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Abstract

Before widespread antiretroviral therapy (ART), an estimated 17% of people delayed HIV care. We report national estimates of the prevalence and factors associated with delayed care entry in the contemporary ART era. We used Medical Monitoring Project data collected from June 2009 through May 2011 for 1425 persons diagnosed with HIV from May 2004 to April 2009 who initiated care within 12 months. We defined delayed care as entry >three months from diagnosis. Adjusted prevalence ratios (aPRs) were calculated to identify risk factors associated with delayed care. In this nationally representative sample of HIV-infected adults receiving medical care, 7.0% (95% confidence interval [CI]: 5.3–8.8) delayed care after diagnosis. Black race was associated with a lower likelihood of delay than white race (aPR 0.38). Men who have sex with women versus women who have sex with men (aPR 1.86) and persons required to take an HIV test versus recommended by a provider (aPR 2.52) were more likely to delay. Among those who delayed 48% reported a personal factor as the primary reason. Among persons initially diagnosed with HIV (non-AIDS), those who delayed care were twice as likely (aPR 2.08) to develop AIDS as of May 2011. Compared to the pre-ART era, there was a nearly 60% reduction in delayed care entry. Although relatively few HIV patients delayed care entry, certain groups may have an increased risk. Focus on linkage to care among persons who are required to take an HIV test may further reduce delayed care entry.

Introduction

Timely initiation of HIV medical care is important because delays may lead to lost opportunities for prevention (Gardner, McLees, Steiner, del Rio, & Burman, 2011; Metsch et al., 2008) and worse clinical outcomes (Gardner et al., 2011). Antiretroviral therapy (ART) leads to decreased HIV transmission and reduced morbidity and mortality (Attia, Egger, Müller, Zwahlen, & Low, 2009; Cohen et al., 2011; Donnell et al., 2010; Montaner et al., 2010), and thus national treatment guidelines now recommend ART for all HIV-infected individuals (Department of Health and Human Services, 2012). Initiation of ART requires persons to be linked to care after diagnosis, and the National HIV/AIDS Strategy employs linkage within three months after diagnosis as a benchmark for monitoring initiation of care (The White House, 2010).

The time from diagnosis to care initiation has been previously described in many populations (Bamford, Ehrenkranz, Eberhart, Shpaner, & Brady, 2010; Jenness et al., 2012; Mahle Gray et al., 2013; Marks, Gardner, Craw, & Crepaz, 2010; Reed et al., 2009; Sullivan et al., 2011; Torian, Wiewel, Liu, Sackoff, & Frieden, 2008; Turner et al., 2000; Ulett et al., 2009; Zetola et al., 2009). The HIV Cost and Services Utilization Study (HCSUS) estimated that 17% of patients who initiated care within 12 months of diagnosis delayed for more than three months (Turner et al., 2000). Of note, this estimate is from the era before widespread ART (i.e., among persons diagnosed and receiving care as of March 1st, 1996). With new developments in ART and prescribing patterns, the contemporary treatment era from 2004 to present is characterized by more tolerable, effective, and simpler regimens (e.g., single-tablet regimens) (Willig et al., 2008). Evidence suggests that persons may be less likely to delay care in the contemporary ART era (Jenness et al., 2012; Reed et al., 2009), but this has not been demonstrated in a nationally representative sample of HIV-infected persons.

To achieve timely linkage to HIV care, persons making diagnoses and care referrals must be aware of factors that increase a patient's risk for delaying care entry. Prior research has focused on various demographic risk factors (Bamford et al., 2010; Gardner et al., 2005; Jenness et al., 2012; Johnston et al., 2013; Mahle Gray et al., 2013; Osmond et al., 1999; Reed et al., 2009; Sullivan et al., 2011; Torian et al., 2008; Turner et al., 2000; Ulett et al., 2009; Zetola et al., 2009). Data from 13 jurisdictions with mandatory CD4+ T-lymphocyte (CD4)/HIV viral load (VL) reporting in the National HIV Surveillance System (NHSS), indicated that a higher proportion of older persons, whites, and heterosexual women initiated care within three months (Mahle Gray et al., 2013). To a lesser extent, aspects of the testing experience have also been examined, and much of the focus has been on the type of diagnosing facility (Bamford et al., 2010; Jenness et al., 2012; Mahle Gray et al., 2013; Marks et al., 2010; Torian et al., 2008; Zetola et al., 2009), if the person had a prior testing history, or the type of test (i.e., confidential versus anonymous) (Reed et al., 2009). Testing characteristics associated with delayed initiation of care included first time and anonymous

(versus confidential) testing and being diagnosed at an HIV counseling or testing site or at a sexually transmitted disease (STD) clinic (versus private doctors office) (Mahle Gray et al., 2013; Reed et al., 2009). The reason persons get an HIV test may also be associated with delayed care seeking (Jenness et al., 2012), but this relationship has not been well described.

To address these gaps, we first estimated the proportion of persons delaying care entry in the beginning of the contemporary ART era (i.e., persons diagnosed with HIV from 2004 to 2009 and entering care within 12 months) using the most recent data available from the Medical Monitoring Project (MMP). Second, we compared our estimate to the HCSUS estimate of delay before widespread ART. Similar to HCSUS (Frankel et al., 1999), MMP is a national facility-based probability sample of adults receiving HIV care, and data are collected via face-to-face interview and medical record abstraction (MRA). Comparable methodology allowed us to assess changes between treatment eras. Third, we evaluated reasons for and risk factors associated with delayed care. Of particular interest, we examined the reason persons tested for HIV as a risk factor. Last, we examined timing of care initiation as a predictor of viral suppression and AIDS diagnosis.

Methods

Ethics statement

The Centers for Disease Control and Prevention (CDC) approved MMP, as a public health surveillance activity, in accordance with the federal human subjects protection regulations, 45 Code of Federal Regulations 46.101c and 46.102d and the CDC Guidelines for Defining Public Health Research and Public Health Non-Research (Department of Health and Human Services (DHHS), 2009; Centers for Disease Control and Prevention, 2010). Participating states or territories and facilities obtained local Institutional Review Board approval to conduct MMP if required locally. Informed consent was obtained from all interviewed participants.

Participants

MMP is a supplemental HIV surveillance system designed to produce nationally representative estimates of behavioral and clinical characteristics of HIV-infected adults receiving medical care in the USA (Blair et al., 2011; Frankel et al., 2012; McNaghten et al., 2007). We used data from the 2009 and 2010 MMP data collection cycles. Data were collected via face-to-face and telephone interviews and MRAs conducted by MMP staff from June 2009 to May 2011.

Detailed methods for MMP sampling have been previously described (Frankel et al., 2012; McNaghten et al., 2007). First, US states and territories were sampled, then facilities providing HIV care, and finally adult persons aged 18 years or older receiving at least one medical care visit in participating facilities between 1 January and 30 April of the cycle year (the calendar year that defined the population for sampling, i.e., population definition period (PDP)). All sampled states and territories participated in MMP in 2009 and 2010: California, Delaware, Florida, Georgia, Illinois, Indiana, Michigan, Mississippi, New Jersey, New York, North Carolina, Oregon, Pennsylvania, Puerto Rico, Texas, Virginia, and Washington.

In the 2009 data collection cycle, 603 facilities were sampled within the states or territories. Of those sampled facilities, 461 participated in MMP (facility response rate 76%), and of 9338 sampled persons, 4217 completed both an interview and a linked MRA (adjusted 2009 patient-level response rate 51%) (Centers for Disease Control and Prevention, 2009). In the 2010 data collection cycle, 582 facilities were sampled. Of those sampled, 474 participated (facility response rate 81%), and of 9400 sampled persons, 4474 completed an interview and MRA (adjusted 2010 patient-level response rate 50%). Data were weighted based on known probabilities of selection at state or territory, facility, and patient levels. In addition, data were weighted to adjust for non-response using predictors of patient-level response including facility size, race/ethnicity, time since HIV diagnosis, and patient age (Centers for Disease Control and Prevention, 2009).

Delayed care entry

HCSUS was a national probability sample of persons diagnosed with HIV and receiving care as of 1 March 1996 (Turner et al., 2000). HCSUS methods, including procedures used for their analysis of delayed care, have been described in detail elsewhere (Frankel et al., 1999; Turner et al., 2000). HCSUS participants had variable opportunity for delayed entry to care, and persons who delayed care beyond 1 March 1996, were not included in the study population. To avoid finding less delay in persons diagnosed more recently, Turner et al. (2000) restricted the analytic population to persons who had comparable opportunity for delayed care, that is, those who had linked to care within 12 months of diagnosis.

Analytic cohorts for examining delayed care—To calculate the proportion of persons who delayed care, we created an MMP analytic cohort analogous to the HCSUS analytic cohort. The MMP primary analytic cohort includes participants diagnosed with HIV from May 2004 to April 2009 who initiated care within 12 months of diagnosis ($N = 1425$). We did not include persons diagnosed before May 2004 because we were interested in delayed care during the contemporary ART era. Additionally, questions about care initiation were only asked of persons diagnosed at most 5 years prior to the PDP to reduce recall bias.

After weighting for probability of selection and non-response, the analytic cohort is estimated to represent 72,920 (95% confidence interval [CI] 61,232–84,608) HIV-infected adults receiving medical care in the USA between January and April in 2009 and 2010.

To evaluate whether our findings were sensitive to limiting the data to those diagnosed within 12 months, we also examined delayed care entry among MMP participants initiating care within 36 months of diagnosis ($N = 694$). To assess the potential for bias in choice of follow-up time, we calculated the cumulative proportion of persons who had initiated care at 12 and 36 months among participants with at least 36 months of observation time (i.e., those diagnosed from May 2004 to December 2006, $N = 582$).

Delayed care measure—We used the same definition of delayed care (more than three months from diagnosis to care entry) as was used for HCSUS. We estimated the duration of delay in months between the self-reported dates of diagnosis and of first medical care. Date of diagnosis was ascertained by the question: "What month and year did you **first** test positive for HIV? Tell me when you got your result, not when you got your test", and date

of care initiation by: "Since testing positive for HIV, what month and year did you **first** visit a doctor, nurse, or other health care worker for HIV medical care?" Care initiation was categorized dichotomously, as delayed or timely care.

Reasons for and predictors of delayed care

If care was delayed, participants were asked the main reason for the delay. Reasons were grouped into three categories: personal (e.g., not wanting to think about being HIV-positive or being afraid), financial/structural (e.g., not enough money), and comorbidities (e.g., substance abuse or poor physical health). For details on categorization of reasons for delay, see supplemental Table 1.

Potential predictors of delayed care were identified upon review of the literature and are listed in Table 2. Sexual orientation/gender refers to a composite variable of sexual orientation, sexual behavior, gender, and sex at birth in which persons are categorized as: men who have sex with men (MSM), men who have sex with only women (MSW), women who have sex with men (WSM), and other (participants who do not fall into the aforementioned categories). Poverty level is based on a participant's household income and number of dependents in the year prior to interview (US Department of Health and Human Services and Office of the Assistant Secretary for Planning and Evaluation, 2014). This measure was a proxy for poverty at the time of diagnosis. Concurrent diagnosis refers to AIDS diagnosis made at the same time as the HIV diagnosis. As the date of AIDS diagnosis was not available, we estimated clinical status at diagnosis by using age in years at HIV and AIDS diagnosis obtained from the MMP jurisdictions' HIV case registry. If the age at HIV diagnosis was the same as the age at AIDS diagnosis, a participant was considered to be diagnosed concurrently with HIV and AIDS. If there was no diagnosis of AIDS or if the age at diagnosis of AIDS was greater than the age at HIV diagnosis, a participant was considered not to have been diagnosed concurrently with HIV and AIDS (i.e., HIV non-AIDS). The testing experience characteristics examined were reason tested and test location.

Association between (a) timely care and viral suppression and (b) delayed care and AIDS diagnosis

Viral suppression—Viral suppression was defined as undetectable if the most recent VL documented was undetectable or 200 copies/mL and was analyzed as a dichotomous variable: detectable or undetectable.

Analytic cohort for examining the association between delayed care and AIDS diagnosis—In our analysis of delayed medical care as a predictor of a later AIDS diagnosis, we restricted the analytic cohort to persons initially diagnosed with HIV, non-AIDS ($N = 983$) who represent 50,881 (42,590–59,172) HIV-infected adults receiving medical care.

AIDS diagnosis—Clinical status was obtained from the MMP jurisdictions' HIV case registry data and AIDS diagnosis was analyzed as a dichotomous variable: AIDS versus non-AIDS as of May 2011.

Statistical analysis

Standard frequency distributions were calculated to describe demographic characteristics. Adjusted prevalence ratios (aPRs) were estimated to investigate risk factors associated with delayed care entry and to examine the association between (1) timely care initiation and viral suppression and (2) delayed care initiation and AIDS diagnosis. To identify factors associated with delayed care, variables were entered into a multivariable model, and backward elimination was used to remove variables with a p-value > .2. The approach was chosen because we were exploring new associations and there was not enough literature for a priori identification of variables. Two variables, concurrent diagnosis and year of diagnosis, were forced into the model. Rao-Scott chi-square test statistics, a corrected version of the Chi-square test that is used when the estimates are derived from complex sample survey data, were used to examine the association between timely care initiation and viral suppression and between delayed care initiation and AIDS diagnosis (Scott, 2007). In the multivariable models examining the association between timely care initiation and viral suppression and between delayed care initiation and AIDS diagnosis, covariates included: age, race/ethnicity, and sexual orientation/gender. Prevalence ratios (PRs) were considered statistically significant when the 95% CI for the PR excluded the null value of 1.

All analyses accounted for complex sample survey design and were conducted using SAS version 9.3 (SAS Institute, Cary, NC) and SUDAAN version 11.0 (RTI, Research Triangle Park, NC).

Results

Cohort characteristics

The primary analytic cohort was composed of 1425 individuals diagnosed with HIV from May 2004 to April 2009 who entered care within 12 months. At time of interview 21% were aged 18–29, 25% aged 30–39, 34% aged 40–49, 19% aged 50+ years, 32% white (non-Hispanic), 44% black (non-Hispanic), and 18% Hispanic. By sexual orientation/gender, 51% were MSM, 21% MSW, 25% WSM, and 3% other. More than half (56%) were living at or above the federal poverty level the year before they were interviewed. By reason tested for HIV, 52% were due to provider recommendation, 32% due to self-initiation, 4% due to a STD, and 4% due to a requirement (Table 1).

Delayed care entry

In the primary analytic cohort, 7.0% (CI: 5.3%, 8.8%) delayed care initiation for more than three months after diagnosis (Table 2). Among persons with more than 36 months of observation time, 94% had initiated care at 12 months (Figure 1), and they had a median observation time of 57.5 months (ranging from 44 to 71 months).

Reasons and risk factors for delayed care entry

The reasons for delayed care initiation were varied; 48% reported a personal factor as the primary reason, 38% reported a financial/structural reason, and 14% cited a comorbid condition(s).

Table 2 shows the weighted proportion, unadjusted and adjusted PRs, and 95% CI for association of various characteristics with delayed care. After adjustment for covariates, MSW were 1.86 (CI 1.05, 3.18) times as likely to delay than WSM. The reason for testing also affected the likelihood of delay. Persons who tested because they were required to (versus recommended by a provider) were 2.52 (CI 1.06, 5.97) times as likely to delay care. We did not find an association between MSM (versus WSM), persons who self-initiated testing, or tested due to a STD (versus recommended by a provider) and delayed care. Black race was associated with lower likelihood of delayed care entry (aPR 0.38, CI 0.23, 0.64) than white race. Hispanic ethnicity and all other races (versus white) were not associated with delayed care. Age, education, English as the primary language, foreign birth, poverty level, concurrent diagnosis, year of diagnosis, and testing location were not significant predictors of delay.

Care initiation as a predictor of viral suppression and AIDS diagnosis

Viral suppression at the most recent test was similar between persons who initiated care within three months (73.5%; CI: 69.7%, 77.2%) and persons who delayed care (69.6%; CI: 59.4, 79.9) (Rao-Scott chi-square p-value = .43, data not shown). Moreover, timely care initiation was not a significant predictor of recent viral suppression, after adjusting for age, sexual orientation/gender, and race/ethnicity (aPR: 1.10; CI: 0.94, 1.27). However, among persons without AIDS at the time of HIV diagnosis, a significantly higher percentage of persons who delayed care subsequently progressed to AIDS (43.2%; CI: 30.7%, 55.7%) than persons who did not delay care (22.3%; CI: 19.9%, 24.6%) (p-value < .001). In a model adjusting for age, sexual orientation/gender, and race/ethnicity, persons who delayed care were twice as likely to progress to AIDS as of May 2011 (aPR: 2.09; CI: 1.56, 2.79).

Discussion

Among persons linked to care within 12 months of diagnosis, 7% delayed care. The reasons for the delay were varied, and nearly half of persons who delayed did so for personal reasons (e.g., feeling healthy). We identified characteristics that increased the risk of delayed care entry. MSW (versus WSM) and persons who tested because they were required to (versus provider-initiated) had an increased likelihood of delay. Delays in care may lead to worse clinical outcomes, and in this analysis, delayed linkage was associated with disease progression to AIDS, but not with viral suppression at most recent test among those currently receiving care.

Compared to the pre-ART era, there was a nearly 60% reduction in delayed care entry in the contemporary ART era (MMP: 7% versus HCSUS: 17%). This is consistent with previous studies, which have found that delay has declined since 1995 (Jenness et al., 2012; Reed et al., 2009). In studies that specifically examined initiation of care within three months of diagnosis in the contemporary ART era, 18–36% of persons diagnosed with HIV delayed care entry (Bauman et al., 2013; Centers for Disease Control and Prevention, 2013; Mahle Gray et al., 2013; Torian et al., 2008). Of note, data from the NHSS found that 18% of persons diagnosed in 2009 delayed care more than three months (Mahle Gray et al., 2013). The comparatively low proportion of persons who delayed care in our analysis

may be explained by the fact that MMP samples only from among persons already in HIV care (Turner et al., 2000). Thus, our estimate of care delay is low, but unlike prior comparisons of delay between treatment eras, it is nationally representative and calculated in a manner that allows direct comparison to a previously published nationally representative estimate. Repeating the analysis on a more loosely defined analytic cohort of those who initiated care within 36 months provided an estimate of the proportion with delayed care that showed similar improvement when compared to the analogous 1995 HCSUS estimate (data not shown). While our results support the interpretation that delay has declined in the contemporary ART era, we did not find a difference in delay by year of diagnosis from 2004 to 2009. This analysis is consistent with research showing that availability of effective treatments and the perceived benefits of care motivate persons in the era of widespread ART to enter care earlier (Reed et al., 2009; Turner et al., 2000).

Approximately half of the sample reported that they delayed care for personal reasons such as feeling healthy, not believing the test result, and not wanting to think about being HIV-positive. One-third reported a financial/structural reason such as not having enough money or insurance, transportation problems, and not knowing where to go or whom to see for care. The remaining (15%) cited comorbid conditions such as substance abuse or illness. This indicates HIV post-test counseling and referral practices may not be sufficient to eliminate barriers to care initiation.

Although relatively few HIV patients delayed care entry, certain subgroups, such as MSW, were disproportionately likely to do so. Contrary to most prior research (Mahle Gray et al., 2013; Reed et al., 2009; Torian et al., 2008; Turner et al., 2000; Ulett et al., 2009), black race was associated with a lower likelihood of delayed linkage than white race. Notably, data from the NHSS showed that more whites (86%) than blacks (78%) initiated care within three months (based on CD4/VL test results in 13 jurisdictions with mandatory laboratory reporting) (Mahle Gray et al., 2013). Our results may be due, in part, to examining a population in which all persons were retained in care, as poor access to medical care is thought to drive racial disparities in care engagement (Johnston et al., 2013; Krawczyk, Funkhouser, Kilby, & Vermund, 2006; Moore, 2011). Data from Medicaid claims suggest that blacks have a lower likelihood of delay than whites (Johnston et al., 2013), and similar to our cohort, the Medicaid cohort includes persons already linked to a healthcare system where they had been diagnosed with HIV(Johnston et al., 2013).

Persons were more likely to delay if the main reason for testing was a requirement (e.g., for military, jail entry, study protocol, or immigration purposes). To our knowledge, only one other study has examined the reason for testing as a risk factor for delayed HIV care, and those authors found no significant relationships after adjustment for covariates (Jenness et al., 2012). The testing experience, which may include counseling and referral, is the gateway to HIV medical care for persons diagnosed with HIV. Individuals who receive active referrals are more likely to be successfully linked to HIV care (Gardner et al., 2005; Garland et al., 2011). Persons who received HIV testing because of a requirement may have had providers who were not actively involved in ensuring appropriate follow-up. Persons required to take an HIV test represented a small proportion of our analysis. However,

increased focus on linkage to care among persons required to take an HIV test may be warranted to reduce delays in care initiation in this group.

Initiation of medical care is required for access to medical treatment and support for treatment adherence. Therefore, delayed care may lead to worse clinical outcomes (Gardner et al., 2011; Mugavero et al., 2012; Ulett et al., 2009), and we found that persons who delayed care were twice as likely to develop AIDS as of May 2011 relative to those who did not delay. This finding provides additional evidence that initiating care within three months is an important benchmark. One limitation of the analysis is that we could not fully control for the possibility that those who delay care after diagnosis may also be more likely to have had a delay between infection and diagnosis, which may have increased their probability of developing AIDS.

Some limitations should be kept in mind when interpreting our data. First, self-reported behaviors are subject to recall bias, which may have introduced some error in measurement of delayed linkage. However, we focused on persons diagnosed within 5 years of the time they were interviewed to minimize this bias, which is the most recent national data available that is comparable to the HCSUS population. Additionally, HCSUS also used self-reported data so this bias, if it exists, should not affect our comparison of delay over time, assuming self-reported data results in bias of equal magnitude in HCSUS and MMP data. Second, individuals who died before or shortly after HIV infection was diagnosed were not represented in the sample because they would not have been in care. Third, our estimate may be considered low, if persons in care but not participating in MMP were more likely to delay care. Fourth, the data presented here cover the time period 2004–2009 and thus might not reflect more recent or current linkage practices. Lastly, associations of marginal significance could be due to multiple comparisons.

Our data indicate delays declined in the beginning of the contemporary ART era (from May 2004 to April 2009), perhaps due to the availability of effective care and treatment prompting persons diagnosed with HIV to enter care earlier. Our study adds to the literature by suggesting that the reason a person gets an HIV test may be associated with delayed care. Although relatively few persons delayed care entry, certain subgroups, such as MSW, were disproportionately likely to do so. Linkage facilitation programs are important, as delays in care increased the likelihood of disease progression to AIDS.

Funding

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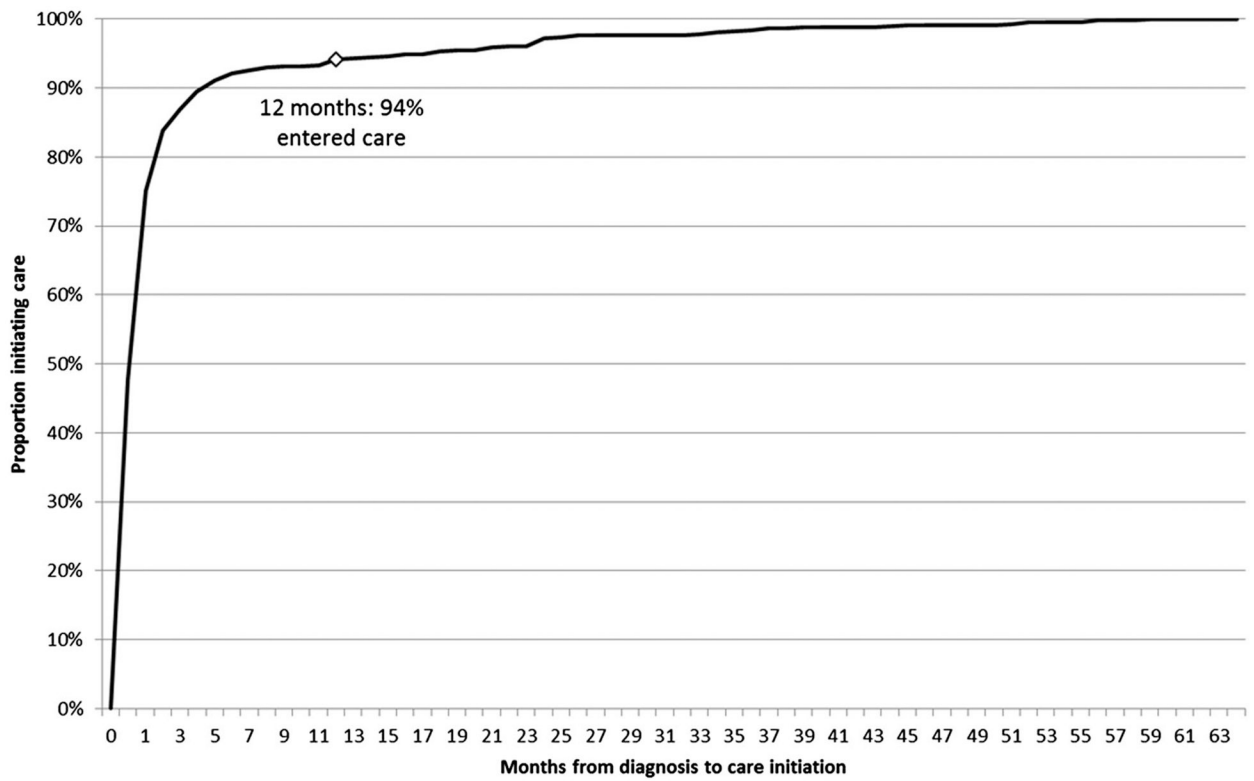
Figure 1.
Time from diagnosis to care initiation among HIV-infected adults receiving medical care
who were diagnosed from May 2004 to Dec 2006, Medical Monitoring Project, United
States (N=582).

Table 1.

Demographic, behavioral, testing, and clinical characteristics of HIV-infected adults receiving medical care who were diagnosed from May 2004 to December 2009 and initiated care within 12 months of diagnosis, MMP, USA.

Characteristic	Number	Weighted % (95% confidence interval)
Total 12-month cohort	1425	
Age		
18–29	306	21.2 (17.9, 24.5)
30–39	354	25.1 (22.9, 27.3)
40–49	477	34.4 (31.8, 36.9)
50+	287	19.2 (17.5, 21.0)
Race/ethnicity		
White	431	31.8 (24.8, 38.7)
Black	632	44.4 (35.4, 53.3)
Hispanic	290	18.6 (13.6, 23.6)
All other	70	5.2 (3.7, 6.6)
Orientation/gender		
MSM	717	51.3 (46.5, 56.1)
MSW	320	21.2 (19.0, 23.4)
WSM	354	25.0 (21.6, 28.4)
Other	34	2.5 (1.6, 3.4)
Concurrent diagnosis		
HIV and AIDS	442	30.2 (27.6, 32.8)
HIV (non-AIDS)	983	69.8 (67.2, 72.4)
Poverty level		
At or above 100% Federal Poverty Level (FPL)	748	56.1 (51.6, 60.7)
Below 100% FPL	629	40.8 (36.5, 45.1)
Education		
>High school	255	16.6 (14.2, 19.1)
High school diploma or equivalent	405	27.3 (24.1, 30.6)
>High school	764	55.9 (51.5, 60.4)
English primary language		
Yes	1244	88.9 (84.4, 93.3)
No	180	11.0 (6.6, 15.5)
Foreign born		
No	1213	85.5 (81.7, 89.2)
Yes	211	14.5 (10.7, 18.2)
Reason tested		
Self-initiated[a]	496	32.7 (28.2, 37.1)
Provider[b]	717	52.3 (46.7, 57.9)
STD	53	3.8 (2.5, 5.2)

Characteristic	Number	Weighted % (95% confidence interval)
Requirement[c]	58	3.9 (2.5, 5.3)
Other reason tested[d]	97	7.1 (5.7, 8.5)
Testing location		
Primary care	561	41.2 (37.9, 44.5)
Health department	210	15.7 (12.8, 18.5)
Emergency room	87	6.2 (4.7, 7.7)
Hospital	214	14.6 (12.2, 17)
HIV testing site (non-primary care)	95	5.7 (4, 7.3)
Other testing location[e]	257	16.6 (13.4, 19.7)
Year of diagnosis		
2004	116	7.8 (6.5, 9.1)
2005	305	22.1 (20, 24.3)
2006	294	20.0 (17.8, 22.2)
2007	369	25.9 (23.4, 28.3)
2008	277	19.7 (17.1, 22.4)
2009	64	4.5 (3.3, 5.6)

[a]Self-initiated includes tests as a result of concerns about sexual contact, injection drug use, or a personal initiative to test.

[b]Provider recommendation includes tests as a result of provider recommendation, other illness, and pregnancy.

[c]Requirement includes tests as a result of a military, court order, or insurance requirement.

[d]Other reason tested includes tests as a result of health department partner notification, blood donation, needle stick, and "other" reasons.

[e]Other testing location includes correctional facility, military or Veteran's Administration facility, or other facility.

Table 2.

Unadjusted and adjusted associations of respondent characteristics with delayed initiation of care[a] among HIV-infected adults receiving medical care who were diagnosed from May 2004 to Dec 2009 and initiated care within 12 months, MMP, USA ($N = 1425$).

Characteristic	Number delayed	Proportion delayed, weighted % (95% CI)	Unadjusted PR (95% CI)	Adjusted PR (95% CI)
Total 12-month cohort	100	7.0 (5.3, 8.8)		
Age				
18–29	29	8.9 (5.8, 12.0)	1.84 (0.79, 4.32)	1.95 (0.97, 3.96)
30–39	30	8.7 (5.3, 12.0)	1.80 (0.73, 4.32)	1.80 (0.77, 4.22)
40–49	30	5.9 (3.5, 8.2)	1.22 (0.41, 3.61)	1.12 (0.40, 3.11)
50+	11	4.8 (0.7, 9.0)	Ref	Ref
Race/ethnicity				
White	37	9.2 (6.0, 12.4)	Ref	Ref
Black	29	4.2 (2.5, 6.0)	**0.46 (0.29, 0.73)** [b]	**0.38 (0.23, 0.64)** [b]
Hispanic	26	8.4 (4.5, 12.2)	0.91 (0.54, 1.53)	0.70 (0.41, 1.19)
All other	7	11.8 (4.3, 19.3)	1.28 (0.59, 2.79)	0.96 (0.41, 2.27)
Orientation/gender				
MSM	55	7.6 (5.2, 10.1)	1.57 (0.83, 2.97)	1.14 (0.56, 2.32)
MSW	24	8.4 (4.5, 12.2)	**1.72 (1.02, 2.90)** [b]	**1.86 (1.05, 3.18)** [b]
WSM	20	4.9 (2.2, 7.5)	Ref	Ref
Other	1	4.2 (0.0, 11.7)	0.86 (0.17, 4.26)	0.61 (0.14, 2.69)
Concurrent diagnosis				
HIV and AIDS	28	6.7 (4.1, 9.4)	0.94 (0.59, 1.49)	1.18 (0.67, 2.07)
HIV (non-AIDS)	72	7.1 (5.1, 9.2)	Ref	Ref
Poverty level				
At or above 100% FPL	49	6.6 (4.7, 8.5)	Ref	Ref
Below 100% FPL	46	7.5 (5.1, 9.9)	1.14 (0.81, 1.60)	1.24 (0.88, 1.78)
Education				
<High school	22	7.8 (3.6, 12.0)	1.09 (0.65, 1.82)	
High school diploma or equivalent	25	6.3 (3.4, 9.2)	0.88 (0.52, 1.48)	
>High school	53	7.1 (5.3, 9.0)	Ref	
English primary language				

Characteristic	Number delayed	Proportion delayed, weighted % (95% CI)	Unadjusted PR (95% CI)	Adjusted PR (95% CI)
Yes	85	6.9 (5.1, 8.8)	Ref	
No	15	7.6 (3.8, 11.5)	1.10 (0.64, 1.88)	
Foreign born				
No	79	6.7 (4.8, 8.7)	Ref	Ref
Yes	21	8.6 (5.3, 11.9)	1.28 (0.79, 2.05)	
Reason tested				
Self-initiated[c]	41	7.6 (3.7, 11.5)	1.47 (0.68, 3.17)	1.41 (0.65, 3.08)
Provider[d]	34	5.2 (2.8, 7.5)	Ref	Ref
STD	5	11.0 (0.6, 21.4)	2.13 (0.69, 6.56)	1.63 (0.46, 5.79)
Requirement[e]	7	12.7 (2.6, 22.8)	**2.46 (1.05, 5.77)**[b]	**2.52 (1.06, 5.97)**[b]
Other reason tested[f]	13	12.8 (7.2, 18.5)	**2.49 (1.26, 4.91)**[b]	**2.20 (1.05, 4.64)**[b]
Testing location				
Primary care	34	5.4 (2.9, 8.0)	Ref	
Health department	11	6.1 (2.8, 9.4)	1.13 (0.60, 2.11)	
Emergency room	8	8.6 (1.5, 15.7)	1.58 (0.56, 4.46)	
Hospital	11	6.0 (1.1, 10.8)	1.10 (0.38, 3.17)	
HIV testing site (non-primary care)	9	9.2 (2.6, 15.7)	1.69 (0.77, 3.70)	
Other testing location[g]	27	11.4 (5.6, 17.2)	2.10 (1.01, 4.35)	
Year of diagnosis				
2004	6	4.7 (0.4, 8.9)	0.57 (0.20, 1.63)	0.65 (0.26, 1.65)
2005	25	8.3 (4.7, 11.8)	Ref	Ref
2006	17	5.7 (2.6, 8.7)	0.69 (0.35, 1.35)	0.66 (0.32, 1.35)
2007	33	8.5 (4.6, 12.5)	1.04 (0.60, 1.80)	1.01 (0.57, 1.78)
2008	14	5.6 (2.5, 8.8)	0.68 (0.37, 1.27)	0.69 (0.38, 1.26)
2009	5	8.0 (1.2, 14.8)	0.97 (0.35, 2.68)	1.00 (0.39, 2.58)

[a] Entered care >three months after diagnosis.

[b] PRs were considered statistically significant when 95% CIs for the PR excluded the null value of 1.

[c] Self-initiated includes tests as a result of concerns about sexual contact, injection drug use, or personal initiative to test.

[d] Provider recommendation includes tests as a result of provider recommendation, other illness, and pregnancy.

[e] Requirement includes tests as a result of a military, court order, or insurance requirement.

[f] Other reason tested includes tests as a result of health department partner notification, blood donation, needle stick, and "other" reasons.

[g] Other testing location includes correctional facility, military or Veteran's Administration facility, and other facility.