Trends in the Spectrum of Engagement in HIV Care and Subsequent Clinical Outcomes Among Men Who Have Sex with Men (MSM) at a Boston Community Health Center

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Abstract

Despite known benefits, only 19–28% of HIV-infected Americans are virologically suppressed (defined as ≤ 200 copies/mL). Engagement in HIV care represents a continuum from patients unaware they are infected to virological suppression. The electronic medical record of all newly diagnosed HIV-infected MSM seen at Fenway Health between 2000 and 2010 were reviewed. Patients were “engaged” if they had one negative HIV test and/or one physical exam within 24 months prior to their HIV diagnosis ($n = 291$). All others were considered “new” ($n = 463$). MSM engaged in care prior to HIV diagnosis were more often identified in acute retroviral syndrome or on routine screening, more rapidly linked to care, and less often diagnosed with a concomitant STI than those who were not engaged in care. Nearly 19% of all patients were diagnosed with AIDS the same time they were diagnosed with HIV. Blacks and those with higher CD4 counts at diagnosis were less likely to be virologically suppressed at 1 year. Between 2000 and 2010, patients retained in care were more likely to initiate ART and be virologically suppressed within 1 year independent of initial HIV viral load and CD4 count. Engagement in care prior to seroconversion influences important HIV outcomes. Programs that care for at risk populations should institute routine opt-out HIV testing and test-and-treat programs to optimize HIV care and prevention.

Introduction

THE WORLDWIDE HIV/AIDS PANDEMIC has resulted in approximately 60 million infections and >25 million deaths.¹ Currently, there are >33 million living with HIV or AIDS.¹ Over the past 3 decades, there has been great progress in HIV research and in the implementation of successful public health interventions. However, men who have sex with men (MSM) continue to be disproportionately affected by the disease in the United States, accounting for over half of all prevalent and incident infections.^{2–4} In contrast to other risk groups for which HIV/AIDS diagnoses have decreased, cases among MSM have increased 8.6% between 2001 and 2006, and 17% between 2005 and 2008.^{5,6} Although the pathogenesis of HIV is well understood, infection can be rapidly diagnosed, and the virus can be suppressed with highly

effective combination antiretroviral therapy (ART) resulting in reduced morbidity and mortality, questions remain about the most effective strategies to curtail the HIV epidemic in MSM.

Studies estimate that only 51% of HIV-infected Americans are receiving regular HIV care and just 19–28% are virally suppressed.^{9,10} Those who are most likely to transmit HIV are least likely to be engaged in care.^{9,10} Engagement in care represents a spectrum of distinct processes as defined by the Health Resources and Services Administration, ranging from patients not in care and unaware of their HIV status to patients fully engaged in comprehensive HIV primary medical care.⁷ Significant deficits in engagement in HIV care, such as late diagnosis, suboptimal linkage to and retention in care, inappropriate ART use, and poor adherence to therapy, present major barriers to achieving optimal outcomes.⁸

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Furthermore, these obstacles present extensive barriers to the successful implementation of healthcare provider dependent public health strategies, including widespread opt-out testing and test-and-treat programs for HIV care and prevention.^{11–13} Despite increasing evidence for the importance of engagement in care, little is known about the characteristics of engaged patients and how engagement prior to seroconversion influences HIV outcomes. Fenway Health is a medical facility in Boston that provides healthcare to >20,000 patients, of which >25% are MSM. These demographics offer a unique opportunity to study the sociodemographic and behavioral characteristics of newly diagnosed HIV-infected MSM. The present study aims to explore how engagement in care prior to diagnosis influences specific HIV outcomes, such as identifying patients in acute retroviral syndrome (ARS) or AIDS at diagnosis, and virological suppression at 1 year. This investigation also seeks to determine sociodemographic, clinical, and behavioral associations with identifying patients in ARS or AIDS at diagnosis, and virological suppression at 1 year.

Methods

Study design, population, and setting

We collected data from the electronic medical record (EMR) database of all newly diagnosed HIV-infected MSM seen at Fenway Health, Boston, between January 2000 and December 2010 ($n = 754$). Transgender women (male at birth) who reported sex with men were also included. Patients transferring HIV care, women at birth, and those reporting heterosexual contact, transfusion, or occupational exposure as their only HIV risk factors were excluded from this analysis. The study was approved by the Institutional Review Board of Fenway Health.

Variables collected

EMRs were individually reviewed to retrieve sociodemographic data systemically collected on Fenway Health patients including age, race, relationship status, insurance status, employment, housing status, as well as standardized clinical information concerning date of initial positive HIV antibody test, location of and reason for initial test, HIV viral load, and CD4 count at the initial visit and 1 year, risk factors for HIV acquisition (e.g., MSM, MSM, and IDU), the presence of acute retroviral syndrome (ARS), AIDS, or opportunistic infections; ART initiation, retention in HIV care, and evidence for other STIs at the initial visit and 1 year. For all patients, chart review was undertaken to extract current risk behavior data at the initial HIV visit concerning recreational drug use, alcohol use, number and gender of sexual partners, being in an HIV serodiscordant primary relationship, and other sexual practices. For patients engaged in care at Fenway Health, the reason (e.g., annual physical exam, urgent visit) and number of Fenway Health visits within 24 months prior to HIV diagnosis were also recorded. Missing data points were excluded from the analysis. Data was confirmed for accuracy by secondary review of patient records.

Definitions and primary outcome variables

Patients were considered “engaged in care” if they had at least one prior HIV negative test and/or one prior routine physical exam with a Fenway Health provider within 24 months prior to HIV diagnosis. Mental health or urgent visits

that may have included a physical exam were excluded. All other newly diagnosed HIV-infected MSM were considered “new” patients if they presented for an initial HIV visit without previous engagement with another HIV provider.

The location of HIV test was categorized into “testing service at Fenway” for patients tested at the Fenway Health walk-in HIV counseling and testing service, “Fenway provider” for patients tested by a provider during an office visit, “home kit” for patients using over the counter HIV testing kits, “inpatient hospital” for patients tested during a hospital admission, “outside PCP” for patients tested by a non-Fenway primary care provider, and “walk-in clinic” for patients tested at a non-Fenway related testing service.

The primary reason for the HIV test was categorized into “exposure” for patients reporting an episode of unprotected sex, “random” for patients reporting an irregular testing history, “routine” for patients reporting a regularly scheduled testing regime, and “symptomatic” for patients reporting any symptoms, including that of an STI, opportunistic infection, or ARS.

Patients were considered “retained in care” if they were maintained in HIV primary care at Fenway Health with a routine follow up visit, including HIV surveillance labs noted between 11 and 13 months after the initial HIV visit. This was also the window for 1-year viral load data. As a definitive reason for loss to follow-up was not always documented, patients who died or transferred care were considered lost to follow-up and included as patients not retained in care.

Our primary outcomes were ARS and AIDS being diagnosed at the initial presentation, and virological suppression at 1 year. Patients with ARS were identified by the presence of detectable plasma HIV RNA without a positive ELISA and/or Western blot, or a physician diagnosis of ARS in the EMR.¹⁴ A physician diagnosis of ARS included patients diagnosed at outside institutions where laboratory data were unavailable for confirmation, but ARS was documented by a healthcare provider and referenced appropriate laboratory data. Patients diagnosed with AIDS were recognized by a CD4 T-lymphocyte count <200 cells/ μ L or CD4 T-lymphocyte percentage of total lymphocytes of <14 or documentation of an AIDS-defining condition as outlined by the CDC.¹⁴ Viral suppression at 1 year was defined as an HIV plasma viremia <75 copies/mL or physician documentation of an undetectable viral load in the EMR.

Statistical analysis

All analyses were performed using SPSS 19 (IBM Corporation, Armonk, NY), with statistical significance determined at the alpha 0.05 level.

Data on newly diagnosed HIV-infected patients were reported and stratified by level of engagement. Continuous variables were summarized using means, medians, and standard deviations, while categorical variables were summarized using proportions. T-tests/Wilcoxon rank sum tests and chi squared/Fisher Exact tests were utilized to examine associations between engaged patients and new patients.

Logistic regression procedures were used to determine factors independently associated with the primary outcomes. Linear regression procedures were used to compare trends in variables over the data collection period. Trends were also stratified by engagement. For all final fitted regression models, all variables with p values <0.10 on bivariate analyses were included.

Results*Characteristics of study population and engagement in care*

We identified 291 “engaged” and 463 “new” HIV-infected patients at Fenway Health who presented for an initial compre-

hensive care visit between January 2000 and December 2010 (Table 1). Engaged patients were more often white, privately insured, and employed full-time compared to new patients. In terms of HIV diagnostics, engaged patients were more often identified in symptomatic ARS or on routine screening by a Fenway Health provider, and at an older age, than new patients. Engaged patients

TABLE 1. BASELINE CHARACTERISTICS OF THE STUDY POPULATION STRATIFIED BY LEVEL OF ENGAGEMENT IN CARE

Variable	Level of engagement			p Value
	All patients (n = 754)	Engaged patients (n = 291)	“New” patients (n = 463)	
Race				
White	551 (73.1%)	237 (81.4%)	314 (72%)	0.004
Black	51 (6.8%)	22 (7.6%)	29 (6.7%)	0.638
Hispanic	97 (12.9%)	27 (9.3%)	70 (16.1%)	0.008
Asian	14 (1.9%)	2 (0.7%)	12 (2.8%)	0.055
Insurance				
Private	444 (58.9%)	208 (71.5%)	236 (54.1%)	<0.001
Medicaid/Medicare	165 (21.9%)	51 (17.5%)	114 (26.1%)	0.007
Free care	54 (7.2%)	8 (2.7%)	46 (10.6%)	<0.001
Mean age at diagnosis $\pm$ SD	36.2 $\pm$ 9.2	37.2 $\pm$ 9.1	35.6 $\pm$ 9.3	0.017
Partnered relationship	298 (39.5%)	117 (40.2%)	181 (41.5%)	0.758
Location of HIV test				
Testing service at Fenway	162 (21.5%)	68 (23.4%)	94 (21.6%)	0.566
Fenway provider	282 (37.4%)	159 (54.6%)	123 (28.2%)	<0.001
Home kit	12 (1.6%)	3 (1%)	9 (2.1%)	0.284
Inpatient hospital	57 (7.6%)	27 (9.3%)	30 (6.9%)	0.239
Outside PCP	77 (10.2%)	2 (0.7%)	75 (17.2%)	<0.001
Other walk-in clinic	107 (14.2%)	22 (7.6%)	85 (19.5%)	<0.001
MSM + IDU	31 (4.1%)	16 (5.5%)	15 (3.4%)	0.178
Reason for HIV test				
Exposure	65 (8.5%)	26 (8.9%)	39 (9%)	0.996
Random	251 (33.3%)	49 (16.8%)	202 (46.3%)	<0.001
Routine	125 (16.6%)	74 (25.4%)	51 (11.7%)	<0.001
Symptomatic	254 (33.7%)	129 (44.3%)	125 (28.7%)	<0.001
Mean days from told positive to initial HIV visit $\pm$ SD	39.8 $\pm$ 310.1	3.8 $\pm$ 11.1	64.1 $\pm$ 399.7	0.011
Mean initial viral load $\pm$ SD	92719 $\pm$ 138636	89566 $\pm$ 138284	94558 $\pm$ 139157	0.664
Median (excluding ARS)	29523	26235	31395	
Mean initial CD4 $\pm$ SD	443 $\pm$ 277	470 $\pm$ 295	427 $\pm$ 265	0.060
Median (excluding ARS)	425	453	417	
Presenting with ARS	93 (12.3%)	59 (20.3%)	34 (7.8%)	<0.001
Presenting with AIDS	140 (18.6%)	48 (16.5%)	92 (21.1%)	0.123
Known serodiscordance	101 (13.4%)	49 (16.8%)	52 (11.9%)	0.061
Substance use				
Crack/cocaine	108 (14.3%)	47 (16.2%)	61 (14%)	0.442
Methamphetamine	180 (23.9%)	95 (32.6%)	85 (19.5%)	<0.001
Ecstasy	86 (11.4%)	52 (17.9%)	34 (7.8%)	<0.001
GHB	63 (8.4%)	36 (12.4%)	27 (6.2%)	0.004
Ketamine	34 (4.5%)	21 (7.2%)	13 (3%)	0.008
Sexual behavior				
Unprotected oral sex	586 (77.7%)	254 (87.3%)	332 (76.2%)	<0.001
Unprotected insertive anal sex	546 (72.4%)	234 (80.4%)	312 (71.6%)	0.007
Unprotected receptive anal sex	534 (70.8%)	232 (79.7%)	302 (69.3%)	0.002
Unprotected group sex	57 (7.6%)	34 (11.7%)	23 (5.3%)	0.002
STIs at diagnosis				
Syphilis	121 (16%)	33 (11.3%)	88 (19%)	<0.001
HBV	53 (7%)	14 (4.8%)	39 (8.4%)	0.036
Gonorrhea	10 (1.3%)	0 (0%)	10 (2.2%)	0.007
Anogenital warts	22 (2.9%)	10 (3.4%)	12 (2.6%)	0.598
Chlamydia	21 (2.8%)	2 (0.7%)	19 (4.1%)	0.003
HSV	15 (1.9%)	7 (2.4%)	8 (1.7%)	0.596
HCV	10 (1.3%)	1 (0.3%)	9 (1.9%)	0.057
	9 (1.2%)	2 (0.7%)	7 (1.5%)	0.328

TABLE 2. CHARACTERISTICS OF THE STUDY POPULATION STRATIFIED BY LEVEL OF ENGAGEMENT IN CARE AT 1 YEAR

Variable	All patients	Level of engagement		p Value
		Engaged patients	"New" patients	
Retained in care at 1 year	595 (78.9%)	251 (86.3%)	344 (78.9%)	0.012
ART initiated within 1 year	338 (44.8%)	140 (50.9%)	198 (52%)	0.789
Mean viral load at 1 year $\pm$ SD	18256 $\pm$ 48786	22598 $\pm$ 56779	15103 $\pm$ 41933	0.065
median	177	304	160	
Mean CD4 at 1 year $\pm$ SD	507 $\pm$ 260	506 $\pm$ 222	508 $\pm$ 295	0.994
median	472	470	472	
Viral suppression if retained in care at 1 year	281/595 (47.2%)	115/251 (45.8%)	166/344 (48.3%)	0.695
Viral suppression if retained and initiated on ART at 1 year	281/325 (86.5%)	115/128 (89.9%)	166/197 (84.3%)	0.380
STIs within 1 year	146 (20.1%)	70 (24.1%)	76 (17.4%)	0.081
Syphilis	66 (9.1%)	32 (11%)	34 (7.8%)	0.141
HBV	3 (0.4%)	0 (0%)	3 (0.7%)	0.279
Gonorrhea	25 (3.4%)	14 (4.8%)	11 (2.5%)	0.097
Anogenital warts	15 (2.1%)	5 (1.7%)	10 (2.3%)	0.593
Chlamydia	19 (2.6%)	11 (3.8%)	8 (1.8%)	0.107
HSV	12 (1.7%)	4 (1.4%)	8 (1.8%)	0.771
HCV	4 (0.6%)	3 (1%)	1 (0.2%)	0.308

reported fewer days between initial diagnosis and linkage to care, more often disclosed unprotected sexual practices and substance use, and less often diagnosed with a concomitant STI at the initial HIV visit than new patients. Engaged patients were also more often retained in care at one year (Table 2).

In contrast, new patients were more often Hispanic, with regard to minority patients, and received free care compared to engaged patients (Table 1). In terms of HIV diagnostics, new patients were more often identified at a walk-in clinic or

by an outside primary care provider (PCP) on random screening at a younger age than engaged patients, and then referred to Fenway Health.

Acute retroviral syndrome

Ninety-three patients were diagnosed with acute retroviral syndrome (ARS) over the decade, representing 12.3% of new HIV diagnoses (Tables 1, 3, and 4). Over 63% of these

TABLE 3. BASELINE CHARACTERISTICS STRATIFIED BY PRIMARY OUTCOMES OF ACUTE RETROVIRAL SYNDROME (ARS), AIDS, AND VIRAL SUPPRESSION AT 1 YEAR

Variable	Outcomes		
	ARS n = 93 (12.3%)	AIDS n = 140 (18.6%)	VL suppression at 1 year, n = 281 (47.2%)
Level of engagement			
Engaged patients	59 (63.4%)	48 (34.3%)	115 (40.93%)
"New" patients	34 (36.6%)	92 (65.7%)	166 (59.1%)
Race			
White	78 (83.9%)	109 (77.9%)	226 (80.4%)
Black	3 (3.2%)	4 (2.86%)	10 (3.6%)
Hispanic	10 (10.8%)	21 (15%)	37 (13.2%)
Asian	0 (0%)	2 (1.4%)	3 (1.1%)
Insurance			
Private	69 (74.2%)	85 (60.7%)	178 (63.4%)
Medicaid/Medicare	13 (14%)	32 (22.9%)	64 (22.8%)
Free care	3 (3.2%)	10 (7.1%)	19 (6.8%)
Mean age at diagnosis $\pm$ SD	36.4 $\pm$ 7.9	39.4 $\pm$ 10.4	38 $\pm$ 9.4
Partnered relationship	41 (44.1%)	57 (40.7%)	125 (44.5%)
Location of HIV test			
Testing service at Fenway	4 (4.3%)	26 (18.6%)	60 (21.4%)
Fenway provider	66 (71%)	50 (35.7%)	112 (39.9%)
Home kit	0 (0%)	2 (1.4%)	3 (1.1%)
Inpatient hospital	16 (17.2%)	23 (16.4%)	28 (10%)
Outside PCP	4 (4.3%)	20 (14.3%)	34 (12.1%)
Other walk-in clinic	3 (3.2%)	15 (10.7%)	36 (12.8%)

TABLE 4. CHARACTERISTICS STRATIFIED BY PRIMARY OUTCOMES OF ACUTE RETROVIRAL SYNDROME (ARS), AIDS, AND VIRAL SUPPRESSION AT 1 YEAR

Variable	Outcomes		
	ARS	AIDS	VL suppression at 1 year
Retained in care at 1 year	81 (87.1%)	128 (91.4%)	281 (100%)
ART initiated within 1 year	58 (62.4%)	129 (92.1%)	279 (99.3%)
CD4 at 1 year $\pm$ SD	567 $\pm$ 230	314 $\pm$ 155	480 $\pm$ 245
median	527	291	430
VL at 1 year $\pm$ SD	19161 $\pm$ 50946	2807 $\pm$ 13202	75 $\pm$ 0
median	75	75	75
Viral suppression if retained in care at 1 year	43/81 (53.1%)	114/128 (89.1%)	281/281 (100%)
Viral suppression if retained and initiated on ART at 1 year	43/50 (86%)	114/120 (95%)	279/279 (100%)
STIs within 1 year	20 (21.5%)	24 (17.1%)	61 (21.7%)
Syphilis	11 (11.8%)	11 (7.8%)	26 (9.3%)
Gonorrhea	3 (3.2%)	4 (2.9%)	12 (4.3%)
Anogenital warts	1 (1.1%)	5 (3.6%)	8 (2.9%)
Chlamydia	3 (3.2%)	2 (1.4%)	6 (2.1%)
HSV	1 (1.1%)	2 (1.4%)	5 (1.8%)
HCV	1 (1.1%)	0 (0%)	3 (1.1%)

TABLE 5. BIVARIATE AND MULTIVARIABLE ANALYSIS FOR PRIMARY OUTCOME OF ARS AT INITIAL HIV VISIT

Variable	Outcome: ARS	
	Bivariate (95% CI)	Multivariable (95% CI)
Level of engagement		
“New” patients	Reference	
Engaged patients	3.007 (1.914–4.725)	1.383 (0.784–2.439)
Race		
White	Reference	
Black	0.379 (0.115–1.246)	
Hispanic	0.697 (0.347–1.397)	
Insurance		
Private	Reference	
Medicaid/Medicare	0.479 (0.259–0.886)	0.573 (0.270–1.216)
Free care	0.329 (0.1–1.082)	0.475 (0.113–2.001)
Mean age at diagnosis	1.003 (0.98–1.026)	
Partnered relationship	1.157 (0.746–1.794)	
Location of HIV test		
Fenway provider	Reference	
All other locations	0.211 (0.131–0.341)	0.364 (0.206–0.642)
MSM + IDU	0.459 (0.108–1.954)	
Reason for HIV test		
Random	Reference	
Exposure	18.492 (2.031–168.4)	17.319 (1.811–165.665)
Routine		
Symptomatic	149.49 (20.63–1083)	191.805 (26.16–1406)
Known serodiscordance	1.782 (0.992–3.010)	2.131 (0.997–4.552)
Substance use		
Crack/cocaine	1.018 (0.554–1.872)	
Methamphetamine	1.628 (1.019–2.6)	1.319 (0.581–2.998)
Ecstasy	2.173 (1.236–3.820)	2.164 (0.755–6.206)
GHB	2.348 (1.255–4.391)	1.015 (0.324–3.184)
Ketamine	2.61 (1.178–5.782)	0.767 (0.210–2.803)
Sexual behavior		
Unprotected oral sex	1.923 (0.996–3.714)	1.392 (0.646–3.011)
Unprotected insertive anal sex	1.242 (0.734–2.102)	
Unprotected receptive anal sex	1.37 (0.811–2.315)	
Unprotected group sex	2.179 (1.125–4.221)	1.753 (0.658–4.667)
STIs at diagnosis	0.499 (0.244–1.023)	

diagnoses were in engaged patients with 17% presenting with a concomitant STI, most frequently syphilis (10.8%).

The correlates of presenting with ARS are analyzed in Table 5. In the multivariable model, HIV testing at any location other than Fenway Health was associated with a decreased odds of being diagnosed with ARS (AOR=0.36; 95% CI: 0.21–0.64). In addition, individuals diagnosed with ARS were more likely to have been tested after a high-risk exposure (AOR=17.32; 95% CI: 1.81–165.67) or to present with symptoms (AOR=191.81; 95% CI: 26.16–1406.4) compared to patients who underwent routine testing.

AIDS

Nearly 19% of all patients had CD4 counts below 200 or an opportunistic infection at the time of their initial HIV diagnosis, accounting for 16.5% of engaged patients and 21.1% of new patients (Table 1). The prevalence of AIDS in newly diagnosed patients remained unchanged over time. Almost 66% of patients diagnosed with AIDS at their first HIV-related visit were new patients, and nearly half presented with a symptomatic opportunistic infection (Tables 3 and 4).

Table 6 shows the correlates of initially presenting with an AIDS diagnosis. In the multivariable analysis, older patients at

the time of their HIV diagnosis (AOR=1.04 95% CI: 1.01–1.06) and those who were symptomatic when they tested (AOR=2.22, 95% CI: 1.42–3.46) were more likely to present with AIDS. Patients who were diagnosed by routine HIV testing (AOR=0.20, 95% CI: 0.08–0.53) and those in a primary serodiscordant relationship (AOR=0.47, 95% CI 0.23–0.98) were less likely to present with AIDS when they were diagnosed with HIV.

Viral suppression at 1 year

Of 595 newly diagnosed HIV-infected patients who were retained in care after 1 year, 47.2% achieved an undetectable viral load, and of patients initiated on ART, 99.3% achieved an undetectable viral load (Tables 2–4).

On multivariable analysis, identifying as Black (AOR=0.37, 95% CI: 0.15–0.91) and having an increased CD4 count on initial HIV labs (AOR=0.99, 95% CI: 0.99–0.99) were associated with a decreased odds of viral suppression at 1 year (Table 7). Having a concomitant STI at the time of HIV diagnosis was associated with an increased odds of viral suppression at one year (AOR=2.81, 95% CI: 1.62–4.86). No patient in ARS was offered immediate ART and those presenting in ARS did not have an increased odds of virological suppression at 1 year.

TABLE 6. BIVARIATE AND MULTIVARIABLE ANALYSIS FOR PRIMARY OUTCOME OF AIDS AT INITIAL HIV VISIT

Variable	Outcome: AIDS	
	Bivariate (95% CI)	Multivariable (95% CI)
Level of engagement		
“New” patients	Reference	
Engaged patients	0.739 (0.502–1.086)	
Race		
White	Reference	
Black	0.34 (0.12–0.965)	0.391 (0.133–1.153)
Hispanic	1.105 (0.654–1.869)	
Insurance		
Private	Reference	
Medicaid/Medicare	1.007 (0.645–1.57)	
Free care	0.952 (0.462–1.956)	
Mean age at diagnosis	1.046 (1.025–1.067)	1.035 (1.013–1.059)
Partnered relationship	0.986 (0.678–1.435)	
Location of HIV test		
Fenway provider	Reference	
All other locations	0.913 (0.547–1.524)	
MSM + IDU	0.279 (0.66–1.183)	0.488 (0.106–2.241)
Reason for HIV test		
Random	Reference	
Exposure	0.329 (0.114–0.949)	0.445 (0.73–2.691)
Routine	0.209 (0.081–0.540)	0.200 (0.076–0.527)
Symptomatic	2.381 (1.65–3.731)	2.217 (1.419–3.464)
Days from told positive to initial HIV visit	1 (1–1.001)	
Known serodiscordance	0.419 (0.212–0.828)	0.472 (0.228–0.976)
Substance use		
Crack/cocaine	1.014 (0.605–1.7)	
Methamphetamine	0.415 (0.248–0.696)	0.601 (0.307–1.174)
Ecstasy	0.582 (0.3–1.128)	
GHB	0.416 (0.176–0.986)	0.773 (0.246–2.433)
Ketamine	0.713 (0.271–1.875)	
STIs at diagnosis	0.981 (0.597–1.612)	

TABLE 7. BIVARIATE AND MULTIVARIABLE ANALYSIS FOR PRIMARY OUTCOME OF VIRAL SUPPRESSION AT 1 YEAR

Variable	Outcome: Viral suppression at 1 year	
	Bivariate (95% CI)	Multivariable (95% CI)
Level of engagement		
“New” patients	Reference	
Engaged patients	1.063 (0.784–1.441)	
Race		
White	Reference	
Black	0.353 (0.173–0.718)	0.367 (0.148–0.910)
Hispanic	0.394 (0.573–1.388)	
Insurance		
Private	Reference	
Medicaid/Medicare	0.992 (0.692–1.442)	
Free care	0.850 (0.473–1.528)	
Mean age at diagnosis	1.034 (1.017–1.052)	1.018 (0.994–1.042)
Partnered relationship	1.264 (0.934–1.711)	
Location of HIV test		
Fenway provider	Reference	
All other locations	0.929 (0.685–1.262)	
MSM + IDU	0.747 (0.346–1.610)	
Reason for HIV test		
Random	Reference	
Exposure	0.957 (0.545–1.681)	
Routine	0.552 (0.343–0.889)	0.775 (0.45–1.337)
Symptomatic	1.693 (1.199–2.391)	0.664 (0.376–1.171)
Presenting with ARS	1.431 (0.923–2.218)	
Presenting with AIDS	11.027 (6.946–17.51)	1.878 (0.908–3.884)
Days from told positive to initial HIV visit	0.999 (0.998–1.001)	
CD4 at 1 st HIV visit (excluding ARS)	0.994 (0.993–0.995)	0.995 (0.993–0.996)
Known serodiscordance	0.740 (0.474–1.155)	
Substance use		
Crack/cocaine	0.923 (0.605–1.408)	
Methamphetamine	0.762 (0.535–1.084)	
Ecstasy	0.740 (0.459–1.194)	
GHB	0.975 (0.573–1.659)	
Ketamine	0.982 (0.483–1.994)	
Sexual behavior		
Unprotected oral sex	1.019 (0.698–1.487)	
Unprotected insertive anal sex	0.831 (0.590–1.170)	
Unprotected receptive anal sex	0.853 (0.609–1.193)	
Unprotected group sex	1.080 (0.622–1.875)	
STIs at diagnosis	1.581 (1.067–2.342)	2.808 (1.623–4.858)
STIs within 1 year	1.119 (0.824–1.52)	

Clinical and demographic trends in study population in 2000–2010

Over the data collection period from 2000 to 2010, there were no significant trends in patient demographics, engagement, plasma HIV RNA and CD4 count at time of presentation, CD4 count at 1 year, the prevalence of ARS or AIDS at time of HIV diagnosis, or rates of retention in care, substance use, sexual behaviors, or STIs.

However, there was a significant increased trend in the percent of retained patients achieving viral suppression at 1 year (1.12, 95% CI: 1.06–1.17), such that by 2010, nearly 65% of retained patients demonstrated an undetectable viral load after 1 year of engagement. Over the decade there was a trend of decreased clinic

viral load at 1 year (0.09, 95% CI: 0.09–0.09) in conjunction with increased ART initiation (1.08, 95% CI: 1.03–1.14). Figure 1 shows mean and median initial viral load and CD4 count (A) compared with percent of retained patients who were virologically suppressed at 1 year (B) during the data collection time period.

Discussion

Despite the advent of safe and effective therapy over the past 16 years, incomplete engagement in HIV care is common. Of the 1.1 million individuals living with HIV in the United States, an estimated 21% of are unaware of their infection, with knowledge rates being as low as 44% in some subpopulations (e.g., Black MSM).^{15,16} About 50% of known HIV-infected individuals are

FIG. 1. Mean and median initial viral load and CD4 count at the initial visit compared with percent in viral suppression after 1 year of HIV care from 2000–2010.

not engaged or retained in regular HIV care.⁹ Poorly engaged, retained, or undiagnosed HIV-infected individuals do not have regular access to the benefits of ART, screening, and prophylaxis for opportunistic infections and STIs, and other medical services. Those unaware of their HIV infection have a significantly higher risk of transmitting HIV, while HIV-infected patients who are virologically suppressed are less likely to transmit the virus to their partners.^{17,18} Incompletely engaged and undiagnosed individuals account for the largest proportion of HIV-infected persons with detectable viremia and significantly contribute to ongoing transmission to uninfected partners.⁹

The current study reviewed trends in HIV diagnosis and engagement in care among newly diagnosed HIV-infected MSM at the largest ambulatory care center for MSM in New England. We found that MSM already engaged in primary care at Fenway Health at the time of their HIV diagnosis were more often identified with symptomatic ARS or by routine screening than those referred from other providers. Patients who had a preexisting relationship with Fenway Health were more rapidly linked to HIV primary care, retained in care at 1 year, and were less often diagnosed with a concomitant STI at the initial HIV visit than new patients.

From a public health perspective, the risk of infection from patients with acute HIV appears to be 10–20 times higher than that from patients with chronic infection.^{19,20} Up to 50% of new infections among MSM in high-income nations may be attributable to acute HIV infection.²⁰ In the face of an intractable rate of new infections among MSM, identifying acutely infected patients with high levels of viremia has considerable benefits at the individual and community level, and under-

scores the importance of educating primary care providers in the recognition of ARS. The provision of comprehensive care for MSM may be an important means to prevent and detect more acute infections, as we found that MSM who presented for more physical exams and medical sick visits within the 24 months prior to HIV diagnosis were more likely to have their HIV infection detected prior to seroconversion.

Fenway Health's comprehensive EMR is a major strength of the present study since it included all patient demographic data, physician, nursing, and mental health notes, notes from tertiary referral hospital, labs, medications, and other relevant information. However, substance use and sexual behavior were not systematically collected, and the high prevalence of methamphetamine and club drug use among many Boston area MSM is probably underestimated among the participants in this study.^{21,22} The seemingly greater prevalence of substance use and unprotected sexual behaviors in engaged patients may be an issue of disclosure, as existing patients under the care of culturally sensitive providers may be more likely to disclose HIV risk behaviors, and have more visits in which to do so, and thus be screened for HIV and other STIs more frequently.

Despite engagement in care prior to diagnosis, a concerning 19% of existing and new patients were identified with AIDS at the time their HIV was diagnosed, and this disturbing figure remained unchanged over time. Moreover, half of the engaged patients diagnosed with AIDS presented with a symptomatic opportunistic infection. This result is surprising, as an existing relationship with a provider was not protective against AIDS, and there was no association with type and number of visits within the 24 months prior to diagnosis.

These findings underscore the importance of ongoing HIV testing in primary care settings and suggest that even in specialized care settings, more frequent routine testing is needed, without waiting for the onset of symptoms.^{23–25} However, patients who disclosed a primary serodiscordant relationship demonstrated a decreased likelihood to be diagnosed with AIDS at HIV diagnosis, likely reflecting more frequent monitoring by their provider.

We also found that older patients were more likely to present with AIDS at their HIV diagnosis. Other studies have shown older populations to be at a greater risk of late presentation or advanced HIV disease at diagnosis.^{23,26–29} The reason for this finding is likely multi-factorial, including cultural factors, patient lack of appreciation for HIV risk, and provider bias in screening older populations for risk behaviors and offering HIV and STI testing. Future studies and public health interventions should address risk perceptions in patients and providers regarding older populations.

Additionally, partnered relationships were not protective of ARS or AIDS. Most patient notes did not specify whether these relationships were monogamous, but the high prevalence of partnered patients with newly diagnosed HIV suggests that all sexually active MSM should be regularly screened for HIV and other STIs regardless of reported relationship status. The high incidence of concomitant STIs at the initial visit and within 1 year further supports this recommendation. Patients diagnosed with concomitant STIs at the time of their HIV diagnosis were more likely to be virologically suppressed after 1 year, which may reflect the provider's preference to initiate ART in the presence of perceived increased risky sexual behaviors as a secondary benefit to the community. Future studies should explore this relationship further in a longitudinal design.

We also found that Black MSM were less likely to be virologically suppressed after 1 year, corroborating other concerning observations of the continued prevalence of racial disparities with regard to HIV prevalence, diagnostic timing, and engagement in care.^{10,30–32} Although there were few Black patients in the present study, these results highlight the role of healthcare disparities in HIV outcomes. The findings confirm the need for further research in this area and culturally-tailored programs to engage Black MSM in their care environments, as is a central point of the National HIV/AIDS Strategy.

In comparison to national data, all patients at Fenway Health significantly benefitted from higher levels of retention in care, ART initiation, and viral suppression.^{9,15–17} However, between 2000 and 2010, there were no appreciable trends in presenting levels of plasma viremia and CD4 count, suggesting the need for new programs to facilitate earlier and more frequent screening of at risk MSM. More encouraging was the finding that between 2000 and 2010, with increasing evidence for early initiation of ART and guideline changes, there was a trend of a greater percentage of retained patients to initiate HAART and to be virally suppressed within 1 year.³³ Of patients retained in care and initiated on ART, over 86% achieved viral suppression throughout the entire data collection period, and by 2010, nearly 99% achieved viral suppression. These impressive findings may have direct implications for public health programs to reduce community viral load such as test-and-treat, where the full engagement of HIV-infected individuals in care will be required for HIV prevention.

However, our broad definition for engagement in care may not accurately reflect true engagement, as two patients satisfying the definition for engagement were diagnosed by an outside PCP. Moreover, sensitivity analysis of patients diagnosed by an outside PCP did not reveal an increased odds of ARS or AIDS. This finding may support the development of an acute HIV screening protocol in addition to opt-out HIV antibody testing. This protocol may capture all patients with any risk factor for HIV acquisition in the setting of symptoms suggestive of viral infection. However, as a convenience sample, these results may not be applicable to patients engaged in primary care prior to diagnosis at centers without comprehensive care for MSM or HIV. Despite this limitation, patients receiving care at a comprehensive care site for MSM resulted in a higher proportion of ARS diagnoses compared to non-Fenway related diagnoses. This benefit cannot be highlighted in isolation as the proportion of AIDS diagnoses at Fenway did not change throughout the data collection period and was not different than patient diagnosed at non-Fenway related location. This represents an area for tremendous improvement.

The present study confirms the positive influence of engagement in primary care prior to seroconversion on important HIV outcomes at diagnosis and within 1 year. Fenway Health is an integrated community-based medical facility with a focus on culturally sensitive, high quality healthcare for sexual and gender minorities, as well as HIV medicine, and may explain why outcomes in Fenway Health patients measured as retention in care and viral suppression are considerably better than national statistics.^{8–10} Fenway Health may also represent an ideal healthcare delivery model for HIV primary care and the successful implementation of widespread opt-out HIV testing and test-and-treat programs for HIV care and prevention. Future studies and public health efforts should focus on more accurately defining engagement and retention, especially as it pertains to healthcare provisions for MSM, and on the development of HIV prevention methods specific to MSM to reduce the high incidence of AIDS when first diagnosed with HIV.

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References

1. Joint United Nations Programme on HIV/AIDS; World Health Organization. AIDS Epidemic Update 2009. Geneva: Joint United Nations Programme.
2. CDC. Twenty-five years of HIV/AIDS—United States, 1981–2006. *MMWR* 2006;55:585–589.
3. CDC. Epidemiology of HIV/AIDS—United States, 1981–2005. *MMWR* 2006;55:589–592.

4. Campsmith ML, Rhodes PH, Hall HI, et al. Undiagnosed HIV prevalence among adults and adolescents in the United States at the end of 2006. *J Acquir Immune Defic Syndr* 2010;53:619–624.
5. CDC. Trends in HIV/AIDS diagnoses among men who have sex with men—33 states, 2001–2006. *MMWR* 2008;57:681–686.
6. CDC. HIV Surveillance Report, 2010; 22.
7. Cheever LW. Engaging HIV-infected patients in care: Their lives depend on it. *Clin Infect Dis* 2007;44:1500–1502.
8. Eldred L, Malitz F. Introduction to the supplemental issue on the HRSA SPNS Outreach Initiative. *AIDS Patient Care STDS* 2007;21:S1–S2.
9. Gardner EM, McLees MP, Steiner JF, Del Rio C, Burman WJ. The spectrum of engagement in HIV care and its relevance to test-and-treat strategies for prevention of HIV infection. *Clin Infect Dis* 2011;52:793–800.
10. CDC. Vital Signs: HIV Prevention Through Care and Treatment—United States. *MMWR* 2011;60.
11. Dieffenbach CW, Fauci AS. Universal voluntary testing and treatment for prevention of HIV transmission. *JAMA* 2009;301:2380–2382.
12. Granich RM, Gilks CF, Dye C, De Cock KM, Williams BG. Universal voluntary HIV testing with immediate antiretroviral therapy as a strategy for elimination of HIV transmission: A mathematical model. *Lancet* 2009;373:48–57.
13. Montaner JS, Hogg R, Wood E, et al. The case for expanding access to highly active antiretroviral therapy to curb the growth of the HIV epidemic. *Lancet* 2006;368:531–536.
14. CDC. Revised Surveillance Case Definitions for HIV Infection Among Adults, Adolescents, and Children Aged <18 Months and for HIV Infection and AIDS Among Children Aged 18 Months to <13 Years—United States, 2008. *MMWR* 2008;57.
15. Campsmith ML, Rhodes PH, Hall HI, Green TA. Undiagnosed HIV prevalence among adults and adolescents in the United States at the end of 2006. *J Acquir Immune Defic Syndr* 2010;53:619–624.
16. CDC. Prevalence and Awareness of HIV Infection Among Men Who Have Sex With Men—21 Cities, United States, 2008. *MMWR* 2010;59:1201–1207.
17. Marks G, Crepaz N, Senterfitt JW, Janssen RS. Meta-analysis of high risk sexual behavior in persons aware and unaware they are infected with HIV in the United States: Implications for HIV prevention programs. *J Acquir Immune Defic Syndr* 2005; 39:446–53.
18. Cohen MS, Chen YQ, McCauley M, et al. Prevention of HIV-1 infection with early antiretroviral therapy. *N Engl J Med* 2011;365:493–505.
19. Cohen MS, Shaw GM, McMichael AJ, Haynes BF. Acute HIV infection. *N Engl J Med* 2011;364:1943–1954.
20. Christopoulos KA, Das M, Colfax GN. Linkage and retention in HIV care among men who have sex with men in the United States. *Clin Infect Dis* 2011;52:S214–S222.
21. Skeer MR, Mimiaga MJ, Mayer KH, et al. Patterns of substance abuse among a large urban cohort of HIV-infected men who have sex with men in primary care. *AIDS Behavior* 2012;16:676–689.
22. Rajasingham R, Mimiaga MJ, White JM, et al. A systematic review of behavioral and treatment outcomes among HIV-infected men who have sex with men who abuse crystal methamphetamine. *AIDS Patient Care STDS* 2012;26:36–52.
23. CDC. Missed opportunities for earlier diagnosis of HIV infection—South Carolina, 1997–2005. *MMWR* 2006;55:1269–1272.
24. Mugavero, MJ. Improving engagement in HIV care: What can we do? *Top HIV Med* 2008;16:156–161.
25. CDC. Revised Recommendations for HIV Testing of Adults, Adolescents, and Pregnant Women in Health-Care Settings—United States. *MMWR* 2006;55:1–17.
26. Dybul M, Bolan R, Condoluci D, et al. Evaluation of initial CD4 T cell counts in individuals with newly diagnosed human immunodeficiency virus infection, by sex and race, in urban settings. *J Infect Dis* 2002;185:1818–1821.
27. Krawczyk CS, Funkhouser E, Kilby JM, Kaslow RA, Bey AK, Vermund SH. Factors associated with delayed initiation of HIV medical care among infected persons attending a southern HIV/AIDS clinic. *South Med J* 2006;99:472–481.
28. Jenkins TC, Gardner EM, Thrun MW, Cohn DL, Burman WJ. Risk-based human immunodeficiency virus (HIV) testing fails to detect the majority of HIV-infected persons in medical care settings. *Sex Transm Dis* 2006;33:329–333.
29. Sabin CA, Schwenk A, Johnson MA, et al. Late diagnosis in the HAART era: Proposed common definitions and associations with mortality. *AIDS* 2010;24:723–727.
30. Ayala G, Bingham T, Kim J, Wheeler DP, Millett GA. Modeling the impact of social discrimination and financial hardship on the sexual risk of HIV among Latino and Black men who have sex with men. *Am J Public Health* 2012; 102:242–249.
31. Mimiaga MJ, Reisner SL, Bland S, et al. Health system and personal barriers resulting in decreased utilization of HIV and STD testing services among at-risk black men who have sex with men in Massachusetts. *AIDS Patient Care STDS* 2009;23:825–835.
32. Hu Yw, Kinsler JJ, Sheng Z, et al. Using laboratory surveillance data to estimate engagement in care among persons living with HIV in Los Angeles County, 2009. *AIDS Patient Care STDS* 2012;26:471–478.
33. Hammer SM, Eron JJ, Reiss P, et al. Antiretroviral treatment of adult HIV infection: 2008 recommendations of the International AIDS Society—USA Panel. *JAMA* 2008;300:557–570.

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