HIV/AIDS Clinical Care Quality Assurance Project

Updated Assessment Of Potential Disparities In HIV Quality Of Care And Outcomes In Ryan White Part A- Funded Sites

2003-2006

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I. EXECUTIVE SUMMARY

This report assesses potential disparities in HIV care based on data from 2003-2006 from HIV care clinics supported by Boston's Ryan White Part A funding. A previous report examined disparities in clinical data through 2002 and the encouraging results identified no healthcare process or outcome disparities for racial/ethnic minority patients, patients with episodes of incarceration, or patients born outside the United States. In fact, non-U.S. born patients were more likely to receive recommended medications than their U.S. born counterparts. The only gender-based difference was that women had an increased risk of hospitalization, a finding supported by medical literature that may represent biologic differences rather than differences in healthcare access or quality.

This report presents an updated analysis, using the same approach (the Andersen-Newman Behavioral model of healthcare utilization and multi-level logistic regression) with data from 2003 through 2006 on 660 patients seen at the 9 of the original 10 clinical sites (those with continued Part A funding). Like the first analysis, disparities in healthcare process (consistent medical visits and laboratory monitoring, and receipt of recommended medications) and disease outcome (medical hospitalizations and CD4 count response to treatment) were identified. In addition, a third clinical outcome was assessed for patients on antiretroviral therapy --- achieving viral suppression as defined by a viral load of below 400 copies/ml on the last test in the time period.

Results show that 19% of patients experienced prolonged gaps (greater than 8 months) between medical care visits at the sites, and the likelihood of gaps in visits was higher for younger patients (less than age 40) and U.S.-born patients. Gaps in laboratory monitoring occurred in 23% of patients, and were more common in patients less than age 40. The third process measure, failure to receive recommended medications for HIV infection or OI prophylaxis, was observed in 18% of patients, associated only with having less time in care.

Twenty percent of patients experienced a medical hospitalization after the first year in care. However, after controlling for time in care, risk was significantly higher for women,

older patients (age 40 and over), U.S.-born patients and Hispanic patients. Lower rates of hospitalizations for patients treated at community health centers may reflect less direct access for chart reviewers to information about admissions than for hospital-based clinics, rather than a true difference. Low CD4 counts (less than 200/mm3) on the final test during the period occurred in 13% of patients, but no predisposing or enabling factors were significant after controlling for initial CD4 count. Finally, the positive outcome of viral suppression (viral load below 400 copies/ml on last test) was identified in 63% of patients on antiretroviral therapy (ART), with significantly lower likelihood for patients with active substance abuse, after controlling for time in care and initial CD4 count.

These encouraging results demonstrate improvements in overall rates for 2 of the 3 process measures (medications and lab monitoring) and both of the outcomes studied previously (CD4 count and hospitalization). Significant predisposing factors for inconsistent medical visits (age less than 40 and being U.S. born) were seen for the first time during this period. Active substance abuse and birthplace are no longer significant predictors of the lab monitoring or medication measures. Laboratory outcome measures assessed (viral load and CD4 levels) demonstrated no patient-level predisposing factors to be significant other than active substance abuse. The first difference related to ethnicity was identified, with Hispanics being 3 times more likely to be hospitalized.

Considering this is a population identified *because of their connection to healthcare*, no global conclusions can be made about general access and quality of care for the general HIV/AIDS population. Nonetheless, it appears that individuals engaged in treatment at the Part A-funded clinics are generally not subject to disparities related to race/ethnicity, gender or other potential sociodemographic disadvantages. Age and country of birth do play a role in both process and outcome indicators, with younger patients (defined as less than 40 years old) and those born in the US or territories having less positive experiences.

II. BACKGROUND

Disparities in treatment and outcomes according to gender, race/ethnicity, or socioeconomic status are of particular concern for providers and policy makers. HIV/AIDS is one of the conditions for which there is alarm about such disparities, given the serious potential for negative impact since mortality in HIV is substantial if infected persons do not receive highly active antiretroviral therapy (ART). There is also a concern that certain disadvantaged subgroups of persons living with HIV (e.g., immigrants, substance abusers, prisoners) might be receiving suboptimal treatment or not benefiting equally from medical care with respect to disease stabilization.

The term "health disparity" has been used broadly and somewhat inconsistently. For example, the Health Resources and Services Administration (HRSA) considers disparities "population-specific differences in the presence of disease, health outcomes or access to care"[1]. The Department of Health and Human Services is more expansive in defining the term as "differences that occur by gender, race or ethnicity, education or income, disability, living in rural localities, or sexual orientation"[2]. Others propose viewing disparities as a "chain of events signified by differences in environment, access/quality/utilization of care, health status, or a particular health outcome"[3].

Some differences are expected and unavoidable, such as the incidence of HIV infection by age, but others are potentially remediable, such as access differentials by gender or race. Women and minorities have been identified as underserved populations at risk for increased morbidity and mortality from HIV/AIDS, but many studies have difficulty adjusting for insurance status in assessing disparities, which is a likely co-factor.

In this analysis, the focus is on an open system of publicly-funded HIV care sites supported by the Ryan White Program Part A in the Boston EMA. Funds from this program provide safety-net services to uninsured patients, eliminating any financial access barriers. However, disparities can result from underuse or substandard care caused by stigma, language barriers, provider biases, low education levels and lack of

[1] HRSA Workgroup for the Elimination of Health Disparities. Rockville MD, November 2000.
[2] US DHHS Healthy People 2010: Understanding and Improving Health 2nd Ed., November 2000.
[3] Carter-Pokras O, Baquet C. What is a "health disparity"? Public Health Rep 2002;117:426-434.

awareness. The cohort of patients followed for clinical quality performance improvement is an ideal group within which to explore the potential for health disparities. The results of this analysis, with comparison to earlier findings from a similar report, are discussed in the following sections.

III. METHODS

3.1 CLINICAL QUALITY MANAGEMENT PROTOCOL

As part of a collaborative project with the Massachusetts Department of Public Health and the Boston Public Health Commission, JSI developed a comprehensive approach to abstract patient-level data across the network of publicly-funded HIV/AIDS clinics in 2000. Chart abstraction has been conducted by research nurses and clinical research assistants from JSI who have had detailed training and are familiar with standards and processes of HIV outpatient care. The JSI staff sign confidentiality agreements assuring their adherence to complete patient privacy protection. Nurses use clinic records including progress notes, flow sheets, laboratory reports and other documentation contained within the record to complete the data collection instrument. Feedback on care performance and missing interventions is given at the time of the site visit and through site- and system-level analyses and reports.

3.2 PARTICIPATING SITES

This analysis includes the results of chart reviews conducted in nine clinical care settings across the Greater Boston area that received Part A funding:

- Boston Medical Center
- Fenway Community Health Center
- Great Brook Valley Health Center
- Greater Lawrence Health Center
- Lowell Community Health Center
- Lynn Community Health Center
- Martha Eliot Health Center
- Whittier Street Health Center
- Zinberg Clinic (Cambridge Health Alliance)

The initial disparities analysis had also included East Boston Neighborhood Health Center, but this site chose not to participate in clinical chart reviews further due to consistently positive feedback. Therefore, East Boston was excluded for the 2003-2006 time period.

Patients were included in the full clinical chart review if they had at least two medical visits with an HIV primary care provider during the review year. An HIV medical visit is defined as being seen by a physician, physician's assistant, or nurse practitioner. The periods of study were defined by calendar year cycles, beginning in 1999 and continuing through 2006. Clinical sites produced a systematic random sample of 70-80 adult patients from their active list of HIV/AIDS participants during their first year of chart audit; over-sampling of women (addition of 10 per site if available) provided adequate numbers to assess gender-specific care indicators. Exceptions to the overall sampling rule were: 1) four pilot sites in which larger samples were derived (approximately 100 patients from each), and 2) sites with fewer than 70 active patients, where the total population was studied.

Four rounds of chart reviews have been conducted, with each cycle capturing two years of retrospective data. Variables of interest included demographics (race/ethnicity, gender, age, country of birth), HIV risk behavior, date of care engagement at the site, baseline clinical status (CD4 and viral load), stage of illness, mental health and substance abuse problems, incarceration episodes, preventive care delivered (recommended counseling, screenings, immunizations, medications), HIV visits, treatment and laboratory monitoring, comprehensive CD4 and viral load results, testing for viral resistance, adherence problems and support provided, side effects and treatment interruptions, hospitalizations (both medical and psychiatric/substance abuse), and vital status.

3.3 DEPENDENT VARIABLES

In this analysis, potential disparities in quality of care were assessed for several process and outcome indicators. These measures were selected because they represent the essential and most standard aspects of treatment and most meaningful outcomes in HIV primary medical care. Table 1 lists and defines the dependent variables used:

Table 1. Dependent Variables – Quality of Care Measures & Definitions

Quality of Care Measures	Definitions
Lapse of 8 months or more in outpatient clinical visits for HIV care	Two consecutive 4-month periods during the study period without documentation of an HIV clinical visit with an MD, NP, or PA at the site.
Lapse of 8 months or more in laboratory monitoring of HIV	Two consecutive 4-month periods during the study period without documentation of a CD4 count or viral load test.
Not on recommended medication: antiretroviral therapy (ART), pneumocystis prophylaxis (PCP), mycobacterium prophylaxis (MAI)	Any year during study period where patient did not receive or take recommended medications (ART/PCP/MAI among eligible patients based on clinical criteria in that year).
HIV suppression based on viral load (≤ 400 copies/ml)	Last viral load measured during the study period is undetectable ≤ 400 copies/ml (if on ART).
Impaired immune status based on CD4 count (≤ 200 cells/mm3)	Last CD4 count measured during the study period is ≤ 200 cells/mm3.
Medical hospitalization potentially HIV-related after the first year in care	Ever hospitalized during the study period (after the 1st year), excluding hospitalizations related to Obstetrics, psychiatry, substance use, and trauma.

3.4 INDEPENDENT VARIABLES

The Andersen-Newman Behavioral Model of healthcare utilization served as the framework for this analysis[4,5]. Originally designed to explain the use of formal personal health services, this model has been used over the years to study the determinants of acute and long term care and frequently used to assess racial differences in care[6].

The core concepts of the model are that healthcare utilization is a function of a predisposition by people to use services, factors that enable or impede such use (including person and system-level characteristics), and individual levels of need for care. The three categories of identified factors are Predisposing, Enabling, and Need Factors.

Under the domain of Predisposing Factors (PF's), the traditional model captures the demographic characteristics (e.g., age, gender, and marital status), health beliefs and social structure (e.g., ethnicity, education, employment, and family size); the PF's are generally considered immutable conditions and not subject to policy forces. The revision for vulnerable populations adds acculturation, immigration status, literacy, criminal behavior, prison history, mental illness, and substance abuse[7]. Included as Enabling Factors for the traditional model are personal and family resources (e.g., regular source of care, insurance and income), community resources related to residence and region, and health services resources (e.g., capacity, price, distribution, structure and process of care). Aday and colleagues further adapted the model by breaking down relevant aspects of the healthcare system to include environmental and provider-related elements[8]. Under the adapted version for vulnerable groups, additional personal and contextual factors might include public assistance/benefits, competing needs, availability and use of information resources, community crime rates and social service

[4] Andersen, R., Revisiting the Behavioral Model and Access to Medical Care: Does it Matter? Journal of Health and Social Behavior, 1995. **36**: p. 1-10.
[5] Andersen, R. and J. Newman, *Societal and individual determinants of medical care utilization in the United States.* Milbank Memorial Fund Quarterly Journal, 1973. **51**: p. 95-124.
[6] Bradley, E.H., et al., *Expanding the Andersen model: the role of psychosocial factors in long-term care use.* Health Serv Res, 2002. **37**(5): p. 1221-42.
[7] Gelberg, L., R.M. Andersen, and B.D. Leake, *The Behavioral Model for Vulnerable Populations: application to medical care use and outcomes for homeless people.* Health Serv Res, 2000. **34**(6): p. 1273-302.
[8] Phillips, K.A., et al., *Understanding the context of healthcare utilization: assessing environmental and provider related variables in the behavioral model of utilization.* Health Serv Res, 1998. **33**(3 Pt 1): p. 571-96.

access. Need Factors capture both perceived need (self-assessed) and evaluated need (determined by others, typically healthcare providers). The level of need is determined by the presence and level of health conditions such as symptoms, laboratory abnormalities or disease states.

For this report, we will focus on a set of predisposing, enabling (including both personal and contextual) and need factors that are relevant to HIV/AIDS care, including several that originate from the Vulnerable Populations modification of Andersen's original model. Table 2 describes these factors in detail.

Table 2. Independent Variables Used in Analysis:
Predisposing, Enabling, Need Factors & Definitions

Independent Variables	Definitions
Predisposing	
Gender	Male or female.
Age	Patient age in 2006.
Race/ethnicity	Patient race/ethnicity: Black non-Hispanic, White non-Hispanic, Hispanic.
Place of birth	U.S. born vs. non-U.S. born.
Mental health	Any active mental illness during the study period.
Substance abuse	Any active substance abuse during the study period.
Male-to-male sex risk (MSM)	HIV transmission risk documented at entry to care.
Injection drug use risk (IDU)	HIV transmission risk documented at entry to care.
Heterosexual risk	HIV transmission risk documented at entry to care.
Hepatitis C positive	Screened for hepatitis C virus and found to be positive at any time
Enabling	
Site type	Community health center vs. non-CHC.
Patient caseload	Patient caseload > 200 (large) vs. ≤ 200 (small).
Clinic location	Metro-Boston vs. outside the urban center
Time in care	Number of years in care at site.
Entry into care	Before 1996 (prior to HAART period) or before 2001 (more recent therapies available)
Incarceration	Documentation of any incarceration during the study period.
Need	
Initial CD4 ≤ 200	Initial CD4 count documented at entry to care.
AIDS Diagnosis	Previous AIDS-defining condition

3.5 STATISTICAL METHODS

The analysis was performed using SAS version 9.1 (SAS Institute, Inc., Cary NC); details of the steps are described below.

3.5.1. Weighting the Sample:

The sampling scheme for the Quality Management data collection project was designed to estimate, with sufficient power and at reasonable cost, program-specific quality parameters within each clinic. Seventy charts were sampled per year per clinic; clinics with < 70 patients contributed all active HIV/AIDS patients. This scheme resulted in small clinics contributing 100% and large clinics contributing as little as 7% of their active HIV/AIDS caseload.

Since the present analysis will make generalizations across participating clinics and thus to the larger HIV-patient population receiving care in BPHC-Part A funded sites, a weighting step was applied to all analyses to make the sample more representative of the total population.

The weight for each site (and applied to each patient sampled from the site) was the product of two factors, which themselves were ratios:

(1) site case load / sample size;
(2) total sample size / sum of the weights from (1).

Thus, the weights took into account the imbalance of sampling within each site and the imbalance across sites.

3.5.2. Unadjusted Bivariate Analysis:

In characterizing differences in predisposing, enabling and need factors for the subgroups based on race/ethnicity, gender and nativity, chi square statistics for categorical variables (Rao-Scott chi square for complex samples) and student t-tests for continuous variables were used; two tailed tests of significance were used throughout. To make statistically valid inferences with the complex sample design, SAS SURVEYFREQ and SURVEYMEANS was used.

3.5.3. Adjusted Analysis using Logistic Regression Modeling:

The SURVEYLOGISTIC procedure was used with the clinic (n=9) as the class variable. The six dependent variables tested were dichotomous (coded '0' for no and '1' for yes), and the parameters of the model included the covariates found to be associated in the bivariate comparisons (Rao-Scott chi square statistic $p< 0.10$) or identified as potentially important in the literature. The SURVEYLOGISTIC models were initially run using all significant covariates.

IV. RESULTS

This section presents the findings from this analysis on disparities in care processes and outcomes across the nine BPHC-Part A funded sites during 2003-2006. Data presented will answer the following questions:

(1) What patient-level attributes or site factors are associated with differences in processes of HIV care (medical visits, HIV monitoring, antiretroviral therapy use)?

(2) What patient-level attributes or sites factors are associated with health outcomes (viral suppression, CD4 count, and hospitalizations)?

(3) Controlling for site factors (enabling) and severity of illness (need), are there any patient-level disparities in HIV care processes and outcomes, specifically by gender, race/ethnicity, or place of birth?

4.1. STUDY POPULATION

Patients reviewed with at least two visits in at least one of the study years from 2003 to 2006 were included in this analysis. A total of 660 patients represented the analytic sample. Table 3 describes the characteristics of this sample, separated by categories in the Andersen-Newman behavioral model of healthcare utilization.

Table 3. Sample Characteristics: Weighted Percentages of Explanatory Variables (N=660)

Explanatory Variables	Weighted Percentages (%)
Predisposing Factors	
Gender (Female)	32.3%
Black	21.7%
White	45.6%
Hispanic	32.8%
Age ≥ 50 (in 2006)	26.3%
Age ≥ 40 (in 2006)	68.1%
Country of birth (non-U.S. born)	28.1%
Active Mental Illness	51.3%
Active Substance Abuse	23.7%
MSM-related risk	40.6%
Heterosexual risk	49.3%
Injection Drug Use history	22.1%
Hepatitis C positive	24.7%
Enabling Factors	
Entered care before 2001	55.3%
Entered care before 1996	22.0%
Time in care more than 5 years 3-5 years 0-2 years	55.3% 44.1% 0.7%
Community health center	60.7%
Clinic with >200 HIV patients	85.6%
Metro-Boston clinic	82.3%
Incarceration in study period	5.9%
Need Factors	
AIDS diagnosis	53.6%
CD4 at entry to care ≤ 200	23.1%

Using weighted data, one-third of the patient sample were female, 22% were Black non-Hispanic, 46% were White non-Hispanic, and 33% were Hispanic. Non US-born patients represented about 28% of the study sample. Approximately 41% had MSM risk and 22% had any IDU risk. Active mental illness during the study period was found for 51% of patients, while 24% had any active substance use.

4.2 ANALYSIS OF PROCESS AND OUTCOME MEASURES

As shown in the table below, there was improvement in most of the process and outcome measures compared to the findings of the original 4 years (1999-2002). The overall rate of having inconsistent lab monitoring decreased 3% (from 26% to 23%) and missing recommended medications declined 4% (from 22% to 18%). There was a 1% increase in the proportion with inconsistent medical visits (from 18% to 19%). Substantial improvement in the proportion with low CD4 counts was noted (8% decrease from 21% to 13%); viral load measures were not analyzed originally. Rates of medical hospitalizations declined from 28% to 20% when the analysis was restricted to causes most potentially related to HIV disease by excluding psychiatric, obstetric, substance abuse and trauma related admissions.

Table 4. Clinical Process and Outcome Measures: Weighted Percentages of Dependent Variables

Dependent variables	Weighted Percentages (%)	
Care Process Measures	**2003-2006**	**1999-2002**
Inconsistent Visits	19%	18%
Inconsistent Labs	23%	26%
Missed Recommended Medications	18%	22%
Care Outcome Measures		
Last viral load ≤ 400	63%	Not collected
Last CD4 count ≤ 200	13%	21%
Medical hospitalization after the first year in care*	20%	28%

*excluding psychiatric, obstetric, substance abuse, and trauma causes

4.3 DISPARITIES ANALYSIS

In the following section, the findings of the analysis are described for each of the 6 dependent variables used as indicators of quality in care process and outcome. In an effort to make this report useful to a broad audience of readers, the results are introduced with a basic explanation of how to interpret the technical and statistical terms used.

Evaluating the importance of a range of factors on health care processes and outcomes requires complex statistical tools. In the case of HIV/AIDS, many important background factors (including patient characteristics and stage of illness, healthcare provider, clinic, and resource/financial aspects) must be taken into account in a comprehensive fashion. The sequence of the analysis progresses from a crude measurement of the importance of each separate factor ***on its own*** to each of the measures, to a complex model that calculates the importance of each factor ***while taking into account or "adjusting for" the effect of the others***.

The relative importance of each factor in the adjusted model is described by the Odds Ratio (OR) with a specific Confidence Interval (CI). If the OR is less than 1, then patients with this factor are less likely than others to have the outcome; conversely, when the OR is greater than 1, the factor increases the likelihood that a patient will have the outcome. For example, an OR of 1.4 means that patients with this factor are 40% more likely than those without it to have the outcome. The strength of the relationship between the factor and outcome is measured in the CI, which is the 95% range that the OR value would be captured within (in other studies or samples of patients). As long as the 95% CI does not contain a value of 1, the relationship between the factor and the outcome is considered "statistically significant"; the basis for this is a less than 5% chance that the relationship is due only to coincidence and not an indication of a true relationship. The actual probability that a relationship is due to chance is shown as the "p value"; when it is less than 5% ($p<0.05$), the observed relationship is considered to be real and not due to chance.

4.3.1 Inconsistent Clinical Visits

Each of the predisposing, enabling and need factors was evaluated in relationship to the first process measure --- having a lapse of more than 8 months between medical visits at the site. Data from these chart reviews indicated that 19% of patients overall had this extended gap between medical visits. The unadjusted odds ratios noted in Table 5 under the heading “Crude Analysis” represent the association of each factor with this outcome, when none of the other factors are considered. Statistically significant relationships are indicated in boldface type. The “Adjusted Analysis” shows the impact of taking the multiple factors into account simultaneously. This allows for a clearer picture of the population because it accounts for other patient factors and their relationships.

Table 5. Factors Independently Associated with the Probability of Having Inconsistent Clinical Visits (>8 months without a Clinical Visit)

	Crude Analysis			Adjusted Analysis		
Explanatory Variables	Odds Ratio	95% CI	p	Odds Ratio	95% CI	p
Predisposing factors:						
Female	0.99	0.63-1.57	0.973	0.60	0.32-1.12	0.947
Active substance abuse	0.99	0.57-1.73	0.973	0.73	0.39-1.38	0.108
Active mental illness	1.21	0.76-1.92	0.434	1.17	0.69-1.98	0.338
Age 40 and over in 2006	0.64	0.39-1.03	0.068	**0.44**	**0.24-0.80**	**0.007**
MSM	0.73	0.43-1.23	0.236	0.48	0.19-1.21	0.118
IDU	1.23	0.77-1.99	0.385	0.93	0.48-1.78	0.821
Black	1.36	0.84-2.20	0.212	1.40	0.65-3.03	0.394
Hispanic	1.27	0.80-2.02	0.303	1.48	0.70-3.14	0.304
Non-U.S. born	0.70	0.42-1.17	0.170	**0.45**	**0.23-0.88**	**0.020**
Enabling factors:						
Time in care (continuous variable)	0.99	0.93-1.04	0.582	0.98	0.91-1.04	0.454
Incarcerated during study period	**2.68**	**1.37-5.26**	**0.004**	2.16	0.95-4.90	0.067
Community health center	0.72	0.46-1.14	0.161	0.67	0.36-1.24	0.201
Caseload >200	0.81	0.50-1.32	0.399	0.92	0.47-1.76	0.787
Need factors:						
Initial CD4 ≤ 200	0.68	0.36-1.20	0.184	0.40	0.25-0.97	0.403

Being incarcerated during the study period was the only significant predictor in the crude analysis, while age was borderline with p=0.068. With the adjusted model, however, incarceration dropped out and two significant predictors emerged --- age and country of birth. Patients age 40 and above were 44% less likely to miss visits, while non-U.S. born patients were 45% less likely. No enabling or need factors were significant in the adjusted model. In the previous report (1999-2002), there had been no significant predisposing factors; only small clinic, less time in care, and entry CD4 below 200 were significant predictors of inconsistent medical visits.

4.3.2 Inconsistent Laboratory Tests

Table 6. Factors Independently Associated with the Probability of Having Inconsistent Labs (>8 months without a CD4 or Viral Load Test)

	Crude Analysis			Adjusted Analysis		
Explanatory Variables	Odds Ratio	95% CI	p	Odds Ratio	95% CI	p
Predisposing factors:						
Female	1.31	0.86-1.98	0.2089	0.94	0.53-1.65	0.828
Active substance abuse	1.39	0.84-2.30	0.1972	1.19	0.64-2.21	0.577
Active mental illness	1.08	0.70-1.67	0.7192	0.95	0.57-1.56	0.837
Age 40 and over in 2006	0.56	0.35-0.88	0.113	**0.48**	**0.28-0.82**	**0.0079**
MSM	0.69	0.42-1.13	0.1424	0.80	0.35-1.86	0.609
IDU	1.22	0.78-1.91	0.3873	0.96	0.48-1.91	0.904
Black	**1.76**	**1.13-2.75**	**0.0120**	1.49	0.76-2.90	0.246
Hispanic	1.16	0.76-1.78	0.4918	1.09	0.55-2.14	0.807
Non-U.S. born	0.87	0.55-1.38	0.5545	0.66	0.34-1.29	0.229
Enabling factors:						
Time in care (continuous variable)	0.99	0.95-1.05	0.8203	0.97	0.92-1.03	0.350
Incarcerated during study period	**2.74**	**1.44-5.22**	**.0022**	2.12	0.93-4.83	0.074
Community health center	0.74	0.49-1.13	.1643	0.58	0.33-1.01	0.056
Caseload >200	0.66	0.42-1.03	.0673	0.68	0.37-1.22	0.196
Need factors:						
Initial CD4 ≤ 200	0.97	0.59-1.61	.9136	0.74	0.41-1.32	0.306

Crude analysis findings revealed that Black non-Hispanic patients were significantly more likely to have inconsistent laboratory monitoring of HIV disease than White non-Hispanics. However, after controlling for other predisposing, enabling, and need factors, this racial/ethnic disparity disappeared and only age was found to be a significant predictor of inconsistent laboratory monitoring. Specifically, younger patients (less than 40 years of age) were more likely to have inconsistent viral load or CD4 tests.

4.3.3 Missed Recommended Medications

Table 7. Factors Independently Associated with the Probability of Missing Recommended Medications (Antiretroviral Therapy or PCP or MAI Prophylaxis among Eligible Patients)

	Crude Analysis			Adjusted Analysis		
Explanatory Variables	Odds Ratio	95% CI	p	Odds Ratio	95% CI	p
Predisposing factors:						
Female	0.80	0.49-1.29	0.352	1.12	0.58-2.16	0.738
Active substance abuse	**1.91**	**1.13-3.26**	**0.016**	1.49	0.78-2.85	0.222
Active mental illness	1.15	0.70-1.88	0.589	0.88	0.49-1.57	0.654
Age 40 and over in 2006	1.21	0.70-2.06	0.497	1.26	0.67-2.38	0.468
MSM	1.46	0.89-2.44	0.137	1.46	0.70-3.05	0.314
IDU	1.31	0.81-2.12	0.265	1.69	0.84-3.40	0.141
Black	0.82	0.48-1.39	0.457	0.59	0.29-1.18	0.135
Hispanic	0.84	0.52-1.36	0.475	1.25	0.55-2.84	0.591
Non-U.S. born	**0.52**	**0.29-0.92**	**0.025**	0.58	0.26-1.30	0.185
Enabling factors:						
Time in care (continuous variable)	0.88	0.54-1.43	0.595	**0.91**	**0.86-0.98**	**0.008**
Incarcerated during study period	1.54	0.74-3.20	0.244	1.32	0.51-3.46	0.570
Community health center	1.36	0.85-2.17	0.204	1.00	0.53-1.90	0.990
Caseload >200	0.68	0.42-1.11	0.124	0.60	0.31-1.18	0.140
Need factors:						
Initial CD4 ≤ 200	0.66	0.36-1.23	0.194	0.57	0.28-1.14	0.111

Detailed national guidelines are available concerning use of antiretroviral medications and prophylaxis for pneumocystis and mycobacterium avium. In general, the Boston EMA study population had very high levels of receiving these medications and no serious financial barriers have been identified for patients in Massachusetts. Receipt and use of these medications among eligible patients are important for preventing HIV progression to AIDS and maintaining health stability. Results from the crude analysis showed that patients having any active substance abuse during the study period were 1.9 times more likely to miss recommended medications compared to patients without any active substance use. U.S. born patients were also more likely to miss recommended therapies compared to non-U.S. born patients. In the adjusted model, however, these differences disappeared and only length of time in care at the clinical site was significantly associated with adherence to medication guidelines. Specifically, patients who have been in care longer at the site were less likely to miss medication recommendations.

4.3.4 Last Viral Load ≤ 400 among Patients on ART at Last Visit

Table 8. Factors Independently Associated with the Probability of Having an Undetectable Last Viral Load (Last Documented Viral Load during Study Period is ≤ 400)

	Crude Analysis			Adjusted Analysis		
Explanatory Variables	Odds Ratio	95% CI	p	Odds Ratio	95% CI	p
Predisposing factors:						
Female	1.17	0.81-1.69	0.4159	1.23	0.76-2.02	0.403
Active substance abuse	**0.47**	**0.30-0.74**	**.0009**	**0.53**	**0.32-0.88**	**0.013**
Active mental illness	0.70	0.48-1.03	0.0691	0.78	0.51-1.19	0.250
Age 40 and over in 2006	**1.69**	**1.12-2.55**	**0.012**	1.46	0.92-2.32	0.111
MSM	0.87	0.58-1.31	0.5141	0.94	0.49-1.79	0.839
IDU	1.03	0.70-1.54	0.8743	1.00	0.56-1.78	0.999
Black	0.91	0.61-1.35	0.6311	0.83	0.46-1.51	0.548
Hispanic	1.22	0.84-1.78	0.3004	1.18	0.65-2.14	0.590
Non-U.S. born	1.06	0.72-1.57	0.7700	0.89	0.51-1.55	0.671
Enabling factors:						
Time in care (continuous variable)	**1.06**	**1.01-1.12**	**0.02**	**1.07**	**1.01-1.14**	**0.026**
Incarcerated during study period	0.82	0.44-1.53	0.5258	0.86	0.40-1.87	0.703
Community health center	0.94	0.65-1.36	0.7531	1.47	0.91-2.37	0.119
Caseload >200	1.03	0.68-1.55	0.9014	0.94	0.55-1.62	0.820
Need factors:						
Initial CD4 ≤ 200	**1.74**	**1.11-2.72**	**.0149**	**2.01**	**1.20-3.37**	**0.008**

Viral suppression or a viral load ≤ 400 is an indicator of treatment success. Thus, for this measure, we included only patients who were on antiretroviral therapy. In the crude analysis, several factors were found to be significant predictors of having viral suppression. Older patients (age ≥ 40), having been in HIV care for a longer period of time, and having an initial CD4 ≤ 200 were more likely to have an undetectable last viral load. Patients who had any active substance use were 53% less likely to have a last viral load ≤ 400.

In the adjusted analysis, age dropped out as a predictor of viral suppression. However, patients who are newer to care at the site and have active substance use have decreased odds of viral suppression, independent of all other factors. More attention to patients with shorter time in care at site and patients with substance abuse problems would help ensure adherence to antiretroviral therapy and monitoring of viral loads, which are necessary for achieving viral suppression.

4.3.5 Last CD4 ≤ 200

Table 9. Factors Independently Associated with the Probability of Having the Last CD4 count ≤ 200

	Crude Analysis			Adjusted Analysis		
Explanatory Variables	Odds Ratio	95% CI	p	Odds Ratio	95% CI	p
Predisposing factors:						
Female	1.07	0.64-1.78	0.80	0.82	0.40-1.70	0.60
Active substance abuse	1.24	0.71-2.17	0.45	0.80	0.40-1.59	0.53
Active mental illness	1.14	0.68-1.90	0.63	1.04	0.56-1.96	0.89
Age 40 and over in 2006	**2.31**	**1.27-4.19**	**0.01**	1.47	0.71-3.02	0.30
MSM	0.55	0.29-1.04	0.07	0.72	0.30-1.74	0.46
IDU	**1.83**	**1.10-3.04**	**0.02**	1.00	0.52-1.93	0.995
Black	**1.99**	**1.19-3.33**	**0.01**	1.45	0.62-3.37	0.39
Hispanic	1.20	0.72-1.99	0.49	1.18	0.49-2.89	0.71
Non-U.S. born	0.61	0.33-1.11	0.11	0.60	0.29-1.24	0.17
Enabling factors:						
Time in care (continuous variable)	**1.09**	**1.02-1.16**	**0.01**	1.06	0.96-1.17	0.25
Incarcerated during study period	**2.49**	**1.19-5.21**	**0.02**	2.11	0.82-5.46	0.12
Community health center	0.71	0.43-1.17	0.18	0.69	0.34-1.42	0.32
Caseload >200	0.68	0.40-1.16	0.16	3.25	1.85-5.71	0.65
Need factors:						
Initial CD4 ≤ 200	**4.00**	**2.35-6.81**	**<.0001**	**3.25**	**1.85-5.71**	**<.0001**

A CD4 count of less than 200 represents less than adequate immune function. Several predisposing factors – age 40 and over, IDU risk, and being Black non-Hispanic – were significantly associated with poorer immune function ($p<0.05$). Specifically, older patients (age ≥ 40) were 2.3 times more likely, patients with IDU risk were 1.8 times more likely, and Black non-Hispanics were 2.0 times more likely to have a last CD4 ≤ 200 compared to younger patients (age < 40), patients with no IDU risk, and White non-Hispanics respectively. Further, having ever been incarcerated during the study period and having been in care at the site for a longer time also increased the likelihood of having a last CD4 ≤ 200.

In the adjusted model, all disparities observed in the crude analyses disappeared, with the exception of initial CD4 count ≤ 200. Patients who enter into care with more compromised immune systems were more likely to have poorer health outcome, independent of all other potential factors. Interventions for early testing and detection of HIV disease and linkage to care may improve likelihood of better treatment outcome.

4.3.6 Any Hospitalizations after First Year in Care (Excluding Psych, OB, Trauma, Substance Abuse)

Table 10. Factors Independently Associated with the Probability of Having a Hospitalization

	Crude Analysis			Adjusted Analysis		
Explanatory Variables	Odds Ratio	95% CI	p	Odds Ratio	95% CI	p
Predisposing factors:						
Female	**2.34**	**1.54-3.56**	**<.0001**	**2.32**	**1.21-4.44**	**0.011**
Active substance abuse	**1.95**	**1.21-3.13**	**0.0060**	1.05	0.52-2.11	0.892
Active mental illness	**1.68**	**1.01-2.59**	**0.0192**	1.47	0.82-2.64	0.201
Age 40 and over in 2006	**3.40**	**1.94-5.95**	**<.0001**	**2.03**	**1.05-3.95**	**0.036**
MSM	**0.27**	**0.15-0.49**	**<.0001**	0.71	0.27-1.83	0.476
IDU	**3.27**	**2.11-5.06**	**<.0001**	0.81	0.40-1.63	0.559
Black	1.29	0.82-2.02	0.2740	1.99	0.89-4.46	0.095
Hispanic	**2.22**	**1.46-3.38**	**0.0002**	**3.08**	**1.48-6.45**	**0.003**
Non-U.S. born	**0.32**	**0.18-.56**	**<.0001**	**0.17**	**0.08-0.39**	**<.0001**
Enabling factors:						
Time in care (continuous variable)	**1.30**	**1.22-1.38**	**<.0001**	**1.30**	**1.20-1.39**	**<.0001**
Incarcerated during study period	**2.89**	**1.49-5.60**	**0.0017**	2.23	0.96-5.20	0.062
Community health center	**0.27**	**0.17-0.41**	**<.0001**	**0.27**	**0.13-0.55**	**0.0004**
Caseload >200	1.21	0.72-2.02	0.4687	0.83	0.38-1.85	0.653
Need factors:						
Initial CD4 ≤ 200	1.12	0.69-1.82	0.6435	0.99	0.51-1.93	0.976

Illnesses that require hospitalization are an objective measure of out-patient clinical care, particularly in chronic medical conditions such as HIV infection. To focus on the outcome of established HIV clinical care, we have analyzed only admissions occurring after the first year in care, excluding those occurring early in the treatment period or related to the initial HIV diagnosis. We further restricted this analysis by removing admissions related to trauma, obstetrics/gynecology, or psychiatric diagnoses in order to capture hospitalizations potentially related to HIV disease. With these specifications, a hospitalization rate of 20% was found.

As shown in Table 10, the crude analysis identified a gender difference, with women having more than double the likelihood of hospitalization. A number of other predisposing factors related to active substance abuse, mental health issues, older age, injection drug use and Hispanic ethnicity also were found to increase risk. Patients who

were born outside the US and those with MSM risk had significantly lower rates of hospitalization. Enabling factors of time in care and incarceration were also significant; community health center sites had lower rates of admission. This finding represents a potential bias in the data collection process whereby hospital-based clinics have easier and more complete access to information about admissions, and the ability to control for this effect in the adjusted model is important.

After adjustment, only female gender, older age, Hispanic ethnicity, US birth, and longer time in care were significant predictors of hospitalization. It has been established by others that women with HIV are at increased risk of hospitalizations[9], but we are not aware of any published reports of Hispanics having higher hospitalization rates.

[9] Gebo KA, Diener-West M, Moore RD. Hospitalization rates differ by hepatitis C status in an urban cohort. *J Acquir Immune Defic Syndr* 2003; 34:165-173

4.4 SUMMARY OF FINDINGS

To synthesize predictors identified in the adjusted models, the following table illustrates the predisposing, enabling and need factors for each measure.

Table 11. Predictors of Clinical Care Quality (Process and Outcome Measures) from Adjusted Models

Dependent Variables	Predisposing Factors	Enabling Factors	Need Factors
Inconsistent Visits	**Age < 40** **U.S. born**	None	None
Inconsistent Labs	**Age < 40**	None	None
Missed Recommended Medications (ARV/PCP/MAI Prophylaxis)	None	**Shorter time in care**	None
Last CD4 ≤ 200	None	None	**Initial CD4 ≤200**
Medical hospitalization after the first year in care (excluding Psych, OB, SA, Trauma)	**Female** **Age ≥ 40** **Hispanic** **U.S. born**	**Longer time in care** **Hospital-based site**	None
Last Viral Load ≤ 400 [Note that this is a positive outcome, while others above are all negative]	**No active substance abuse**	**Longer time in care**	**Initial CD4 ≤200**

This analysis updates the findings from 1999-2002 in which rates of 5 of these 6 measures were explored[10]. Since the earlier period, rates of inconsistent labs and missed medications have declined by 3% and 4%, respectively. Active substance abuse was no longer found to significantly predict inconsistent labs and small clinics were no longer found to have more inconsistent visits or labs. While being born in the United States or territories was a predictor of missing recommended medications in the earlier period, it was a only a predictor of inconsistent visits in the updated analysis. The only factor to significantly predict missing recommended medications was having a shorter time in care, which most likely reflects a period of gradual assessment and

[10] Kunches LM, Reinhalter NE, et al: Assessment of potential disparities in HIV Care Quality and Clinical Outcomes in Boston EMA Sites Providing primary medical care 1999-2002, Boston Public Health Commission 2005 *www.bphc.org/bphc/pdfs/aids_BPHC-**Disparities**.pdf*

adjustment to chronic disease and medication requirements rather than a healthcare inequality.

The health outcomes of CD4 and hospitalization both declined considerably in the recent analysis, compared to the original. Only 13% of recent patients had low CD4 counts (under 200) on their last test, compared to 21% in the earlier period. Differences by IDU history and type of clinic were no longer found in the updated analysis of CD4 outcomes, and only the baseline CD4 level was significant.

Hospitalization rates declined from 28% to 20% and differences related to injection drug use and mental health diagnosis disappeared in the recent period. Higher rates for females continued, consistent with other published research on HIV populations. For the first time, increased risk of hospitalization was noted for U.S. born and Hispanic patients during the recent period. A follow-up analysis of the reasons for hospitalization according to ethnicity and birthplace found a lower rate of HIV/AIDS related conditions in Hispanics (16%) than non-Hispanics (26%), while Hispanics had higher rates of musculoskeletal diagnoses (22% vs. 7% for non-Hispanics). U.S. born patients had higher rates of gastrointestinal causes (38% vs. 10%) and neurologic causes (17% vs. 0%) and somewhat lower rates of infection-related causes (47% vs. 55%).

Finally, the factors associated with the positive outcome of viral suppression (for patients on antiretroviral therapy) included not abusing substances, being in care longer, and having a low initial CD4 count. There were no differences related to gender or race/ethnicity, the types of healthcare disparities thought to represent discrimination, lack of access, or social barriers to quality medical care.

Considering that this is a population identified *because of their connection to healthcare*, no global conclusions can be made about general access and quality of care for the general HIV/AIDS population. However, these results suggest that the Boston EMA's system of services and medical care for PLWH/A is providing high quality treatment resulting in equally positive process and outcome experiences across genders and race/ethnicity groups. Although hospitalizations were higher for Hispanics and U.S.

born patients, there is no evidence that HIV/AIDS related illnesses accounted for these differences. Previous findings that substance abuse and mental health diagnoses led to inconsistent laboratory monitoring or greater risk of hospitalization were resolved in the updated study period. Age and country of birth do play a role in both process and outcome indicators, with younger patients and those born in the U.S. or territories having less positive experiences.

Understanding these disparities can help inform service providers how to best support clients by recognizing the factors associated with less than optimal healthcare process and outcome measures.

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Appendix A. Additional Analysis on Medical Hospitalizations

US Born vs. non-US born patients
27.3% of US born (124/454) and 9.8% (20/205) of non-US born patients had any medical hospitalization after the first year (excluding OB, Trauma, SA, Psych). This difference is statistically significant at $p<0.0001$.

Hispanic vs. non-Hispanic patients
26.5% of Hispanic (63/238) and 19.4% (82/422) of non-Hispanic patients had any medical hospitalization after the first year (excluding OB, Trauma, SA, Psych). This difference is statistically significant at $p<0.05$.

Among patients with any medical hospitalization, % who were ever hospitalized for any of the following reasons:	US-Born	Non-US born	Hispanic	Non-Hispanic
Causes of Hospitalizations	Percentage (n=124)	Percentage (n=20)	Percentage (n=63)	Percentage (n=82)
HIV/AIDS Related Conditions	21.8% (27)	20.0% (4)	15.9% (10)	25.6% (21)
Cardiovascular	19.4% (24)	15.0% (3)	20.6% (13)	17.1% (14)
Gastrointestinal	37.9% (47)	10.0% (2)	36.5% (23)	31.7% (26)
Hematologic	8.1% (10)	10.0% (2)	9.5% (6)	7.3% (6)
Hepatic	9.7% (12)	0.0% (0)	4.8% (3)	11.0% (9)
Infectious	46.8% (58)	55.0% (11)	46.0% (29)	50.0% (41)
Musculoskeletal	14.5% (18)	10.0% (2)	22.2% (14)	7.3% (6)
Neurologic	16.9% (21)	0.0% (0)	17.5% (11)	13.4% (11)
Respiratory	25.8% (32)	25.0% (5)	28.6% (18)	24.4% (20)
Surgical	9.7% (12)	15.0% (3)	9.5% (6)	11.0% (9)

Appendix B: All Medical Hospitalizations after First Year

Among the 149 patients with any medical hospitalizations after the first year (no exclusions), % who were ever hospitalized for any of the following reasons, by category:	
Causes of Hospitalizations	Percentage (n=149)
HIV/AIDS Related Conditions	20.8% (31)
Allergic RX	1.3% (2)
Cardiovascular	18.1% (27)
Dermatologic	2.0% (3)
Drug RX Side Effects	4.0% (6)
EENT	2.0% (3)
Endocrine	3.4% (5)
Genitourinary	2.7% (4)
Gastrointestinal	32.9% (49)
GYN	7.4% (11)
Hematologic	8.1% (12)
Hepatic	8.1% (12)
Infectious	47.0% (70)
Musculoskeletal	13.4% (20)
Neoplasm (Non AIDS Related Cancers)	2.0% (3)
Nephrologic	6.7% (10)
Neurologic	14.8% (22)
OB	4.0% (6)
Psych	12.8% (19)
Respiratory	25.5% (38)
Substance Abuse	20.1% (30)
Surgical	10.1% (15)
Trauma	5.4% (8)
Substance abuse medical emergency	0.7% (1)
Unknown	2.7% (4)