



C.H.A.I.N 2011-4 BRIEF REPORT

Determinants of HAART Use and Adherence

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Introduction

Consistent with local and national trends, the introduction of HAART in 1996 has been a central factor in the dramatic and sustained decline in mortality among members of the NYC EMA's PLWHA cohort study, CHAIN. However, it is also evident that the benefits of HAART are unevenly distributed across various segments of the HIV-infected population. Disparities in HAART effectiveness may be tied to difficulties that HIV-infected individuals encounter in accessing medical care and equally important, the challenges they confront in sustaining long-term adherence to HAART regimens. A previous CHAIN report (2008-2: Predictors of Treatment Effectiveness) demonstrated that among HAART-eligible cohort members, HAART use (adherent use in particular) was among the most important predictors of timely achievement of viral load suppression and sustained suppression once achieved. This report presents findings examining potential patient-related and medical care quality-related determinants of HAART use and adherence.

Methods

CHAIN participants from New York City and Tri-County eligible for this study had a history of antiretroviral treatment (ART) and/or ever had a CD4 count below 200. We included multiple observations for CHAIN participants if they completed one or more follow-up interviews subsequent to the interview in which they became eligible for this study. Study data are based upon 3,717 observations for 1,091 CHAIN participants completing up to five interviews completed between 2001 and 2009.

A three-category HAART use variable was created from participant reports of their ART medications and medication adherence at time of each interview: 1) non-HAART use, 2) non-adherent HAART use, or 3) adherent HAART use. A participant was classified as a HAART user if he or she was taking an ART combination that conformed to the national guidelines in effect at the time the interview was conducted. Two questions were asked regarding medication adherence: (1) number of pills missed in the two days prior to the interview and (2) participant's general experiences in taking HIV medications during the previous six months. Responses to this question could range from "exactly as prescribed" to "rarely take my pills as prescribed." To be considered completely adherent, a participant had to report taking all pills as prescribed in the last two days and taking ART medications exactly as prescribed during the past six months. Individuals placed in the "non-HAART use" category included those who were taking a non-HAART ART combination at time of interview, along with those not taking any ART medication. The three HAART categories do not form sharp separations between HAART use and non-HAART use or between adherent and non-adherent use. Some individuals in the non-HAART use group enjoy some benefits from whatever regimens they are on, and not all individuals in the adherent HAART use group may not have a continuous history of adherent use (see CHAIN report 2008-2 for an elaboration on this point). Therefore, we conceive of the HAART use variable as a three-level, ordered variable measuring ART effectiveness that

roughly corresponds to breaks between low, middle and high levels of potential ART effectiveness.

Possible determinants of HAART use included the following demographic characteristics: age, ethnicity, gender, education (less than high school or completed high school), place of residence (New York City, Tri-County urban region or Tri-County suburban/rural regions), and place of birth (U.S., Puerto Rico or another country). We classified participants as having poor mental health at the time of interview if they had low scores on a standardized mental health functioning scale. Recent substance use was defined as any use of heroin, cocaine/crack, or problem drinking in the six months prior to interview. For housing status, study participants were classified as follows: (1) homeless (any episode in the past six months of sleeping on the street or in a public place, in a homeless shelter, or in a limited-stay SRO or welfare hotel); (2) unstably housed (residence in a transitional housing program, treatment facility, or unit where the participant was temporarily doubled up with others); or (3) stably housed (continuously residing in permanent housing). We included two measures of quality of medical care. Comprehensive primary care was defined as participant self-report that during the six months prior to interview there was always someone (1) to go to for routine check-ups, vaccinations and medical tests, (2) to go to for health related information or advice, and (3) to call 24 hours a day for a medical emergency. Cohort members were classified as receiving HIV/AIDS adequate care if, in the six months prior to the interview, they had a physical examination with blood work and at least one (1) HIV medical visit (for individuals with CD4 counts greater than 500) or at least two (2) HIV medical visits (for individuals with lower CD4 counts or who were taking ARTs).

Study findings are presented in two ways. First, in Tables 1, 3 and 5 we cross tabulate the HAART use variable by each independent variable. These tables allow us to compare directly differences in the percentages of HAART use and adherent HAART use between levels of each potential determinant. Second, we conceive of the HAART use levels as forming an ordered ART effectiveness variable. Tables 2, 4 and 6 present coefficients from a sequence of regression models that predict ART effectiveness for multiple determinants. These coefficients are odds ratios. They measure the strength of association between each independent variable and ART effectiveness. A coefficient with a value greater than 1 indicates a positive association or an increase in potential ART effectiveness, and a value less than 1 indicates an inverse relationship or a decline in potential ART effectiveness.

The leftmost column of Tables 2, 4 and 6 presents estimates of the odds ratio for each independent variable before controlling for other variables. The second column presents estimates of associations while controlling for all other participant characteristics [adjusted odds ratio (1)]. The third column represents the adjusted odds ratios (2) after including the two quality of care measures in the full multiple regression model. Comparison of coefficients across columns suggests that each variable's association with ART effectiveness generally remained stable, before and after controlling for other variables. Tables 1 and 2 present findings when New York City and Tri-County cohorts are pooled. Tables 3 and 4 present findings for New

York City alone. Tables 5 and 6 present findings for Tri County alone. A technical discussion of study methods is presented in a Methodological Appendix at the end of the report.

Key Findings

- Lack of access to medical care or medications did not appear to be an important factor in HAART use among CHAIN participants.
 - A primary medical care provider in charge of HIV treatment was almost universally reported by CHAIN participants at all interviews.
 - Upwards of 98% of participants had some form of insurance (including ADAP) at time of interview to cover cost of medication.
- At any round of interviews, an average of 75% of CHAIN participants reported HAART use and 50% of CHAIN participants reported adherent HAART use (Table 1).
 - Nonetheless, only 26% of study participants reported adherent HAART use at every interview, and half (49%) reported not currently using HAART at one or more interviews (Data not tabulated).
- When both cohorts are combined, ART effectiveness was positively associated with being male, non-Hispanic white, 50 years of age or older and born outside of the U.S. and Puerto Rico (Table 2).
 - Inspection of percentages across subgroups revealed that those born outside the U.S. had the highest proportion of adherent HAART use (64%), and those under 35 had the lowest proportion (47%) (Table 1).
 - The level of *not using* HAART was highest among those with less than a high school education (31%), those born in Puerto Rico (30%), and those under 35 (30%) (Table 1).
- ART effectiveness was negatively associated with poor mental health, recent substance use and recent spells of homelessness (Table 2).
 - The proportion of adherent HAART use was particularly low among recent substance users (39%) and those with spells of homelessness (39%) (Table 1).
 - The proportion of non-HAART use was highest among individuals with spells of homelessness (41%) (Table 1).
- Both access to comprehensive primary care and receiving at least minimum standard of HIV care increased level of ART effectiveness (Table 2).
- With a few exceptions as noted below, patterns of association were similar when New York City and Tri County are examined separately (Tables 4 and 6).
 - The effects of age, gender and ethnicity on ART effectiveness were stronger in Tri-County than in New York City (Tables 4 and 6).
- In both New York City and Tri-County, the proportion of adherent HAART use dropped below 40% for the least adherent groups. (Tables 3 and 5)

- In New York City, the groups with the lowest proportions of adherent HAART use were those with recent spells of homelessness (38%), with recent substance use (38%), and without access to comprehensive primary care (46%) (Table 3).
- In Tri County the groups with the lowest proportions of adherent HAART use were similar to those in NYC: unstably housed individuals (39%), recent substance users (40%), and those without access to comprehensive primary care (42%) (Table 5)
- In both New York City and Tri-County, non-HAART use reached 40% or higher for some subgroups.
 - In NYC the proportion of non-HAART use was highest among those experiencing spells of homelessness (40%) and recent substance users (34%) (Table 3).
 - In Tri-County, the proportion of non-HAART use was highest among those experiencing spells of homelessness (42%), those with less than a high school education (34%) and individuals born in Puerto Rico (34%) (Table 5).

Table 1: HAART Use by Participant Characteristics and Quality of Medical Care , 2001-2009 for Pooled Cohort Sample(N=1,091)

	Non-HAART Use	Non-Adherent HAART Use	Adherent HAART Use	Total Observations
Total	27%	22%	51%	3,717
Age**				
Under 35	30%	23%	47%	660
35-49	27%	24%	49%	1,589
50+	24%	20%	56%	1,468
Gender**				
Male	25%	20%	55%	2,015
Female	28%	25%	48%	1,702
Education +				
Less than H.S.	31%	20%	49%	1,040
Completed H.S.	25%	23%	52%	2,277
Poor Mental Health**				
No	25%	21%	54%	2,553
Yes	30%	25%	46%	1,149
Race/Ethnicity				
White	20%	23%	56%	529
Black	27%	24%	49%	2,048
Latino	29%	22%	54%	1,140
Region of Residence				
Tri-County:				
Suburb/Rural	25%	25%	50%	520
Urban	25%	26%	49%	717
New York City	28%	20%	52%	2,480
Place of Birth**				
U.S.	27%	23%	50%	2894
Puerto Rico	30%	18%	52%	344
Other Country	20%	16%	64%	479
Recent Substance Use**				
No	25%	20%	55%	2,882
Yes	33%	28%	39%	835
Housing Stability**				
Stable	26%	22%	53%	3,067
Unstable	26%	25%	49%	386
Homeless	41%	21%	39%	264
Primary Care**				
No	31%	25%	44%	1,100
Yes	25%	20%	55%	2,572
Adequate HIV Care**				
No	31%	22%	48%	1,498
Yes	24%	22%	54%	2,219

+p<.1, *p<.05, **p<.01

Table 2: Ordered Logit Regression for ART Effectiveness, 2001-2009 for Pooled Cohort Sample,(N=1.091)

	Unadjusted Odds Ratio	Adjusted Odds Ratio (1)	Adjusted Odds Ratio (2)
Age			
Under 35(ref.)	1.00	1.00	1.00
35-49	1.10 (.89,1.36)	1.08 (.88,1.32)	1.05* (.86,1.29)
50+	1.40**(1.11,1.77)	1.31*(1.04,1.65)	1.27 (1.01,1.60)
Gender			
Female(ref.)	1.00	1.00	1.00
Male	1.27** (1.07, 1.52)	1.26* (1.05, 1.51)	1.25* (1.01, 1.60)
Education			
Less than H.S.	.83+ (.68, 1.02)	.92 (.74, 1.14)	.93 (.75, 1.15)
Completed H.S.(ref.)	1.00	1.00	1.00
Poor Mental Health			
No(ref.)	1.00	1.00	1.00
Yes	.75** (.65, .86)	.80** (.69, .93)	.82** (.71, .95)
Race/Ethnicity			
White(ref.)	1.00	1.00	1.00
Black	.73 (.56, .95)	.73 (.55, .95)	.70* (.53, .93)
Latino	.81 (.61, 1.08)	.73 (.53, 1.01)	.71* (.51, .99)
Region of Residence			
Tri-County:			
Suburban/Rural(ref.)	1.00	1.00	1.00
Urban	0.99(.74, 1.32)	1.15(.85, 1.56)	1.15(.85, 1.55)
New York City	1.01(.79, 1.30)	1.22(.93, 1.60)	1.30+ (.99, 1.71)
Place of Birth			
U.S.(ref.)	1.00	1.00	1.00
Puerto Rico	1.02 (.75,1.38)	1.06 (.73, 1.53)	1.07 (.74, 1.55)
Other Country	1.77**(1.33,2.34)	1.75**(1.29,2.37)	1.76**(1.30,2.39)
Recent Substance Use			
No(ref.)	1.00	1.00	1.00
Yes	.58** (.49, .68)	.62** (.52, .73)	.63** (.53, .74)
Housing Stability			
Stable(ref.)	1.00	1.00	1.00
Unstable	.91 (.74, 1.12)	.97 (.78, 1.19)	.98 (.80, 1.20)
Homeless	.53** (.41, .69)	.61** (.46, .79)	.63** (.48, .82)
Primary Care			
No(ref.)	1.00		1.00
Yes	1.44** (1.25, 1.67)		1.35** (1.17, 1.55)
Adequate HIV Care			
No (ref.)	1.00		1.00
Yes	1.34** (1.18, 1.54)		1.32** (1.14, 1.51)
(Observations)	(3,682 to 3,717)	(3,702)	(3,671)

+P<.1, *p<.05, **p<.01

Coefficients for AOR(1) and AOR(2) are adjusted for other variables listed in model

See Methodological Appendix for further details on model specification and interpretation of coefficients

Table 3: HAART Use, Participant Characteristics and Medical Care Quality Variables , 2001-2009 for NYC. Cohort(N=693)

	Non-HAART Use	Non-Adherent HAART Use	Adherent HAART Use	Total Observations
Total	28%	20%	52%	2,480
Age+				
Under 35	30%	21%	48%	413
35-49	28%	22%	50%	1,024
50+	26%	18%	56%	1,043
Gender				
Male	28%	17%	55%	1,423
Female	27%	24%	49%	1,057
Education+				
Less than H.S.	31%	19%	50%	972
Completed H.S.	26%	20%	54%	1,508
Poor Mental Health**				
No	26%	20%	54%	1,769
Yes	32%	21%	47%	708
Race/Ethnicity				
White	24%	21%	56%	270
Black	28%	23%	49%	1,376
Latino	28%	15%	57%	834
Place of Birth**				
U.S.	29%	21%	50%	1,907
Puerto Rico	29%	16%	55%	255
Other Country	18%	16%	66%	318
Recent Substance Use**				
No	25%	17%	57%	1,849
Yes	34%	28%	38%	631
Housing Stability**				
Stable	26%	20%	54%	1,976
Unstable	25%	22%	53%	276
Homeless	40%	21%	38%	228
Primary Care**				
No	32%	22%	46%	790
Yes	25%	19%	56%	1,667
Adequate HIV Care**				
No	32%	20%	49%	1,169
Yes	24%	21%	56%	1,311

+P<.1, *p<.05, **p<.01

Table 4: Ordered Logit Regression for ART Effectiveness, 2002-2009 for NYC.(N=693)

	Unadjusted Odds Ratio	Adjusted Odds Ratio (1)	Adjusted Odds Ratio (2)
Age			
Under 35(ref.)	1.00	1.00	1.00
35-49	1.08 (.83,1.40)	1.04 (.81, 1.35)	1.00 (.78, 1.30)
50+	1.33+ (.99, 1.78)	1.21 (.91, 1.60)	1.15 (.86, 1.53)
Gender			
Female(ref.)	1.00	1.00	1.00
Male	1.12 (.90, 1.40)	1.09(.86, 1.37)	1.06(.84, 1.34)
Education			
Less than H.S.	.82+ (.65, 1.03)	.90 (.71, 1.13)	.90(.71, 1.14)
Completed H.S. (ref.)	1.00	1.00	1.00
Poor Mental Health			
No(ref.)	1.00	1.00	1.00
Yes	.75** (.62, .90)	.81* (.67, .98)	.84+ (.70, 1.02)
Race/Ethnicity			
White(ref.)	1.00	1.00	1.00
Black	.78(.54, 1.14)	.76(.52, 1.11)	.75 (.52,1.10)
Latino	.96(.65, 1.44)	.85(.56, 1.30)	.83(.54, 1.27)
Place of Birth			
U.S. (ref.)	1.00	1.00	1.00
Puerto Rico	1.15(.81, 1.65)	1.11 (.73, 1.70)	1.13 (.74, 1.73)
Other Country	1.94** (1.37, 2.74)	1.75** (1.21, 2.54)	1.77** (1.22, 2.57)
Recent Substance Use			
No(ref.)	1.00	1.00	1.00
Yes	.54** (.44, .66)	.59** (.48, .72)	.60** (.49, .74)
Housing Stability			
Stable(ref.)	1.00	1.00	1.00
Unstable	1.02 (.79, 1.31)	1.08 (.83 1.40)	1.10 (.85, 1.42)
Homeless	.53** (.40, .70)	.62** (.47, .82)	.65** (.49, .86)
Primary Care			
No(ref.)	1.00		1.00
Yes	1.45** (1.22, 1.74)		1.35** (1.14, 1.61)
Adequate HIV Care			
No(ref.)	1.00		1.00
Yes	1.38** (1.18, 1.62)		1.35** (1.15, 1.58)
(Observations)	(2,457 to 2,480)	(2,477)	(2,457)

+P<.1, *p<.05, **p<.01

Coefficients for AOR(1) and AOR(2) are adjusted for other variables listed in model

See Methodological Appendix for further details on model specification and interpretation of coefficients

Table 5: HAART Use, Participant Characteristics and Quality of Medical Care, 2001-2009 for Tri-County Cohort (N=398)

	Non-HAART Use	Non-Adherent HAART Use	Adherent HAART Use	Total Observations
Total	25%	26%	50%	1,237
Age*				
Under 35	30%	26%	45%	247
35-49	26%	27%	47%	565
50+	20%	24%	56%	425
Gender**				
Male	19%	26%	55%	592
Female	30%	25%	45%	645
Education				
Less than H.S\	35%	21%	44%	68
Completed H.S.	25%	26%	50%	1,169
Poor Mental Health*				
No	24%	23%	53%	784
Yes	26%	31%	43%	441
Race/Ethnicity**				
White	17%	26%	57%	259
Black	25%	27%	48%	672
Latino	31%	23%	46%	306
Region of Residence				
Suburb/Rural	25%	25%	50%	520
Urban	25%	26%	49%	717
Place of Birth**				
U.S.	24%	27%	49%	987
Puerto Rico	34%	24%	43%	89
Other Country	23%	16%	61%	161
Recent Substance Use*				
No	24%	25%	51%	1,033
Yes	30%	30%	40%	204
Housing Stability*				
Stable	24%	25%	51%	1,091
Unstable	28%	33%	39%	110
Homeless	42%	17%	42%	36
Primary Care**				
No	28%	31%	42%	320
Yes	24%	24%	53%	905
Adequate HIV Care*				
No	28%	29%	44%	329
Yes	24%	25%	52%	908

+P<.1 , *p<.05, **p<.01

Table 6: Ordered Logit Regression for Adherent HAART Use, 2001-2009 for Tri-County Cohort (N=398)

	Unadjusted Odds Ratio	Adjusted Odds Ratio (1)	Adjusted Odds Ratio (2)
Age			
Under 35(ref.)	1.00	1.00	1.00
35-49	1.14 (.80,1.62)	1.09 (.77, 1.54)	1.08 (.76, 1.53)
50+	1.58*(1.06, 2.35)	1.48+ (.99, 2.21)	1.47+ (.98, 2.19)
Gender			
Female(ref.)	1.00	1.00	1.00
Male	1.64** (1.23, 2.20)	1.64** (1.20, 1.51)	1.65** (1.21, 2.26)
Education			
Less than H.S.	.69 (.39, 1.22)	.78 (.46, 1.34)	.83(.49, 1.41)
Completed H.S. (ref.)	1.00	1.00	1.00
Poor Mental Health			
No(ref.)	1.00	1.00	1.00
Yes	.75* (.59, .95)	.80+ (.63, 1.01)	.80+(.63, 1.01)
Race/Ethnicity			
White(ref.)	1.00	1.00	1.00
Black	.68* (.47, .99)	.66* (.44, .99)	.64* (.42, .97)
Latino	.58* (.37, .90)	.54* (.32, .92)	.52* (.30, .90)
Region of Residence			
Suburban Rural(ref.)	1.00	1.00	1.00
Urban	.99 (.73,1.33)	1.25 (.89, 1.75)	1.24 (.89, 1.75)
Place of Birth			
U.S.	1.00	1.00	1.00
Puerto Rico	.72 (.39,1.32)	.94 (.44, 1.97)	.94 (.45, 1.98)
Other Country	1.47(.90, 2.38)	1.95* (1.14, 3.35)	1.96*(1.15, 3.36)
Recent Substance Use			
No(ref.)	1.00	1.00	1.00
Yes	.68* (.49, .93)	.74+ (.54, 1.01)	.73+ (.54, 1.00)
Housing Stability			
Stable(ref.)	1.00	1.00	1.00
Unstable	.68* (.47, .99)	.80 (.54, 1.18)	.81 (.55, 1.20)
Homeless	.55 (.25, 1.20)	.67 (.30, 1.50)	.68 (.30, 1.55)
Primary Care			
No(ref.)	1.00		1.00
Yes	1.43** (1.12, 1.83)		1.37* (1.08, 1.75)
Adequate HIV Care			
No(ref.)	1.00		1.00
Yes	1.33* (1.02, 1.73)		1.27+ (.98, 1.66)
(Observations)	(1,225 to 1,237)	(1225)	(1214)

+P<.1, *p<.05, **p<.01

Coefficients for AOR(1) and AOR(2) are adjusted for other variables listed in model

See Methodological Appendix for further details on model specification and interpretation of coefficients

Methodological Appendix

The ordered logit model procedure in Stata 12.0 was used to estimate the relationships between HAART use and potential determinants. The ordered logit model assumes that the ordered dependent variable, in this case HAART use, is a realization of an underlying continuous score, which we refer to as ART effectiveness. The ordered logit model estimates this underlying score (ART effectiveness) as a linear function of the independent variables. Model coefficients estimate how change in each independent variable alters the probability of observing each of the three HAART use outcomes. In Tables 2, 4, and 6 we report the exponential of the original coefficients that have the interpretation of odds ratios. In the ordered logit model the odds are proportional across outcome categories. That is to say the model assumes, for each independent variable, the change in the odds of HAART use is the same as the change in the odds of adherent HAART use. For example, in the leftmost column in Table 2, the coefficient for those 50 and older is the unadjusted odds ratio, 1.40. This means that compared to individuals under the age of 35, the model predicts that those 50 and older have a 40% increase in the odds of HAART use as well as a 40% increase in adherent HAART use. After adjusting for other participant variables, the increased odds of HAART (adherent) use for being 50 years or older declines to 31% , reflected by the 1.31 in adjusted odds ratio (AOR)(1) column, and to 27% after we add the two quality of care measures, reflected by the 1.27 in the AOR(2) column. Because the 95% confidence interval for each of these coefficients includes the other two coefficients, we are cautious in concluding that this decline in the coefficient age represents a real trend in the population. Standard errors and hence the 95% confidence intervals are adjusted for clustering of repeated observations within individual participants.