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Medical Services Utilization

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C.H.A.I.N. REPORT

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Introduction

Efforts are under way in New York City to intensify case finding and referral into care for HIV infected individuals who are currently not receiving medical care. These efforts will necessarily increase the demand for HIV medical care services by some as yet unknown amount. To assess whether the existing supply of medical providers in New York City competent to care for HIV patients is sufficient to manage an increased demand for their services requires information on three factors. First an estimate of the number of potential individuals who are infected but not in care (unmet need for medical care). Second an estimate of the amount of medical services that each newly found case would generate consistent with appropriate HIV care, and finally the capacity or more precisely the surplus capacity of the medical care system to meet the demand.

This study contributes information to the second factor–the demand for or use of medical services. Specifically, this report presents information on utilization of medical care based upon the experience of the CHAIN II cohort. Because of the broad base of its sampling frame, the CHAIN data set is an excellent source of information to approximate the medical care utilization of the general population of New York City HIV individuals. We use CHAIN data to identify a subset of participants who are free of any manifest impediments that limit access to ambulatory medical care at levels appropriate to treatment of HIV. For this group of CHAIN participants, those stably engaged in medical care, we estimate average visits to ambulatory care centers, emergency rooms and inpatient days. Among those with stable engagement in medical care, we next investigate possible variation in service utilization associated with potential determinants that are both directly relevant (e.g. co-morbid conditions) and irrelevant to medical care needs (e.g. race). We conclude this report with a illustrations of how these data may be used to estimate latent demand for medical services among HIV infected individuals who are not currently in care.

Key Findings

- CHAIN participants report an average of 5.16 visits to a physicians office during the six month period that preceded the interview. The number of visits ranged from no visits, reported by 3% of participants to 60. 50% of sample reported between 2 and 6 visits.

- 562 CHAIN participants were free of any indicators of impediments to medical care. These individuals average 5.58 visits for ambulatory care over six months compared to 3.98 visits for participants with one or more impediments to stable medical care.

- Among participants with stable engagement in medical care, a co-morbid health condition added approximately .56 ambulatory care visits over six months.

- Among those with stable engagement in medical care, low mental health functioning added .86 ambulatory care visits over six months.

- Stable engagement in medical care was associated with an average of .47 visits to the ER and 1.55 inpatient days in the previous six months. Both averages are lower than utilization for these services among participants with one or more impediments.

- Among a large number of variables examined for their associations with medical care utilization, access to a comprehensive medical care practice reduced the average number of visits, while unstable housing was associated with an increase in average number of visits.

- If CHAIN participants, who experience one or more impediments to medical care, had average medical care utilization similar to those with stable engagement, total ambulatory care visits would have increased almost 10% or by 611 visits above the actual number of visits of 6,378 reported for the six-month intervals preceding the two rounds of interviews. The hypothetically full engagement level would have been associated with a 6.8% predicted decline in visits to the emergency room, and a 13.3% decline in inpatient days.

- Using the models estimated for this study, we estimate that 1,000 newly identified HIV+ persons would generate between 10,380 and 12,020 additional ambulatory visits each year, assuming characteristics used to model utilization of medical services were similar to those for CHAIN participants with stable engagement in medical care.

- Study results suggest that stable engagement in medical care may reduce emergency room use and inpatient care. An unexpected finding was the association between access to comprehensive medical care and fewer medical care visits. Further study is needed to understand the significance of these findings, but they suggest that efforts to promote better organization of medical care may help to contain the number of medical care visits as well as reduce more costly visits to the ER and hospital stays.

Methodology

Data for this study were obtained from the first two rounds of interviews with the NYC CHAIN II cohort. This cohort of 693 was originally recruited and first interviewed during 2002 and 2003. During 2004-2005, 548 participants were re-interviewed. This represented an 89 percent completion rate among CHAIN II cohort members surviving and still living in New York City. To minimize the influence on summary statistics of a small number of individuals who provide unreliable reports of high levels of medical care utilization, we inspected all interviews in which a respondent reported more than 50 outpatient visits in the last 6 months. Ten interviews were dropped for lacked of supporting information to account for these extremely high levels of use. The final study sample includes 690 baseline interviews and 541 second round interviews.

Table 1 lists study variables and their operational measures. The CHAIN interviews

collect detailed self-reported information on use of a wide range of health services during the six months preceding each interview. For this study, medical care utilization is measured with respect to visits for ambulatory care, visits to emergency rooms, and days of inpatient care.

The remaining study variables are used to investigate the sensitivity of the medical care utilization measures to different factors routinely conceived to have some bearing on use of medical services. As a first step, we separate participants who give some indication of less than full engagement in medical care or of receiving sub-optimal HIV care. These indicators include lack of medical insurance, various measures of discontinuity in medical care, and an index capturing deviations from appropriate HIV care. Operational definitions for each of the five "impediments" are presented in the second panel of table 1. We classify participants who are "free" of all these impediments at the time of interview as "stable engagement medical care." Individuals with one or more of the above impediments are combined into a contrasting a group, which we label as "unstable engagement in medical care. The small number of participants (N=9), who shift between stable and unstable engagement between interviews are placed unto the unstable group.

Among participants with stable engagement in medical care, we examined factors that may indicate greater need for medical care, above and beyond treatment for HIV/AIDS. We examine whether the presence of one or more of the following co-morbid health conditions, low mental health functioning, low CD4 t cell counts, are associated with increased medical utilization. We also considered in this group of medically relevant factors, a quality of care measure: access to comprehensive medical care (see third panel of table 1 for definition). We next consider a set of variables that are routinely proposed as determinants of service utilization. These variables may function as proxies for real variation in medical care need or capture social disparities in access to needed medical care. For this study it is not important to definitively classify these variables in one or the other of these conceptual categories, but to recognize their potential role in influencing the level of use. These "confounding" variables are age, gender, race/ethnicity, unstable housing and current substance use. Operational definitions of these variables are presented in the fourth panel of table 1.

The analysis proceeded in three steps. First, we examined the observed distribution of use of the three services combining data from both rounds of interviews and then separately for participants that provided evidence for "stable" and "unstable" medical care engagement. Next we undertook regression analysis to model six- month rates of utilization for each of the services conditioned on various combinations of the study variables. Results of the regression analysis were used to estimate service utilization for selected sample characteristics. The results of the regression analysis were then used to estimate six-month service utilization rates and the corresponding 95% confidence interval for different subsets of the CHAIN cohort. The results of the regression analyses and discussion of the technical aspects of the estimation procedure are presented in the appendix to this study.

Table 1: Study Variables

Variable Name & Measurement
I. Service Utilization Measures (all measures refer to six-month period preceding interviews) • Ambulatory Medical Care : Number of visits to outpatient clinic including hospital or community health clinic, or neighborhood health center, or private doctor's office • Emergency Room Visits : Number of visits to ER • Inpatient Care : Number of overnight stays in a hospital
II. Medical Care Engagement status Stable access to HIV medical care is defined as the absence of all the following impediments a. Unconnected to medical care at time of baseline interview b. Uninsured at time of interview c. At a time of interview, did not have current HIV medical care d. At round two interview, reported experiencing a gap of six or more months between ambulatory care visits e. In last six months, did not get one or more of the following; blood work-up, physical exam, cd4 count, or viral load
III. Relevant Medical Care Factors (all measures refer to six-month period preceding interviews) Co-Morbid Chronic Health Conditions : at the time of interview, having problem with one or more of asthma, breathing problem, hypertension/high blood pressure /diabetes/arthritis or rheumatism, high cholesterol, or chronic sinusitis Low Mental Health Functioning : using MOS-SF36, mental health summary score < 37.0 (mean score seen in psychiatric inpatient populations) Low CD4 Count : CD4 count equal or lower than 200 Access to Comprehensive Primary Care : Reports HIV medical care that is coordinated (one provider in charge), comprehensive (access to preventive care and regular source of medical information or advice), and accessible (24hr emergency access) at time of interview
Utilization factors unrelated to medical care Sex : Male=1, Female=0 (transgender is recategorized by their biological sex) Age : Continuous variable Race/Ethnicity : Self reported race/ethnic identity(3 categories): African American, Hispanic, Non-Hispanic White/Other Unstable Housing : Individuals currently in a transitional housing program, a halfway house or drug treatment housing with no other address, or those temporarily doubled up with friends or family in someone one else's home. Or persons who describe themselves as homeless or report sleeping on the street, in a shelter, an SRO or welfare hotel, in an abandoned building, a public or private place (e.g. subway station, store) not intended for sleeping in last six months. Current substance use :use of heroin, cocaine/crack, or methamphetamine or five or more drinks weekly or more often, or positive on CAGE measure of problem drinking in last six months.

Results

Observed Use of Medical Care services

Table 2 presents descriptive statistics that summarize the central tendency of service utilization. Figures 1 through 3 complement table 2. They display histograms for each of the utilization measures that overlay frequency distributions for stable and unstable engagement in medical care. Combining first and second round interviews, participants reported from none to 60 ambulatory care visits over a six-month period, with 50 percent concentrated between 2 and 6 visits, for an average of 5.16 visits. Most individuals either reported not going to the emergency room (67%) or going at most once. Overall, CHAIN participants averaged .5 visits to the emergency room over six months. Similarly only a small percentage of individuals, 20%

Table 2: Medical Service Utilization Summary Statistics

	Ambulatory Care Visits	Emergency Room Visits	Inpatient Days
All Interviews (N =1,231)			
Mean (S.D.)	5.16 (6.13)	0.50 (1.07)	1.55 (6.09)
% Zero	3.0%	66.9%	80.4%
Interquartile Range (25%, 75%)	(2,6)	(0,1)	(0,0)
95% Confidence Interval	(4.85, 5.51)	(0.46, 0.56)	(1.45, 1.67)
Stable Engagement in Medical Care (N =909)			
Mean (S.D.)	5.58 (6.64)	0.47 (0.98)	1.36 (5.63)
% Zero	3.5%	67.5%	80.6%
Interquartile Range	(2,6)	(0,1)	(0,0)
95% Confidence Interval	(5.15, 6.01)	(0.41, 0.53)	(0.99, 1.72)
Experience one or more impediments to stable engagement in medical care (N = 322)			
Mean (S.D.)	3.98 (4.19)	0.60 (1.27)	2.10 (7.22)
% Zero	1.6%	65.2%	79.8%
Interquartile Range	(1,6)	(0,1)	(0,0)
95% Confidence Interval	(3.53, 4.44)	(0.46, 0.74)	(1.31, 2.89)

N is based on interviews completed over two rounds of interviews

Figure 1*:* Ambulatory Care Visits

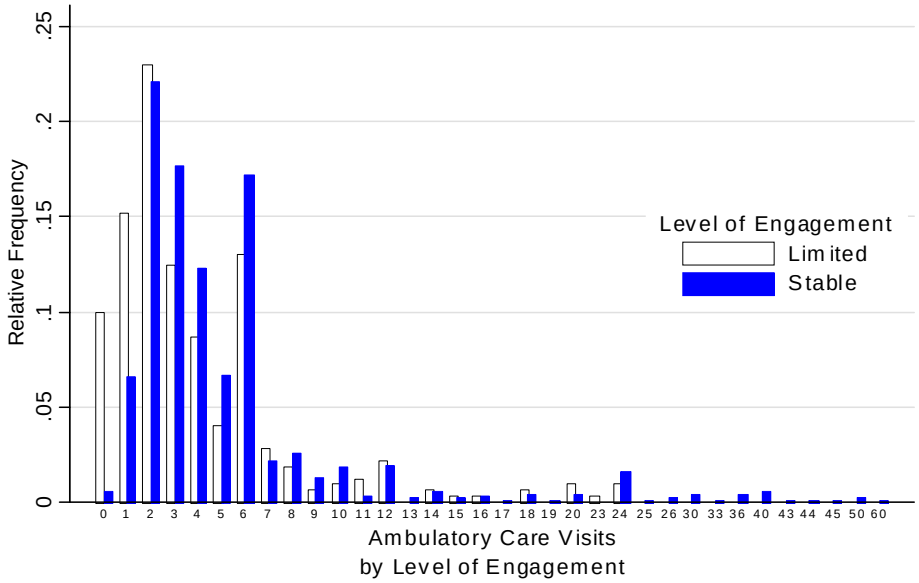


Figure 2: Emergency Room Visits (Interviews reporting 1 or more visits)

No Emergengcy Vistist reported in 67% of interview

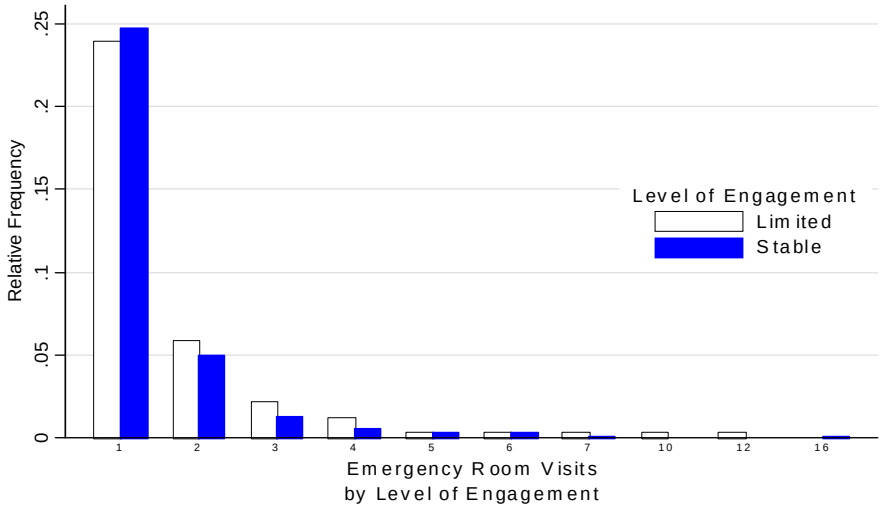
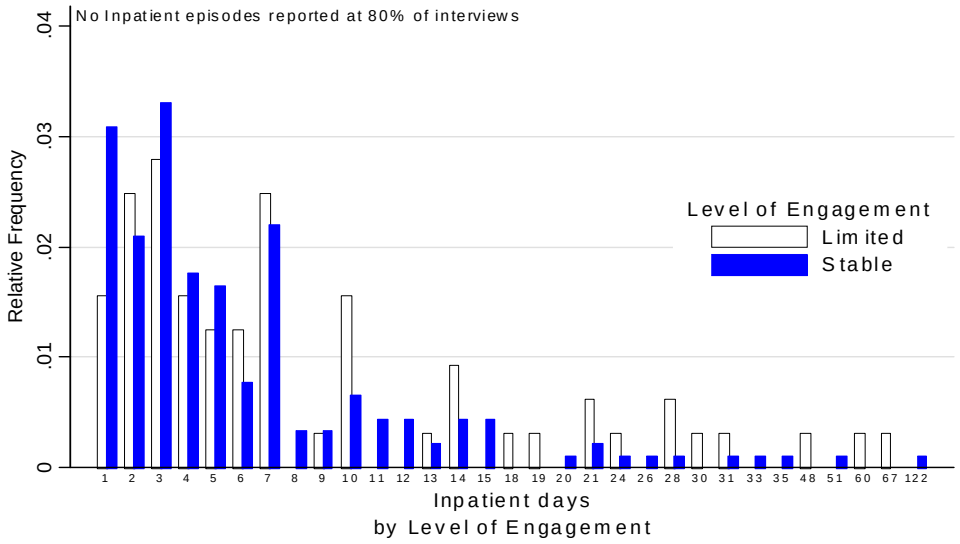


Figure 3: Inpatient Care (Interviews reporting one or more inpatient days)



reported even a single overnight stay in the hospital. CHAIN participants averaged 1.55 inpatient days over six months.

The bottom two-thirds of table 2 indicates, as expected, a substantial reduction in ambulatory care visits associated with medical care impediments. CHAIN participants with stable engagement in medical care average of 5.6 ambulatory care visits over six month compared with just under 4 visits for those with one or more impediments. Figure 1 illustrates that there is an excess of the unstably engaged with zero or one visits, while high volume users of ambulatory care services are virtually all stably engaged In contrast, stable engagement in medical care has a contrary effect on emergency room and outpatient utilization, as unstable engagement is associated with non-trivial increases in the average use of these services. Although the percentage of individuals not using either of these services is the same for both stable and unstable engagement, Figures 2 and 3 show that the higher use rates associated with unstable engagement is the result of excess numbers of the unstably engaged among the high volume users of these services.

Subgroup variation in medical care utilization

The top half of table 3 illustrates that each impediment is associated with sharply lower ambulatory care visits. For instance, individuals without medical care at baseline or follow-up interview reported an average of about 2 visits over 6 months, less than half the number of visits for those with stable engagement in medical care. In contrast each impediment is associated with increased use of emergency rooms. The reliance on emergency room is most pronounced among the small number of individuals that were uninsured or unconnected with medical care at

time of baseline survey. The impediments have a more inconsistent pattern with inpatient care. The anomalous impediments, being uninsured and lacking a current HIV care provider might be better interpreted as a result rather than a cause of hospitalization. Once hospitalized, the previously uninsured patient will be enrolled in medicaid and will undoubtedly be referred for outpatient care post-discharge.

The lower half of table 3 presents estimated utilization levels for CHAIN participants grouped by the presence or absence of medical complications associated with co-morbidities and mental illness. Our general expectations are born out. Among individuals with stable engagement, both complications independently increase the number of ambulatory visits. Thus individuals with no complications on average report just under 5 ambulatory visits during a six-month period compared to an average of 6.7 for individuals who report both a co-morbidity and low mental health functioning. These conditions have a measurable impact on increased visits to the emergency room. The pattern of results for inpatient care are more difficult to interpret. Somewhat unexpectedly co-morbidities does not impact on length of inpatient stays, where as low mental health functioning almost doubles the average length of days in a hospital compared to individuals with medical complications unrelated to HIV infection. Some caution should be applied in interpreting mental illness as the causal agent in this association. It is quite possible that low mental health functioning might be a consequence of a poorer mental outlook following extended hospitalization for treatment of an AIDS-related health condition.

Table 3: Selected Subgroups Utilization: Mean and (95% C.I.)

	Ambulatory Care Visits	Emergency Room Visits	Inpatient Days
Impediments to Engaging in Medical Care			
Unconnected to medical care at Baseline Interview	1.9 (1.1,3.6)	.82 (.39,1.75)	4.76 (3.80,8.07)
No Current HIV Care provider	2.2 (1.4 3.5)	.78(.44,1.35)	.48 (.25,.92)
Gap of 6 or more months between Medical care visits	4.1 (3.4,5.0)	.61 (.46,.81)	3.17 (2.62,2.83)
Uninsured	2.8 (1.1,7.1)	1.2 (.42,.3.55)	00
Inadequate HIV Medical Care	3.7 (3.2,4.3)	.58 (.45,.74)	2.03 (1.70,2.44)
Selected subgroups among those with Stable Engagement in Medical Care*			
No other Conditions	4.94 (4.4, 5.6)	.3 (.25,.39)	1.04 (.89,1.22)
Other Co-Morbid Health Conditions	5.5(5.0,6.2)	.42(.35,.51)	.97 (.84,1.11)
Low Mental Health Functioning	5.8 (4.9,6.9)	.52 (.39,.68)	2.05 (1.69,2.50)
Both Co-morbidity and low mental health functioning	6.7 (5.8,7.62)	.71 (.58,.88)	1.88 (1.60,2.20)

* Other covariates are access to comprehensive medical care and current cd4 t-cell counts less than 200.

The influence of other factors on medical care utilization

The average change in medical care estimated for mental health status and presence of co-morbidities are based on regression equations that include adjustments for low CD4 counts and access to comprehensive medical care. A CD4 t-cell count less than 200 has no bearing on ambulatory visits but it does increase both emergency room visits and length of inpatient stays (see tables A.2, A.3 and A.4). In contrast, access to comprehensive medical care operates contrary to expectations, as it is associated with a reduction in ambulatory visits but an increase in length of inpatient stay.

Results of the regression analysis further indicate that the remaining covariates examined for this study have minimal impact on the use of ambulatory care or emergency room use (see tables A.2 and A.3). Unstable housing has a marginal impact on increased use of ambulatory care services and emergency rooms. Women frequent emergency rooms more than men . In contrast to ambulatory care and emergency room services, inpatient care has a much stronger social determinant component(table A.4). Specifically, the number of inpatient days is higher among younger members of the cohort, females, Latinos, current substance use, unstable housing conditions.

Simulating new demand for medical care services

Table 4 and 5 present different ways the preceding analysis may be used to project demand for medical services associated with policy changes intended to aggressively engage HIV+ individuals who were marginally connected to or not in care. We first consider in table 4 change in aggregate level use of medical services reported by CHAIN participants for the two rounds of interviews that would have resulted had the unstably engaged had rates of utilization comparable to those stably engaged, keeping unchanged the former group's prevalence of co-morbid conditions and low mental health functioning. Given this scenario, the number of ambulatory visits would have increased by about 10% for an additional 611 visits, while both Emergency room and hospital stays would have decreased during this period.

Table 5 presents projections of annualized medical care utilization for several alternative scenarios. These projections are based upon the models predicting medical care utilization for CHAIN participants with stable engagement that are presented in the appendix and the procedures for making these projections are detailed in the appendix, as well. The first scenario assumes the mix of individual characteristics affecting utilization as CHAIN participants with stable engagement in care. For example under this scenario 61percent of individuals have one or more co-morbid conditions and 33 percent experience poor mental health function. Such a hypothetical group of 1,000 we estimate might make between 10,380 and 12,020 ambulatory care visits, with an average of 11,180. In addition they would make 840 visits to the emergency room and spend collectively 2,240 days in hospital. The second row in table 5 presents similar estimates for a hypothetical group of 1,000 that had the attributes of the unstably engaged CHAIN participants. In comparison with the stably engaged group, in this scenario, 53 percent of individuals have co-morbid conditions and 39 percent experience low mental health

Table 4: Actual and "Full" CHAIN Sample Medical Care Utilization

	Ambulatory Care Visits	Emergency Room Visits	Inpatient Days
1. Total Utilization: Stable Engagement Participants (N of Interviews=909)	5,090	427	1,236
2. Total Utilization: Unstable Engagement Participants (N Interviews= (322)	1,288	193	676
3. "Full" Utilization for Unstable Engagement participants assuming rates for Stable Engagement	1,899	151	422
4. Change in Utilization based on Full Stable Engagement. (3 -2)	611	-42	-254
5. Change in Utilization as % of Actual Use 5 / (1+2)	9.6%	-6.8%	-13.3%

Note: The total utilization are based upon six-month utilization rate for two rounds of interviews

Table 5: Annualized Medical Care Utilization per 1,000 individuals Based on Rates for Stable Engagement in Medical Care (Mean and 95% C.I.)

	Ambulatory Care Visits	Emergency Room Visits	Inpatient Days
1. Assuming Characteristics of CHAIN Participants with Stable Engagement in medical care	11,180 (10,380,12,020)	840 (740,960)	2,260 (2,040, 2,500)
2. Assuming Characteristics of CHAIN Participants with one or more impediments to stable engagement.	11,640 (10,740,12,620)	880 (760,1,020)	2,500 (2,240, 2,760)
3. With one or More Co-Morbid Conditions*	11,300 (10,120, 12,620)	860 (720,1,040)	1,920 (1,660, 2,220)
4. Low Mental Health Functioning*	11,360 (9,600,13,420)	1,000 (760,1,320)	4,100 (3,360, 4,980)
5. Co Morbid and Low Mental Health*	13,100 (11,440,15,020)	1,420 (1,160,1,740)	3,820 (3,260,4,480)
6. HIV only*	9,780 (8,640,11,100)	620 (480,780)	2,060 (1,760, 2,420)

*CD4 below 200 and access to comprehensive medical care are set to their sample means.

functioning. Under this scenario, the number of ambulatory visits declines slightly with compensating increases in emergency use and inpatient days. The remaining rows present projections in which all or none of the members of hypothetical population have either or both co-morbid conditions and/or low mental health functioning. These projections are useful in assessing the sensitivity of our analysis to assumptions about the mix of additional medical complications. An additional 1,500 ambulatory visits are projected when a cohort of 1,000 with a either a co-morbid condition or low mental health condition are compared with a cohort free of both these conditions. By combining projections for each of the groups in rows 3 to 6 it is possible to estimate service demand for composite cohorts with various combinations of co-morbid conditions and low mental health functioning.

Conclusion

In this report, CHAIN interview data are used to measure demand for HIV medical care. This empirical based approach to estimating medical care utilization may be contrasted with one based upon expert opinion as codified in best practices guideline. Here, CHAIN members' self reports of medical care history are the basis for estimating levels of utilization. We interpret these findings as a valid and reliable indicator of the standard of HIV care as practiced by New York City physicians. Our first step was to remove from the analysis, CHAIN participants experiencing one or more indications that they were experiencing impediments to full access to effective HIV care. Removing these individuals from the analysis created a subset of individuals that we characterized as having a stable engagement in medical care. For policy purposes, this analytical sample yields estimates of utilization that are more in line with levels for appropriate medical care for persons living with HIV/AIDS. CHAIN participants stably engaged in medical care averaged between 5 and 6 visits for ambulatory care in a six month period preceding the interviews. A mean value that is substantially higher than that for the CHAIN participants removed because of evidence for unstable or impeded access to medical care. On average, the sample experienced just under a half a visit to the emergency and 1 and 1/3 days of inpatient care. There are obviously wide variations in individual levels of use around these mean values. The great majority of the sample neither visited emergency rooms nor spent any time in a hospital. There are also only a small number of high volume users of these services.

We refined the analysis to assess the sensitivity of the average use levels to variation in non-HIV health conditions and individual characteristics known to affect use of medical care apart from care needed to treat HIV. Extrapolating these findings to New York City in general, we estimated that each 1,000 new cases referred for medical care will generate anywhere between 10,000 and 12,000+ ambulatory visits based upon what appears to be levels consistent with the provider norms for appropriate HIV care

Interesting side lights to the analysis include findings that the increased ambulatory care among the stably engaged was associated with a desirable decline in emergency room use and inpatient stays, when compared to the subset of individuals excluded from the analysis because of unstable engagement in medical care. Our index of comprehensive medical care was unexpectedly associated with a lower number of ambulatory visits accompanied with longer

inpatient stays. Both of these findings merit further investigation before drawing definitive conclusions.

The CHAIN dataset has both strengths and limitations for this purpose. A major strength of the CHAIN cohort is its excellent representation of broad spectrum of New York City residents living with HIV/AIDS, who are engaged in medical care. Combined with a the rich interview data, it is possible to compare various empirical scenarios for populations with different mixes of individual characteristics that are selected because of their potential influence on use of medical care services. The repeated nature of the interviews increases the reliability of each individual's reported use of medical services. The relatively large sample size and rich data for measuring determinants of medical care utilization offers opportunity for both sensitivity analysis as well as separate extrapolation of use for subgroups of interest. The interview data has the further benefit of being able to estimate usage across multiple provider agencies. Agency records including CARE Act encounter data and medicaid claims might be regarded as more accurate counts, but these sources cannot be assumed to completely cover all sources of medical care.

On the negative side the study relies on possibly faulty recall of number of episodes of medical care over a six months. This is evident in the spike at six months in the ambulatory care histogram in figure 1. This discontinuity in the distribution curve suggests that many respondents adopted the cognitive strategy of estimating that they went to a doctor's office or clinic on average of once per month and then multiplied to elicit the 6-month count. Extrapolation outside the CHAIN sample adds the additional uncertainty that the characteristics of new HIV cases that affect service utilization are not known and may differ from those of the CHAIN sample. Fortunately, by simulating projected utilization for different mixture of individual characteristics a range of likely values can be generated as a basis for assessing the sensitivity of our estimates to variation in population characteristics. Despite these shortcomings, the estimates developed in this report, do provide some empirical grounding for policy discussion about the level of increased demand for medical services that might result for improved case finding and referrals.

Appendix: Methods of Analysis and Estimated Equations.

Regression Methodology

We applied multiple regression methodology to project expected medical care service utilization. Single regression equations model hypothesized sources of systematic variation in use of medical care services. The estimated regression equations for the CHAIN cohort are then used to predict expected use of medical care services for various patient characteristic combinations. The uncertainty of the projections are taken into account both by considering different patient case mixes and computing 95 percent confidence intervals (95% C.I.) for each projection.

The regression equations were estimated using the population averaged variant of the Generalized Estimation Equation(GEE) that assumes the error term follows a negative binomial distribution as implemented in STATA 9.0's panel analysis suite (xt). The negative binomial distribution was selected in preference to the more common normal distribution because the former better approximates the distribution of the dependent variables, which are count data. The GEE estimator adjusts from clustering resulting from repeated observations for many of the survey participants. The regression model assumes a log linear relationship between the independent variables and the outcome variables. The table reports the estimates of the original coefficients. Negative values indicated an increases in the independent variable is associated with lower values on the independent variables. The exponential form of the coefficients are more easily interpreted as the relative impact of each independent variable on expected frequency or incidence of the outcome measure.

Table A.1 presents the estimated coefficients for a series of models estimating the effects of each impediment variable separate and then an index variable that compares individuals with one or more of the impediments with those free of all impediments. Three regression models were estimated for each of the three service utilization measures (ambulatory care visits, ER visits, and inpatient days) restricted to individuals free of all impediments. The first model included just the medically relevant variables. The second include the remaining variable, and the third estimates the full complement of variables. Table A.2, Table A.3 and Table A.4 report results of the regression analyses for ambulatory care visits, emergency room visits, and inpatient days.

The projections of utilization of services in Tables 4 and Table 5 were calculated based on best fitting, predicted values from the regression models in Table A.2, Table A.3 and Table A.4 along with upper and lower bounds of the 95% confidence intervals.

Projection Methodology.

The projections in Tables 4 and 5 extrapolate from the utilization model fit the sub sample of stably engaged CHAIN cohort requirements. The steps in projecting utilization are 1) estimate a model for a specified a set of independent variables, 2) calculate predicted values for individuals based upon a given set of values on the independent variables, 3) if one or more of

the independent variables vary across individuals, average the individual-level predictions. The generic formulation is:

$$E(Use) = \sum_{N} f(\text{a, bX=x}_{i}\text{,,bX=x}_{i2})/\text{N}$$

Parallel formulae are used to estimate the upper and lower bounds for the 95% C.I. These values are multiplied by 1,000 to derive the utilization per 1,000 population. Specifics of the calculation for Tables 4 and 5 are presented below.

Table 4

Lines 1 and 2 in table 4 are the observed or actual utilization levels reported by the stable engagement (N=909 interviews) and unstable engagement (N=322 interviews) CHAIN cohort subgroups. Line 3, reports a counterfactual condition, "full" utilization levels for the unstable engagement individuals had they experienced the same average rate of utilization as the stably engaged after adjusting for differences in CD4 counts, mental health status, presence of co-morbidities and access to comprehensive care, mental health status. The values on line 3 are derived from use levels for each interview with an unstable engaged participant predicted from Model 1 in Tables A.2, A.3, and A.4, fitted to the stably engaged sample, where values for the independent variables as those actually reported for each completed interviews. The predicted values are then summed across all interviews with unstably engaged respondents. This sum, results in the number of medical care encounters that would have occurred had the unstably engaged experience the same utilization rate as those stably engaged in medical care.

Table 5

The projected annualized utilization rates per 1,000 individuals in lines 1 and 2 of table 5 are extrapolations based on the mix of characteristics for the stably and unstably engaged participants, respectively. Line 1 is predicted utilization level based on Model 3 in tables A.2 to A.4, when all the independent variables are set to the average values for stably engaged participants. The predicted utilization and the upper and lower bounds of its 95% confidence interval are then doubled and multiplied by 1,000 to obtain the annualized rate per 1,000 patients.

Line 2 is calculated in the same way except the independent variables are set to the average values for the unstably engaged participants.

Lines 3 and 6 project levels of utilization for hypothetical populations in which all individuals have both, one or the other or neither low mental health functioning or a co-morbid health conditions. These projections use Model 1 in Tables A.2 through Table A.4 in which we set to "1" or "0" the low mental health functioning and co-morbid condition variables that correspond to the desired presence or absence of these complicating factors. In all projects, low CD4 t-cell count and access to comprehensive care are set to their means in the stable engagement sample.

Table A.1: Negative Binomial Regression of Impediments to Medical Care and service utilization measures. (coefficient and standard error)

	Ambulatory Care Visits	Emergency Room Visits	Inpatient Days
Delayed Accessing medical care 3 or more months	0.005 (0.073)	0.95 (0.11)	-0.02 (0.08)
Unconnected to Medical Care	-0.86*** (0.23)	0.44 (0.29)	-1.19*** (0.33)
6 or more months with ambulatory Care Visits	-0.23* (0.10)	0.26+ (0.16)	1.10*** (0.11)
Lacks HIV Medical Provider	-0.98** (0.31)	0.50 (0.39)	1.15*** (0.27)
Inadequate HIV Care	-0.39*** (0.09)	0.16 (1.14)	0.32** (0.10)
Uninsured	-0.62 (0.48)	0.89 (0.55)	-9.56 (38.9)
Experience one or more impediments to medical care	- 0.33*** (0.07)	0.22+ (0.11)	0.43*** (0.08)

+ p<.1 * p < .05 ** p < .01 *** p < .001

Table A.2: Negative Binomial Regression Models of Ambulatory Care Visits for Individuals with Stable Engagement in Medical Care (coefficient and standard error)

	Model 1	Model 2	Model 3
Co Morbid Health Conditions	0.14+ (0.08)		0.13 (0.08)
Low Mental Health Functioning	0.15+ (0.08)		0.16* (0.16)
Access Comprehensive Medical Care	-0.34*** (0.09)		-0.32*** (0.09)
CD4 T-Cell Counts < 200	0.07 (0.09)		0.06 (0.09)
Age		0.00 (0.00)	0.00 (0.00)
Sex (Male=1)		-0.13+ (0.08)	-0.06 (0.08)
Race/Ethnicity African American Latino Non-Hispanic White or Other (Reference)		 -0.01 (0.13) -0.11 (0.13) .00	 0.01 (0.13) -0.09 (0.13) .00
Unstable Housing		0.18* (0.09)	0.15+ (0.09)
Current Drug Use		-0.03 (0.09)	0.00 (0.09)
N=	860	909	860

+ p<.1 * p < .05 ** p < .01 *** p < .001

Table A.3: Negative Binomial Regression Models of Emergency Visits for Individuals with Stable Engagement in Medical Care (coefficient and standard error)

	Model 1	Model 2	Model 3
Co Morbid Health Conditions	0.34* (0.13)		0.28* (0.14)
Low Mental Health Functioning	0.50*** (0.13)		0.42** (0.42)
Access Comprehensive Medical Care	-0.19 (0.14)		-0.17 (0.15)
CD4 T-Cell Counts < 200	0.44** (0.14)		0.38** (0.15)
Age		-0.01 (0.01)	-0.01 (0.01)
Sex (Male=1)		-0.61*** (0.13)	-0.52*** (0.14)
Race/Ethnicity African American Latino Non-Hispanic White or Other (Reference)		 -0.16 (0.22) 0.06 (0.22) .00	 -0.04 (0.23) 0.12 (0.23) .00
Unstable Housing		0.25+ (0.14)	0.25+ (0.15)
Current Drug Use		0.07 (0.14)	0.02 (0.15)
N	860	909	860

+ p<.1 * p < .05 ** p < .01 *** p < .001

Table A.4: Negative Binomial Regression Models of Inpatient Days for Individuals with Stable Engagement in Medical Care (coefficient and standard error)

	Model 1	Model 2	Model 3
Co Morbid Health Conditions	-0.07 (0.10)		-0.06 (0.10)
Low Mental Health Functioning	0.69*** (0.10)		0.49*** (0.10)
Access Comprehensive Medical Care	0.33** (0.12)		0.40** (0.12)
CD4 T-Cell Counts < 200	0.82** (0.10)		0.78*** (0.11)
Age		-0.02*** (0.01)	-0.02** (0.01)
Sex (Male=1)		-0.25** (0.09)	-0.24* (0.10)
Race/Ethnicity			
African American		.10 (0.17)	.23 (0.18)
Latino		0.71*** (0.17)	0.67*** (0.18)
Non-Hispanic White or Other (Reference)		0.00	0.00
Unstable Housing		0.25* (0.11)	0.30** (0.11)
Current Drug Use		0.73*** (0.11)	0.62*** (0.12)
N	860	909	860

+ p<.1 * p < .05 ** p < .01 *** p < .001