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The Young and the Care-less?:
Youthfulness as a predictor of poor linkage to community-based HIV care among seropositive jail releases in the EnhanceLink cohort

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ABSTRACT

The Young and the Care-less?:
Youthfulness as a predictor of poor linkage to community-based HIV care among seropositive jail releases in the EnhanceLink cohort

By Simona Goldman Lang

The US currently experiences a dual epidemic of incarceration and HIV/AIDS. Due to highly transitional jail populations and disruption in access to HIV care caused by incarceration, linking HIV-infected inmates to care both poses an important public health challenge. Youthful clients face additional challenges to accessing care. Data from the national, 10-site EnhanceLink demonstration project intending to promote linkage to HIV primary care were analyzed to explore associations between youthfulness and linkage to community-based HIV care after jail release. After excluding individuals not discharged and with missing age data, 1,072 participants were eligible for analysis. The majority of the participants were Black, male, and reported substantial mental health and drug use burdens. In univariate analysis, younger ages were highly predictive of unsuccessful linkage to both HIV medical care and case management services. Multivariate logistic regression identified factors associated with linkage to an HIV care provider or case manager 30 days post-discharge and linkage to CD4 count or viral load laboratory-based testing 6 months post discharge. Youthful age (< 30 years old) was significantly associated with not linking to an HIV care provider (aOR = 0.45, 95 % CI 0.22–0.93). Hispanic identity and prior HIV care were correlated with linkage to HIV provider care while longer length of jail stay was associated with linkage failure. Clients under 30 years old were also less likely to have linked to HIV laboratory measures testing compared to those 50 or older (aOR = 0.41, 95 % CI 0.21–0.77). Results of a sub-analysis indicate that young clients who met with a case manager were more likely to link to laboratory-based care compared to young clients with no interaction with community-based case management (aOR = 10.69, 95% CI 2.53, 45.10). The results of this non-controlled, observational study suggest that younger individuals experience poorer care linkage and may benefit from increased services or tailored assistance in order to achieve successful linkage to HIV care after jail release. The findings advocate for the development and evaluation of linkage programs that aid HIV-positive individuals, particularly those under 30, in the transition from jail to community.

The Young and the Care-less?: Youthfulness as a predictor of poor linkage to community-based HIV care among seropositive jail releases in the EnhanceLink cohort

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BACKGROUND

The U.S. maintains the highest incarceration rate of any industrialized country, creating a 'Prison Industrial Complex' in which 1 out of every 34 adults is under correctional supervision (including parole and probation) (1). Most recent data from the United States Bureau of Justice Statistics indicate that close to 12 million persons were admitted to jails in 2011 (2). Jails, short-term correctional facilities which house those awaiting trial or with brief sentences, have an average daily census of over 725,000 detainees, which, when contrasted with the annual admittance, indicates both a high turnover rate and a highly transient population (2, 3). In fact, there is a great diversity in release patterns for this population and, compared to prison, the length of stay is significantly shorter. Half of jail inmates are released within 2 days and the median length of stay for felony defendants is one week (4-6). This 'epidemic' of mass incarceration in the US, driven largely by drug policies, longer sentences, and stricter probation/parole rulings, has severe implications for public health both within and outside of the criminal justice system (CJS) (7).

In the US, correctional populations bear a larger burden of disease than the general population for both physical and mental health conditions (8, 9). One of the major public health challenges in correctional settings is disproportionately high levels of infectious disease. Human Immunodeficiency Virus/Acquired Immunodeficiency Syndrome (HIV/AIDS) is one such condition disproportionately experienced by incarcerated individuals. In 2006, 1 in 6 HIV-positive adults served time in the CJS (3). HIV seroprevalence among incarcerated individuals was 1.5%, three-fold greater than that of the general population, and prevalence of AIDS was 0.5% in 2010 (10, 11). The

high burden of disease in this population can be explained in part by the fact that many of the prosecuted activities leading to incarceration are often also risk behaviors for HIV transmission, such as intravenous drug use and commercial sex work (12). The dual epidemics of incarceration and HIV work to create in this population a significant public health challenge.

Given the large number of individuals passing through per year and the high burden of HIV in this population, the CJS can be considered an ideal intervention point for HIV diagnosis and subsequent linkage to care. For many individuals, the CJS represents a first meaningful interaction with the healthcare system and access to HIV care specifically (13). Over 40% of HIV-positive inmates initially received their diagnosis within a correctional facility and, according to recent analyses, up to 1.4% of all positive HIV test results were new diagnoses (14). Linkage to timely HIV care is crucial for optimal health outcomes. Pharmaceutical advances in antiretroviral therapy (ART) significantly reduce HIV-associated mortality and have also been shown to decrease transmissibility - both beneficial to individuals as well as their communities and sexual or drug partner networks. Nevertheless, these benefits of treatment require access to and engagement with consistent care (15, 16). The guaranteed receipt of HIV care while incarcerated is a legally protected right and serves to greatly increase the ability of individuals to access ART and begin managing their diagnosis while incarcerated (17). However, considering the frequent, dynamic movement of inmates between jail and their communities, the provision of care solely through the CJS is inadequate. Possible barriers to linking to community-based HIV care for correctional populations include past incarceration history and high level of involvement in the CJS, substance use, lack of

health insurance, mental health conditions, lower socio-economic status, homelessness, and racism/discrimination (15, 16, 18-21). The above variables have each displayed significant associations with poorer linkage to care and tend to be experienced in large proportions by correctional populations. Incarceration acts as a major life disrupter, especially for those who frequently cycle in and out of the CJS. In this sense, incarceration not only interrupts normal daily functions but directly disrupts connections to healthcare within the community. Correctional settings have the potential to impact continuity of care and decrease obstacles to care through effective transitional interventions geared toward HIV-positive inmates and releasees (3, 22).

Understanding the factors that are associated with successful engagement with HIV care will allow programs in correctional facilities to focus efforts on creating effective linkages. Current research in the field suggests that some significant factors associated with linkage to care include provision of HIV and ART education to inmates and operationalization of discharge planning for releasees, including staff knowledge of release timelines (23). As discussed previously, there are many barriers to linkage. A study in Los Angeles County indicated that the prevalence of lack of retention in care was greater for those who used injection drugs, were diagnosed at a public facility, or were less than 45 years old (24). While most of these associations are corroborated in other studies, youthfulness is often not assessed as a predictor of linkage or retention in care or it fails to maintain significance in regression analyses (25-28).

Studies in non-correctional populations suggest that men and younger adults struggle to efficiently access health services or fail to follow up with care, particularly with regard to their HIV diagnoses (29-31). An age-based dichotomy that has emerged

from the literature points out that while delayed linkage was associated with older ages, younger ages were associated with worse retention in HIV care within the first two years after diagnosis (32, 33). Other studies showed ages over 35 years as protective against the difficulty of establishing care and significantly more likely to have attended multiple visits to an HIV care provider compared to younger ages, which remained an indicator of poor linkage to care in both univariate and multivariate analyses (34, 35).

Although youthfulness has yet to be explicitly analyzed, correctional populations appear to exhibit similar trends in linkage to care. A San Francisco County jail-based study found that older ages were more likely to be on continuous ART versus intermittent or never initiated treatment (17). In another EnhanceLink analysis, younger ages were found to be associated with a decreased likelihood of advanced HIV of about 40% (16). However, this protective effect is likely not due to better engagement with care at younger ages but simply that HIV disease has not yet progressed for younger individuals. In fact, older ages were found to be associated with a decreased likelihood of uncontrolled viremia, a viral load of greater than 400 copies, of about 60%, indicating that older ages are more likely to be in care and on antiretroviral therapy, giving further evidence to the hypothesis that youthfulness is associated with poorer linkage to care.(16).

A retrospective cohort study of HIV-infected prison releasees in Texas reported that only 20% enrolled in an HIV clinic within 30 days of release and that inmates over 30 years old were twice as likely than their younger counterparts to have enrolled in care within 30- or 90-days (36). Consistent with other studies, this finding provides initial evidence about the relationship between youthfulness and linkage to care among

incarcerated populations. However, as far as the authors are aware, there have been no studies directly investigating the role of age or youthfulness in HIV care linkage in jail populations or the mechanisms through which it may impact provider visits, viral suppression, ART uptake, CD4 count, and future retention in care. To address this gap in the literature, the present study intends to examine the relationship between linkage to care and youthfulness and to explore its underlying mechanisms.

In order to examine this relationship, data from the EnhanceLink project, a multisite study of HIV-positive jail inmates, were analyzed. The aims of this study included exploring the associations between the exposures of youthfulness and youthful incarceration history and evidence of linkage to community-based HIV care.

METHODS

Setting, Participants, and Data Collection

EnhanceLink, a demonstration project funded by the Health Resources and Services Administration's (HRSA) HIV/AIDS Bureau, seeks to appraise the feasibility and effectiveness of models of HIV-testing and interventions that promote linkages to HIV healthcare for HIV+ jail releases (37). As previously described, ten project sites, comprised of AIDS service organization, health department, or university grantees partnered with local jails, developed various interventions to enhance linkage to community-based HIV care services (12, 37). These sites were located in Atlanta, GA; Chester, PA; Chicago, IL; Cleveland, OH; Columbia, SC; New Haven, CT; New York, NY; Philadelphia, PA; Providence, RI; and Springfield, MA.

HIV-positive jail entrants were recruited to participate in voluntary evaluations of their experiences in linkage programs. Enrollment criteria for this client-level observational study varied across study sites however participation was limited at all sites to persons 18 years or older (37). Data on this population of 1,270 men and women were collected between January 2008 and October 2011 through administration of a baseline survey with questions regarding demographic characteristics, employment, history of criminal justice involvement, mental and physical health, substance use, and HIV care as well as through medical chart reviews of all clinical data recorded during the client's index incarceration and documentation of all jail-based and community-based encounters with program staff.

For the present study, only participants with evidence of discharge from jail to the community were eligible for analysis, to ensure that the sample includes those who would

have had the opportunity to link to community-based HIV care (Figure 1). As a result, 188 clients were excluded based on available discharge data. Reasons for ineligibility varied and included transfer to prison or a locked or non-participating correctional facility, continued jail time at the end of the observation period, refusal of further participation or resettlement outside of a grantee site's range of service, deportation, and death (38). Univariate and multivariate analyses included only those with data on age, yielding a final sample size of 1,072 clients.

Variables Used in Analysis

Measures of youthfulness, the exposure of interest in this study, included age at index incarceration (the incarceration event during which the client was enrolled into the EnhanceLink study) and age at first arrest. Age at index incarceration was dichotomized from continuous integer age as young and not young based on a mean of 42 years for the baseline comparisons. For univariate and multivariate analyses, age was divided by decades into 4 categories, under 30, 30-39, 40-49, and 50 and older. The oldest group (50+) acted as the reference category due to literature evidence of youthfulness as a risk factor for poor linkage. The variable for youthful criminal justice involvement was dichotomized from continuous integer age at first arrest as juvenile and adult based on 18 years, the age of majority in the United States.

The outcome of interest was initial linkage to care within 30 days post-release from the index incarceration. The type of care included both HIV-specific services through a medical provider as well as case management services. For the analysis, a participant was considered linked to care if he/she attended the first appointment with an

HIV care provider or if he/she met with a case manager within 30 days after release from jail. In population-level monitoring, the definition of 'linked to care' has been a central question. Some studies based on HIV surveillance data have used the receipt of at least 1 or 2 or more CD4 or viral load (VL) tests to indicate linkage because they do not have records of patient visits (39). In multivariate modeling, this study has included a third outcome measure, laboratory-based linkage, to align with this trend in the literature. Linkage was considered successful if there was a record of at least 1 CD4 or VL blood draw in the 6 month follow-up period after release. While virulogic and immunologic outcomes have also been used to demonstrate linkage, these measures may not account for initial variation in CD4 count or VL between participants and do not directly measure accessed care (40). For the purposes of this analysis in which we have data on provider appointments, linkage to care is defined by attendance and testing.

Other covariates and potential confounders included ethnicity, gender, site of index incarceration, homelessness, education, employment, criminal justice involvement, mental health, substance use, and medical status. Race was defined as Black or non-Black and ethnicity was defined as Hispanic or non-Hispanic. Mental health and substance use status were measured using questions from the Addiction Severity Index (ASI) and composite scores were evaluated based on diagnostically-appropriate cutoffs (41, 42).

Many factors related to HIV health status and care were also included, such as advanced HIV disease and uncontrolled viremia at jail entry, prior antiretroviral therapy or contact with a HIV care provider, achievement of viral suppression in jail, and vintage of HIV diagnosis. Advanced disease was defined as a CD4 count of fewer than 200

cells/mm^3. Uncontrolled viremia was defined as a viral load of greater than 400 copies/ml, as recorded on the earliest viral load measurement after jail entry, and viral suppression was defined as a viral load of fewer than 400 copies/ml in a sample drawn at least 30 days after release. Although viral suppression is generally medically defined as less than or equal to 200 copies/ml, the 400 threshold was selected to account for laboratories which did not report ultrasensitive quantification (38, 43). Vintage of HIV diagnosis, or time from HIV diagnosis to jail entry, was a very crude variable based on the client's knowledge of how long he/she had been positive at enrollment. For this analysis, the variable was dichotomized to more than 2 years or less than or equal to 2 years.

Statistical Analysis

Demographic characteristics of the EnhanceLink study population were compared among young and not young participants using the Chi-square test for dichotomous variables and the Wilcoxon two-sample test for continuous variables, with a significance level of alpha = 0.05. For each of the two main outcomes of interest (attendance of appointment with HIV care provider and meeting with case manager), univariate logistic regression was conducted to determine the unadjusted odds ratios for all categorical and continuous variables of interest.

Multivariate logistic regression was performed for each of the three outcomes of interest to determine adjusted odds ratios, with the same exposures of interest and possible confounders. Due to quasi-separation of data from the correlation between sexual orientation and gender identity, only gender was included in the multivariable

model. To determine a more parsimonious, final model, backwards elimination was used in the full model to eliminate non-significant covariates. Using the full model as the gold standard, variables were removed individually to assess whether the odds ratio of the exposure stayed within 10%, and to examine whether precision decreased or increased. If a variable caused the odds ratio to remain within the 10% range and narrowed the confidence interval, then the variable was eligible to be dropped; otherwise, the variable was retained in the model to be controlled as a potential confounder. Additionally, models were assessed for collinearity and interaction. All statistical analyses were performed using SAS 9.3 (SAS Institute Inc., Cary, North Carolina).

The EnhanceLink study was approved by the Institutional Review Boards of Emory University and Abt Associates, and individual site programs were reviewed by the responsible IRBs where appropriate. A certificate of confidentiality was obtained for the study and informed consent was obtained from all participants.

RESULTS

Of 1,270 participants enrolled in the EnhanceLink observational study, 84.4% were considered eligible for the present analysis because their discharge was certain and they had data on age, the primary exposure of interest. The excluded, ineligible persons did not differ from the rest of the cohort by age, race, or gender. The outcomes were analyzed on 1,072 eligible individuals.

Table 1 displays demographic characteristics of the cohort and compares these characteristics and risk factors of youthful individuals to older individuals. The majority of the participants were Black (64.2%) and male (68.4%). Forty-four percent of this cohort was first diagnosed with HIV in a correctional facility, roughly equal to the percentage that was diagnosed at a medical facility in the community. Those who were older were significantly more likely to be black, to identify as homosexual or bisexual, and to have a recent history of homelessness. Unsurprisingly, older individuals were also more likely to have more arrests and to have spent more than 2 years incarcerated in their lifetime. Younger individuals were overall younger, but not significantly more likely to be juveniles (under 18 years old), at their first incarceration. On the other hand, older individuals (40-50+ years old) were significantly more likely to have been over 18 at their first arrest ($X^2 = 8.281$, $p= 0.041$). The majority of study participants reported substantial mental health and drug addiction burdens, and younger individuals were more likely to have severe psychiatric illness compared to older individuals.

Close to 80% of the cohort knew they were HIV-positive for more than 2 years prior to index incarceration, although older individuals had a significantly earlier vintage of diagnosis compared to younger individuals. Most HIV related covariates differed by

age with younger individuals reporting worse CD4 and VL outcomes and less interaction with the health care system with regard to their HIV.

The univariate analysis examined factors significantly associated with the two main outcomes (Table 2). Younger ages, both those under 30 years old and under 40 years old, were highly predictive of unsuccessful linkage to both HIV medical care and case management services. Other statistically significant associations with linkage to care in univariate analysis were, not surprisingly, having health insurance and having a HIV provider prior to incarceration. Having ever been on antiretroviral therapy at baseline and identifying as Hispanic were also significantly associated with successful linkage. Additionally, in univariate analysis, the indication of psychiatric morbidity as determined by ASI score was significantly associated with poorer linkage to case management services while severe drug addiction appears to predict better linkage to both HIV care and case management. None of the criminal justice involvement related variables showed statistically meaningful results in univariate analyses. The odds of linking to care varied greatly by site of index incarceration.

In the multivariate analysis, there was no significant interaction and no evidence of multicollinearity. Tables 3-5 examine the factors associated with the three outcome measures of successful linkage to care using adjusted models. Among 1,072 eligible study participants, 721 (67.3%) were analyzed in the first multivariate model, 682 (63.6%) were analyzed in the second multivariate model, and 788 (73.5%) were analyzed in the third multivariate model, due to different levels of missingness in different potential confounders. Measures that were not significant predictors of each outcome were dropped from that outcome's final multivariate model using backward elimination.

Being younger than 30 years old was significantly associated with not attending a meeting with an HIV care provider within 30 days after release, however other age categories did not differ statistically from those 50 and older (aOR = 0.45, 95 % CI 0.22–0.93). Those who identified ethnically as Hispanic as well as those who had an HIV provider prior to incarceration were more likely to have linked to HIV care. Participants who had a length of jail stay longer than 30 days had half the odds of linking to HIV provider care compared to those serving shorter amounts of time (aOR = 0.57, 95 % CI 0.39–0.85). Age was not a significant predictor of linkage to case management services, however the odds of linking to a case manager were lower for those who were employed in the prior three years compared to those who were unemployed (aOR = 0.58, 95 % CI 0.37–0.90). As with linking to an HIV provider, the odds to linking to case management services were greater for those who had an HIV provider prior to incarceration than for those who did not (aOR = 1.56, 95 % CI 1.02–2.37).

Clients under 30 years old were also less likely to have linked to HIV laboratory measures testing compared to those 50 or older (aOR = 0.41, 95 % CI 0.21–0.77). Additionally, longer jail stays decreased the odds of linking to CD4 or VL testing (aOR = 0.57, 95 % CI 0.39–0.82). Evidence of severe mental problems on the ASI (ASI Psych >0.22) was associated with decreased likelihood of linking to lab work (aOR = 0.66, 95 % CI 0.46–0.94).

The odds of linking to any of the three outcome measures varied by site of index incarceration. Each site had similarly aged clientele within the range of 37.6 to 45.3 years old. Clients in sites A, B, and G were more likely to link to an HIV provider than clients in site R, the referent site, while at the same time, clients in sites E and H were

less likely to link. Clients in sites A and I were more likely to link to case management while those in sites D, E, and H were less likely to do so. Clients in sites B, C, G, and I were more likely to have linked to laboratory CD4 or VL testing while again, those in site E were less likely to link.

In a sub-analysis of only participants under 30 years old, case management was assessed not as a linkage outcome but as a mechanism on the causal pathway between age and laboratory linkage. Multivariate modeling found that the odds of linking to CD4 or VL testing were significantly higher for those who went to a meeting with a case management compared to those who did not, controlling for confounders (aOR = 10.69, 95% CI 2.53,45.10).

DISCUSSION

The results of this study show that youthful HIV-positive jail releasees have poorer linkage to HIV care providers and laboratory measures testing. This finding is consistent with studies that have shown positive associations between older ages (over 30) and linkage to and retention in HIV care. Younger adults may, in comparison to older adults, lack the maturity and adaptations necessary for successful initiation of outpatient care, especially if their only experience has been with well-regimented and organized care within a correctional facility. Several factors may underlie this finding. First, it is possible that the lifestyle adaptations for successful initiation of outpatient care may be more difficult for younger adults. In general, adults younger than 30 years of age have higher rates of substance use than older adults, which has been suggested to play a role in their failure to establish HIV-related care (36). However, in this study, severe alcohol and drug addiction was less divided among generational lines and may not have much explanatory power. Instead, in this sample, younger individuals had higher rates of severe psychiatric conditions, as assessed by the ASI. Clients with mental health issues were 1.5 times more likely to fail to link to care based on CD4 or VL laboratory testing outcomes. Younger individuals with greater mental psychiatric need likely require specialized, intensive social services in order to break down their barriers to HIV care.

In accordance with the health belief model, younger individuals may possess lower self-efficacy, particularly in regards to healthcare tasks (44). They may also continue to harbor adolescent feelings of invincibility or lack the belief that they need help, which would explain lower likelihood of linking to any type of care. According to theoretical frameworks such as the Gateway Provider Model, youthful clients are often

more impulsive and less resilient, and tend to not seek services or treatment on their own and therefore are often directed to services through formal or informal "gateway providers" (45, 46). This model could help explain why clients under 30 years old who attend a meeting with a case manager within 30 days of release are significantly more likely to link to laboratory blood testing of CD4 count or VL within 6 months of release. These observational data suggest that case management is an important step in connecting the youthful jail releasee to longer term HIV care. More generally, this framework argues for the benefits of increased social support from other sources such as family/friends or parole officers. On the other hand, older age may be helpful in encouraging linkage because it may be associated with increased recognition of mortality and older adults may have more social support.

One of the most significant predictors of poor linkage to case management services was employment history in the 3 years prior to index incarceration. That successful past employment is associated with failing to link to care does not seem to make logical sense, however it is possible that only those with demonstrated severe need of social services were given encouragement to pursue it, leaving those deemed not in need of help without access. While no randomized controlled trial has yet been published to show that case management of HIV-positive jail releasees improves linkage to care, case management may play an important role in increasing access and removing barriers to HIV-related resources.

Older individuals, or individuals with earlier infection and therefore older vintages of HIV diagnosis, may also have more experience interacting with the healthcare system and other social services. Youth are likely less accustomed to being a patient,

managing long-term chronic conditions, and have fewer experiences interacting and engaging with medical care. This may explain why having an HIV provider prior to incarceration significantly predicts shorter term linkage to care after release. In addition to taking into account cognitive and developmental states, understanding that there may be age-based disparities in healthcare familiarity and involvement is crucial to providing necessary programs and interventions to aid linkage.

Interestingly, youthful age at first arrest was not a predictive factor in linkage to care in any of the multivariate modeling. While it has been demonstrated that juvenile offenders compared to non-offenders are at higher risk for HIV due to both high rates of risk behaviors which may directly affect transmission and high rates of substance use disorders and psychopathology, comparisons between those with a juvenile history and those involved with the CJS only as adults, as well as associations with linkage to care, are lacking (47). Although this study did not find significant results associated with youthful age at first arrest, using the juvenile incarceration record as a proxy for a troubled youth or a longer history of disruption to support systems and community ties helped to control for possible unknown or unmeasurable confounders.

Linkage differences by site of index incarceration appear to be unrelated to the age distributions at each site. Ultimately, the result that participants at some sites showed more successful linkage to care than others is most likely a result of the varying procedures and protocols implemented as part of the EnhanceLink demonstration project. The services provided in sites A, B, I, G, and C may have been more beneficial to clients overall and could have attenuated the relationships between age and linkage outcomes.

Those with better linkage to care tend to begin antiretroviral therapy which in turn, improves their health and their prognosis as HIV-positive individuals. Moreover, a Texas retrospective cohort study found that prison inmates who were on ART at the time of release were at significantly decreased risk of reincarceration (10). Considering the high recidivism rates and the further disruption to effective community-based HIV care that reincarceration can cause, discharge planning programs that address youthful clients to improve linkage to care may have positive impacts on both health and reincarceration rates. Additionally, provision of linkage services has been shown, through the EnhanceLink demonstration projects, to be cost-effective and cost saving to society (48).

Limitations

The design of this observational study limits the conclusions that can be drawn about the causal effect of age on linkage to HIV care. Analytic limitations include large amounts of missing data, particularly for behavioral variables such as drug or alcohol use, which decreased the number of observations eligible for logistic multivariate modeling, thereby decreasing the effective sample size. Additionally, much of the data was collected through self-report from a self-selecting convenience sample. The multivariate models were unable to examine both gender and sexual orientation at the same time due to convergence problems, which limits the ability to analyze odds of linkage for MSM, a particularly vulnerable population (49). Young MSM may experience intersectional barriers to care linkage due to compound risk factors. Another limitation in this study is the assumption that missing data on any of the three outcomes is equivalent to unsuccessful linkage. Particularly for clients who did not have a CD4 or VL blood draw

within 6 months of release who were categorized as not being laboratory linked, it is possible that they may have been connected to care but lost to follow-up.

As mentioned above, an individual's vintage of HIV (or, length of time since HIV diagnosis) may impact self-efficacy and experiences with the healthcare system and disease management. Because categorization of this variable was very crude due to the phrasing of the survey question, the variation and nuance of this potential confounder may have been lost in analysis.

Conclusions

Despite these limitations, this study provides evidence that individuals under 30 years old may experience significantly more difficult linkage to HIV care after release from jail. Although the clustering of sites in the eastern regions of the United States may decrease generalizability to western parts of the country, due to the 10 site design and the representativeness of the demographics in corrections, these findings are likely generalizable to jails nationwide. More research is needed to examine the psychosocial and other factors that may affect the development of HIV care linking behaviors in this demographic. Information is especially needed on structural factors associated with incarcerated youth in order to better develop interventions, solutions, and policies.

Close to 65% of the HIV-infected releasees in the EnhanceLink project were linked to HIV care in the community; however this success was distributed disproportionately by age. Our findings, taken in context with those from previous studies, suggest that younger individuals experience poorer care linkage and may benefit from increased services or tailored assistance in order to achieve successful linkage to

HIV care after jail release. HIV and incarceration have been deemed "dual epidemics" which require coordinated efforts (50, 51). The results of this study advocate for the need to develop and evaluate linkage programs that aid HIV-positive individuals, particularly those under 30, in the transition from jail to community.

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TABLES

Table 1. Demographic and risk characteristics of HIV-positive jail detainees released from their index incarceration and analysis for significant variation by age of the EnhanceLink cohort

	Among all detainees (n=1,082)			Among detainees with data on age (n=1,072)					
				42 years or younger (n=490)		43 years and older (n=582)			
	No.	%	Missing[a]	No.	%	No.	%	*p* value	Missing[a]
Demographics									
Mean age at index incarceration [SD]	42.2	9.0	10	-	-	-	-	-	-
Gender									
Male	734	68.4	9	300	61.7	429	73.8	<.0001*	5
Transgender	20	1.9		11	2.3	9	1.6	0.3915	
Race: Black	680	64.2	23	285	59.5	391	68.1	0.0037*	19
Ethnicity: Hispanic	264	25.0	31	118	24.6	145	25.6	0.7274	26
Homosexual or bisexual identity, among men	140	19.1	1	94	31.4	44	10.3	<.0001*	344
Homeless in 30 days prior to incarceration	422	39.3	7	215	44.0	204	35.2	0.0033*	3
Education and employment									
Less than high school diploma	539	50.4	13	259	53.3	278	48.3	0.1025	10
Employed in prior 3 years	230	21.5	14	115	23.7	112	19.4	0.0886	10
Employed in prior 30 days	135	13.0	40	63	13.4	72	12.7	0.7267	36
Criminal justice involvement									
Median number of lifetime arrests [SD]	15	25.8	80	19.6	23.7	24.1	27.5	0.0056*	
Incarcerated < 2 years in lifetime	320	29.9	12	182	38.1	135	23.7	<.0001*	24
Spent time in jail in 30 days prior to index incarceration	188	17.7	19	85	17.6	99	17.2	0.8484	14
Length of jail stay > 30 days	736	69.0	16	338	69.3	396	68.8	0.8571	8
Median age at first incarceration [SD]	19	7.7	67	19.4	6.2	22.0	8.6	<.0001*	

Table 1. Demographic and risk characteristics of HIV-positive jail detainees released from their index incarceration and analysis for significant variation by age of the EnhanceLink cohort

	Among all detainees (n=1,082)			Among detainees with data on age (n=1,072)					
				42 years or younger (n=490)		43 years and older (n=582)			
	No.	%	Missing[a]	No.	%	No.	%	*p* value	Missing[a]
Mental health and substance use									
ASI composite score for psychiatry >0.22 cutoff	543	52.9	55	281	60.0	259	46.8	<.0001*	51
ASI composite score for alcohol use >0.17 cutoff	369	39.9	156	171	40.8	197	39.2	0.6112	150
ASI composite score for drug use >0.16 cutoff	582	57.9	77	266	58.2	314	57.9	0.9308	73
HIV, HIV care, and HIV treatment									
Health insurance at time of incarceration	810	75.4	7	339	69.6	469	81.1	<.0001*	7
HIV diagnosed at index incarceration[b]	43	6.71	4	312	91.5	281	95.9	0.0244*	438
Advanced HIV disease on jail chart (CD4 count < 200 cells/mm^3)	213	22.5	136	80	19.2	130	25.0	0.0352*	134
Had an HIV provider in 30 days prior to incarceration	769	74.9	55	314	69.3	452	79.3	0.0010*	49
Ever taken HIV medications at baseline	825	80.3		340	74.9	482	84.7	<.0001*	
Uncontrolled viremia at entry (VL > 400 copies/ml)	549	62.6	205	254	67.2	288	58.5	0.0090*	202
Vintage of HIV diagnosis > 2 years	823	77.9	26	334	80.5	485	91.9	<.0001*	129
Achieved viral suppression in jail according to medical chart	260	29.3	193	105	27.3	155	31.2	0.2060	190
Attended meeting with HIV care provider within 30 days of release	645	65.3	94	276	73.0	366	82.8	0.0007*	252
Attended first meeting with case manager after release	603	60.6	87	241	60.3	358	76.3	<.0001*	203

Table 1. Demographic and risk characteristics of HIV-positive jail detainees released from their index incarceration and analysis for significant variation by age of the EnhanceLink cohort

	Among all detainees (n=1,082)			Among detainees with data on age (n=1,072)					
				42 years or younger (n=490)		43 years and older (n=582)			
	No.	%	Missing[a]	No.	%	No.	%	*p* value	Missing[a]
Site of index incarceration									
A	45	4.2	0	24	4.9	21	3.61	<.0001*	0
B	77	7.1		43	8.8	33	5.67		
C	66	6.1		35	7.1	31	5.33		
D	81	7.5		51	10.4	27	4.64		
E	74	6.8		43	8.8	30	5.15		
F	72	6.7		31	6.3	40	6.87		
R	437	40.4		147	30.0	289	49.7		
G	40	3.7		22	4.5	17	2.92		
H	93	8.6		60	12.2	32	5.5		
I	97	9.0		34	6.9	62	10.7		

[a]For variables with the same number of missings, only the first variable presents this information

* Denotes statistically significant comparison at the alpha = 0.05 level

[b]Excludes all detainees at site R which did not enroll newly diagnosed persons

Table 2. Univariate analysis: factors associated with linkage to HIV care and case management 30 days post-release among EnhanceLink cohort (*n=1072*)

	Attended appointment with HIV care provider		Attended first meeting with case manager	
	OR	95% Wald Confidence Limits	OR	95% Wald Confidence Limits
Demographics				
Age at index incarceration (continuous)	1.02	(1.01, 1.04)*	1.04	(1.02, 1.05)*
Age at index incarceration (categorical)				
≤ 29 years	0.53	(0.33, 0.83)*	0.38	(0.24, 0.60)*
30-39 years	0.64	(0.44, 0.94)*	0.49	(0.34, 0.71)*
40-49 years	0.92	(0.66, 1.28)	0.79	(0.57, 1.09)
50+ years (referent)	1.00			
Gender				
Male	1.72	(1.32, 2.23)*	1.23	(0.95, 1.59)
Transgender	0.82	(0.34, 1.99)	0.79	(0.33, 1.91)
Race: Black	0.94	(0.73, 1.22)	0.91	(0.71, 1.18)
Ethnicity: Hispanic	1.58	(1.18, 2.12)*	1.55	(1.16, 2.07)*
Homosexual or bisexual identity, among men	1.11	(0.75, 1.64)	0.92	(0.63, 1.34)
Homeless in 30 days prior to incarceration	0.82	(0.64, 1.05)	0.80	(0.62, 1.02)
Education and employment				
Less than high school diploma	0.67	(0.53, 0.86)*	0.69	(0.54, 0.89)*
Employed in prior 3 years	0.84	(0.62, 1.13)	0.73	(0.55, 0.98)
Employed in prior 30 days	0.91	(0.63, 1.31)	0.71	(0.49, 1.01)
Criminal justice involvement				
Number of lifetime arrests	1.00	(1.00, 1.01)	1.00	(1.00, 1.01)
Incarcerated < 2 years in lifetime	1.14	(0.87, 1.49)	1.18	(0.91, 1.54)
Spent time in jail in 30 days prior to index incarceration	1.17	(0.85, 1.61)	1.26	(0.91, 1.73)
Length of jail stay > 30 days	1.02	(0.78, 1.32)	1.05	(0.81, 1.36)
Age at first incarceration	1.00	(0.98, 1.01)	1.01	(1.00, 1.03)
Mental health and substance use				
ASI composite score for psychiatry >0.22 cutoff	0.84	(0.66, 1.08)	0.72	(0.56, 0.92)*
ASI composite score for alcohol use >0.17 cutoff	1.05	(0.80, 1.37)	0.88	(0.68, 1.15)
ASI composite score for drug use >0.16 cutoff	1.34	(1.04, 1.73)*	1.32	(1.03, 1.70)*
HIV, HIV care, and HIV treatment				
Health insurance at time of incarceration	1.45	(1.09, 1.93)*	1.84	(1.38, 2.44)*
HIV diagnosed at index incarceration[a]	1.09	(0.58, 2.08)	0.93	(0.49, 1.75)
Advanced HIV disease on jail chart (CD4 count < 200 cells/mm^3)	1.12	(0.82, 1.54)	1.16	(0.85, 1.59)
Had an HIV provider in 30 days prior to incarceration	1.72	(1.29, 2.30)*	1.43	(1.07, 1.90)*
Ever taken HIV medications at baseline	0.72	(0.53, 0.98)*	0.71	(0.52, 0.97)*

Table 2. Univariate analysis: factors associated with linkage to HIV care and case management 30 days post-release among EnhanceLink cohort (*n=1072*)

	Attended appointment with HIV care provider		Attended first meeting with case manager	
	OR	95% Wald Confidence Limits	OR	95% Wald Confidence Limits
Uncontrolled viremia at entry (VL > 400 copies/ml)	1.11	(0.84, 1.47)	0.96	(0.72, 1.26)
Vintage of HIV diagnosis > 2 years	1.03	(0.70, 1.52)	1.63	(1.11, 2.38)*
Achieved viral suppression in jail according to medical chart	0.95	(0.70, 1.27)	0.97	(0.73, 1.30)
Site of index incarceration				
R (referent)	1.00			
A	2.48	(1.12, 5.45)*	2.27	(1.07, 4.84)*
B	1.61	(0.92, 2.80)	1.16	(0.69, 1.94)
C	1.54	(0.86, 2.77)	1.00	(0.58, 1.70)
D	0.37	(0.23, 0.61)*	0.05	(0.02, 0.11)*
E	0.20	(0.12, 0.35)*	0.25	(0.14, 0.42)*
F	0.65	(0.39, 1.08)	0.78	(0.47, 1.29)
G	2.94	(1.21, 7.18)*	1.45	(0.70, 2.99)
H	0.29	(0.18, 0.46)*	0.15	(0.09, 0.25)*
I	0.85	(0.54, 1.35)	2.16	(1.27, 3.67)*

[a]Excludes all detainees at site R which did not enroll newly diagnosed persons
* Denotes statistically significant comparison at the alpha = 0.05 level

Table 3. Multivariate analysis: factors associated with linkage to HIV care provider 30 days post-release among EnhanceLink cohort *(n= 721)*

	aOR	95% Wald Confidence Limits
Youthfulness		
Age at index incarceration		
≤ 29 years	0.45	(0.22, 0.93)*
30-39 years	0.73	(0.44, 1.22)
40-49 years	1.02	(0.67, 1.55)
50+ years (referent)	1.00	
Juvenile (< 18 years old) at first incarceration	1.19	(0.84, 1.70)
Demographics		
Gender: Male or Transgender	1.11	(0.73, 1.68)
Race: Black	1.37	(0.88, 2.12)
Ethnicity: Hispanic	1.62	(1.00, 2.60)*
Homeless in 30 days prior to incarceration	0.87	(0.61, 1.25)
Education and employment		
Less than high school diploma	0.76	(0.54, 1.06)
Employed in prior 3 years	0.84	(0.55, 1.29)
Criminal justice involvement		
Incarcerated < 2 years in lifetime	0.74	(0.49, 1.11)
Length of jail stay > 30 days	0.57	(0.39, 0.85)*
Mental health and substance use		
ASI composite score for drug use >0.16 cutoff	1.25	(0.87, 1.78)
HIV, HIV care, and HIV treatment		
Health insurance at time of incarceration	0.86	(0.51, 1.44)
Had an HIV provider in 30 days prior to incarceration	1.65	(1.07, 2.55)*
Ever taken HIV medications at baseline	0.78	(0.50, 1.22)
Achieved viral suppression in jail according to medical chart	0.93	(0.63, 1.38)
Vintage of HIV diagnosis > 2 years	0.82	(0.44, 1.52)
Site of index incarceration		
R (referent)	1.00	
A	4.24	(1.30, 13.79)*
B	2.48	(1.09, 5.67)*
C	1.78	(0.78, 4.05)
D	0.70	(0.29, 1.68)
E	0.21	(0.09, 0.46)*
F	0.80	(0.32, 1.99)
G	8.59	(1.68, 44.05)*
H	0.40	(0.18, 0.86)*
I	0.89	(0.51, 1.55)

* Denotes statistically significant comparison at the alpha = 0.05 level

Table 4. Multivariate analysis: factors associated with linkage to case management services 30 days post-release among EnhanceLink cohort *(n= 682)*

	aOR	95% Wald Confidence Limits
Youthfulness		
Age at index incarceration		
≤ 29 years	0.58	(0.28, 1.21)
30-39 years	0.72	(0.42, 1.23)
40-49 years	1.12	(0.72, 1.74)
50+ years (referent)	1.00	
Juvenile (< 18 years old) at first incarceration	0.88	(0.61, 1.26)
Demographics		
Gender: Male or Transgender	0.84	(0.53, 1.34)
Race: Black	1.25	(0.79, 1.96)
Ethnicity: Hispanic	1.36	(0.83, 2.22)
Education and employment		
Less than high school diploma	0.83	(0.58, 1.18)
Employed in prior 3 years	0.58	(0.37, 0.90)*
Mental health and substance use		
ASI composite score for alcohol use >0.17 cutoff	0.84	(0.58, 1.20)
HIV, HIV care, and HIV treatment		
Had an HIV provider in 30 days prior to incarceration	1.56	(1.02, 2.37)*
Achieved viral suppression in jail according to medical chart	0.82	(0.55, 1.24)
Site of index incarceration		
R (referent)	1.00	
A	3.13	(1.13, 8.68)*
B	2.12	(0.96, 4.69)
C	1.07	(0.49, 2.33)
D	0.05	(0.01, 0.23)*
E	0.27	(0.13, 0.57)*
F	0.74	(0.30, 1.84)
G	2.40	(0.84, 6.83)
H	0.05	(0.01, 0.19)*
I	2.65	(1.39, 5.05)*

* Denotes statistically significant comparison at the alpha = 0.05 level

Table 5. Multivariate analysis: factors associated with linkage to CD4 or viral load laboratory testing 6 months post-release among EnhanceLink cohort *(n= 788)*

	aOR	95% Wald Confidence Limits
Youthfulness		
Age at index incarceration		
≤ 29 years	0.41	(0.21, 0.77)*
30-39 years	0.89	(0.55, 1.44)
40-49 years	1.06	(0.70, 1.59)
50+ years (referent)	1.00	
Juvenile (< 18 years old) at first incarceration	0.91	(0.66, 1.26)
Demographics		
Gender: Male or Transgender	1.35	(0.91, 2.01)
Race: Black	1.37	(0.90, 2.07)
Ethnicity: Hispanic	1.07	(0.69, 1.66)
Criminal justice involvement		
Length of jail stay > 30 days	0.57	(0.39, 0.82)*
Mental health and substance use		
ASI composite score for psychiatry >0.22 cutoff	0.66	(0.46, 0.94)*
HIV, HIV care, and HIV treatment		
Had an HIV provider in 30 days prior to incarceration	1.44	(0.99, 2.09)
Advanced HIV disease on jail chart (CD4 count < 200 cells/mm^3)	1.35	(0.92, 1.99)
Site of index incarceration		
R (referent)	1.00	
A	1.03	(0.48, 2.23)
B	13.49	(4.46, 40.85)*
C	3.73	(1.64, 8.49)*
D	1.64	(0.76, 3.56)
E	0.40	(0.20, 0.83)*
F	1.27	(0.55, 2.90)
G	5.04	(1.83, 13.88)*
H	0.72	(0.38, 1.37)
I	2.65	(1.47, 4.78)*

* Denotes statistically significant comparison at the alpha = 0.05 level

FIGURES

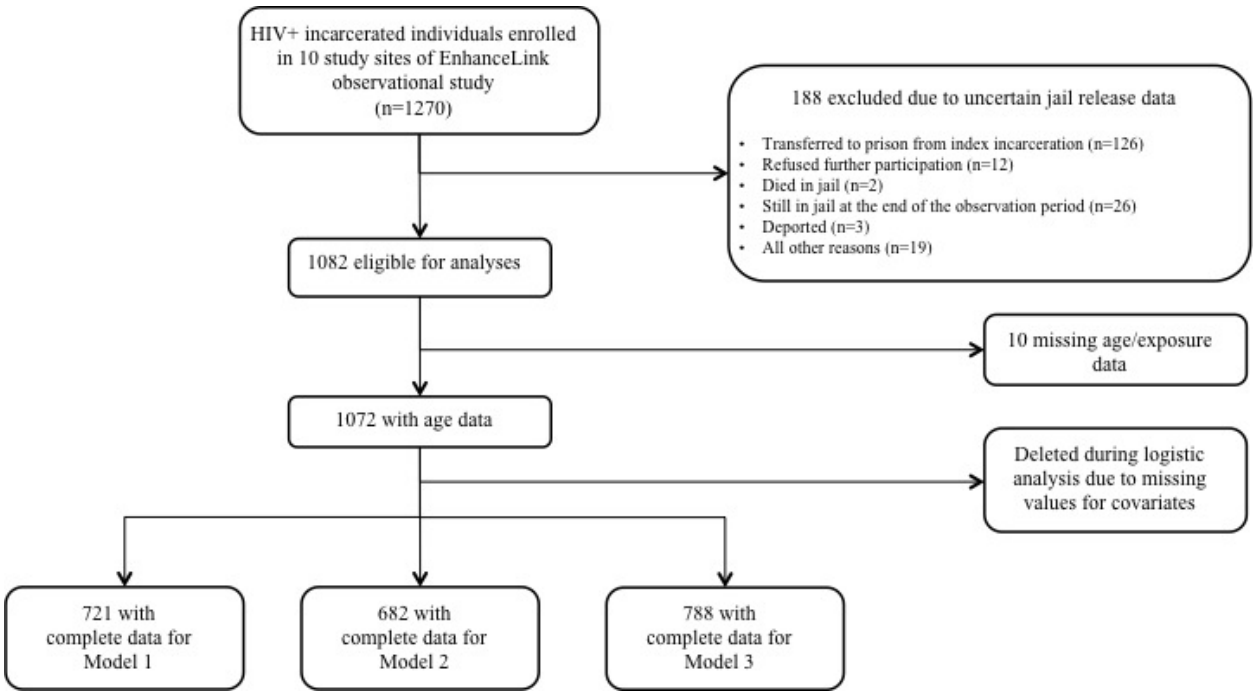

Figure 1. Participants in EnhanceLink study considered in analysis of predictors of linkage to HIV community care