



Duration Since Never in HIV Care and Immediate Blood-Draw After HIV Diagnosis are Associated with Willingness to Link to Care Following Health Department Outreach, New York City

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Abstract

Late presentation to human immunodeficiency virus (HIV) care is an important concern for clinical outcomes and HIV prevention. Significant proportions of HIV-diagnosed persons are not timely linked to care following HIV diagnosis. We implemented and evaluated an intervention to link to care persons never in HIV care (NIC). Disease intervention specialists (DIS) traced persons presumed to be NIC since HIV diagnosis, offered them assistance with linkage to care, and elicited reasons for NIC. We examined the overall outcomes of the intervention and reasons for NIC. From January 2013 to December 2016, 121 persons were traced; 19% were linked to HIV care. Significantly (all $P < 0.001$) higher proportions of persons linked versus not linked to care were diagnosed < 1 year prior to being contacted by DIS (48% vs. 13%) or had a HIV-related laboratory test performed within 0–7 days of their diagnosis (87% vs. 33%). Among the 105 who provided reasons for NIC, most commonly reported were not believing one's HIV diagnosis (30%) and lacking medical insurance (18%). Approximately 10% had been to a hospital emergency room and 20% to a primary care physician in the past year. Health department efforts to link persons NIC for HIV care were effective with a minority of eligible persons. Persons diagnosed within 1 year or who underwent HIV-related testing within 0–7 days of diagnosis were more likely to link to care. Newly HIV-diagnosed persons should be promptly referred to undergo all diagnostic testing and assessments on the same day or within 1 week of diagnosis.

Keywords HIV care continuum · Linkage to care · HIV diagnosis · Loss to follow-up · HIV care

Introduction

Late presentation to human immunodeficiency virus (HIV) care is an important concern for clinical outcomes and HIV prevention [1–4]. Timely diagnosis of HIV and the provision of ongoing care and antiretroviral therapy (ART) are important components of comprehensive strategies to maximize survival and stem the risk of onward HIV transmission [4–7]. In recent years, immediate initiation of ART after

HIV diagnosis is recommended for all persons who are willing and able to start treatment [4, 8, 9].

However, evidence abounds that significant proportions of HIV-diagnosed persons are not linked to HIV care soon after diagnosis [10–12]. In 2013, of persons diagnosed with HIV in the United States aged ≥ 13 years, 82% linked to care within 3 months of diagnosis [11]. In New York City (NYC), among the 2493 persons aged ≥ 13 years and newly diagnosed with HIV in 2015, 71% linked to care within 3 months of diagnosis [12]. Studies have shown that many HIV-diagnosed persons who are not timely linked to HIV care may continue to delay initiation of care long after diagnosis [13–15].

The proportions of HIV-diagnosed persons timely linked and then retained in care, and ultimately placed on ART, are critical steps toward improved prognosis for persons living with HIV and reduction in the number of new infections. In recent years, public health departments have implemented Data-to-Care (D2C) [16, 17], the use of laboratory reports—CD4 T cell count or HIV viral load (VL) reports to the HIV

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surveillance registry (hereafter referred to as the registry) to identify persons deemed out-of-care (OOC). Persons lacking any or recent CD4 or VL are contacted with the aim of offering them assistance with linkage or re-engagement in care when found, but little is known about the outcomes of efforts focused on persons who were not timely linked to HIV care, and had not engaged in care for some time following diagnosis.

Since 2007, the HIV Field Services Unit within the NYC Department of Health and Mental Hygiene implemented D2C focusing on re-engaging into HIV care, persons who initiated, and subsequently disengaged from care [16]. In 2013, we dedicated additional staff resources within our D2C team, with the aim of identifying and reaching persons deemed to have been never in care (NIC) since HIV diagnosis to: (1) ensure that they were aware of their own diagnosis, and (2) assist them with linkage to HIV care and services. We present the outcomes of our D2C effort for persons NIC.

Methods

Study Population and Data Sources

We used CD4 and VL reports to the registry as proxy for an HIV-related medical care visit, and considered timely if received within 3 months (91 days) of HIV diagnosis, following a 7-day lag. For population-level monitoring of linkage to care, NYC Surveillance considers CD4 or VL tests performed within 0–7 days of the date of the initial diagnosis date to be a component of the diagnostic workup and, therefore, not indicative of linkage to an outpatient care provider for ongoing HIV care [18]. Although HIV-related laboratory results are transmitted electronically, data processing and matching activities typically result in a lag of at least 1 month from specimen draw date before the data can be used by the D2C team, and 10% of laboratory results have a lag of more than 3 months. Moreover, in New York State, providers are required to link their patients to HIV care timely, within 3 months of diagnosis. Therefore, for our intervention, persons were considered NIC if, after 6 months from the date of diagnosis until the date of selection for D2C, they had not had any report of CD4 or VL tests in the registry or whose only CD4 or VL report in the registry since diagnosis was performed within 0–7 days of diagnosis date.

Persons presumed NIC whose investigations were completed by DIS from January 2013–December 2016 were included in our analysis. We used two data sources for our analyses: the registry and the D2C database; a unique person-based identifier linked clients across these two databases. The registry is a population-based public health registry of persons diagnosed with acquired immune deficiency syndrome (AIDS) in NYC since 1981 and HIV since

2000. Records are continuously updated with incoming matched HIV-related laboratory results, which since 2005 have included all CD4 counts, VL results, viral nucleotide sequences, and positive diagnostic tests. Vital status is updated through quarterly matches with local vital records data and annual matches to the National Death Index and Social Security Death Master File.

The D2C database is a case management system for DIS activities on linkage to care and partner services. All persons traced and confirmed NIC were asked to respond to a short, structured DIS-administered questionnaire regardless of their willingness to link to care. NIC persons were informed that the health department would like to learn about the barriers they experienced in linking to care since their diagnosis for the purposes of program planning and enhancements. The reasons (e.g., lacking health insurance, feeling well, personal obligations, stigma) for being NIC were considered in providing options for clients and in determining best prospects for linkage to HIV care.

NYC DOHMH D2C Program

Described in detail elsewhere [16], the Field Services Unit uses the registry to identify persons presumed OOC to be approached for linkage to HIV care. Using a CD4 or VL laboratory report in the registry as a proxy for receipt of HIV medical care, persons who had initiated care following diagnosis, but had not had any care during the most recent nine-month period were considered OOC. For the current effort, persons who had no record of CD4 or VL ≥ 6 months since HIV diagnosis or whose only CD4 or VL since diagnosis was performed within 0–7 days from the date of diagnosis were considered NIC.

In brief, disease intervention specialists (DIS) obtain the most current locating information (telephone number, address) from databases (registry, medical records, and social services). A stepwise approach (phone calls, letters, and field visits) is used to establish contact with clients, with failure to connect with clients prompting each successive step until the person is contacted or all steps have been exhausted. The prescribed time to locate and link persons to care is 30–60 days from the date of assignment to a DIS.

When contact is successful, DIS interview presumed NIC persons to confirm their care status, assess their reasons for being NIC, and offer assistance for linkage to care and partner services, which involves eliciting potentially exposed sex- or needle-sharing partners, exposure notification and HIV-testing. The NYC Field Services Unit has established collaborative relationships with NYC HIV medical, social services agencies, and community-based case management providers. Based on persons' reasons for being NIC, DIS discuss options for linkage to care and needed support services. For instance, persons who appear to be unaware or

do not believe their HIV diagnosis are offered DIS escort or referral to a NYC sexual health clinic or community provider to obtain HIV test and evaluation. For persons who agree to link to care, DIS first offer referral to a comprehensive HIV care facility, where in addition to HIV care, they would receive, as needed, case management support, mental health and substance abuse treatment. However, persons who prefer smaller community-based clinics or private providers, in addition to linkage to care, are given referrals (if indicated) to social services agencies that will address their unmet needs and potential barriers to care (e.g., housing, medical insurance).

If clients accept DIS offer to facilitate their linkage to care, DIS and clients select the most suitable time and clinical provider for HIV care; referrals for social services such as housing, health insurance, substance use, or mental health are made as needed. DIS offer assistance to facilitate the attendance of clinic appointments through escort with an official vehicle or issuance of a roundtrip Metrocard for use of NYC public transport system. Persons who refused assistance with linkage to care are encouraged to seek care, and are given contact information, such as program and providers' Internet websites, palm cards and NYC public service call-line ("311"). DIS also ask persons refusing to link to care to contact the DIS or call the NYC HIV Field Services call-line at any future time for assistance with linkage to care and services.

Definition of Outcomes and Variables

Persons presumed NIC were assigned outcomes based on the results of the contact attempts and linkage to care efforts. *Traced* was defined as any elicited response (e.g., answered/returned telephone call or in-person communication) by DIS from persons presumed NIC. Persons presumed NIC and traced but not confirmed to be NIC include: (i) *current with care*, because persons were receiving care from providers in New York State counties surrounding NYC or due to lag time from test dates to entry into the registry; (ii) *moved away from NYC*; (iii) *HIV-negative* following medical record review and/or HIV re-testing, or *HIV-unconfirmed* when DIS found contradictory HIV test results and NIC clients refused to complete required HIV tests to rule out HIV infection; (iv) *deceased*, based on documented records; (v) *duplicate case records* due to client use of different names or birth dates; or (vii) *incarcerated*, persons who were located in a non-NYC correctional facility. Persons presumed NIC were considered *unable to locate* if DIS did not elicit a response from them through phone call or field visits to their listed addresses.

Persons who were traced and confirmed to be NIC had two outcomes: (i) *linked to care*, or (ii) *not linked to care* within 3 months from the date of being traced or after at

least three attempts (e.g., clinic appointments) had been made by DIS to link them to care. Persons were considered *linked to care* if they were traced and confirmed NIC and subsequently kept an appointment with a provider. For persons traced to a NYC correctional facility, DIS arranged an in-person visit, and other outcomes, such as *refused linkage to care* or *linked to care* at an on-site clinic or community clinic (upon release) were assigned. *Factors contributing to NIC* were grouped into four areas of concern, clients: (i) resided in NYC in the past 12 months and were aware of their diagnosis; (ii) cited reason for being NIC; (iii) received assistance with linkage to care at the time of initial diagnosis; (iv) disclosed HIV diagnosis to someone.

Statistical Analysis

We excluded persons presumed NIC traced and subsequently confirmed to be HIV-negative or HIV unconfirmed from further analyses. We provided descriptive statistics of all persons presumed NIC and assessed time since NIC from diagnosis date by creating three categories (≥ 6 months to < 1 year, 1–3 years, > 3 years). We calculated the proportions of NIC persons who may have had interaction with healthcare providers (in addition to receiving HIV testing) near the time of diagnosis (CD4/VL within 0–7 days of diagnosis), and/or with DIS (received partner services within 3 months of diagnosis), indicative of knowledge of one's diagnosis.

We characterized clients' sociodemographic and HIV-related characteristics at diagnosis, and compared these among persons who were traced versus not traced and persons linked versus not linked to care. The sociodemographic variables considered were age at diagnosis, gender, HIV transmission risk, race/ethnicity, country of birth, history of incarceration and injection drug use (IDU). HIV-related characteristics examined were HIV transmission risk (MSM, IDU or heterosexual), time since HIV diagnosis (categorized as ≥ 6 months to < 1 year, 1–3 years or > 3 years), if clients had CD4/VL within 0–7 days of diagnosis or if they were previously interviewed for partner services.

Differences between groups were compared using the Chi square test or Fisher's exact test for categorical variables and Wilcoxon sum rank test for continuous variables. We used multivariable logistic regression modeling to examine the association between characteristics significant in bivariate analysis between persons traced or not traced, using step-wise backward elimination to generate adjusted odds ratios (aOR) and their 95% confidence intervals (CI). Analyses were done in SAS 9.3 software (SAS Institute, Cary, NC) and statistical significance was set at $P < 0.05$.

Ethics Statement

No institutional review board approval was necessary because this is a secondary analysis of data collected as part of the NYC Department of Health and Mental Hygiene routine D2C program.

Results

Description and Outcomes of Intervention

From January 2013 to December 2016, DIS completed steps to contact 768 persons presumed NIC (Fig. 1). Of these, DIS did not trace 52% (400). Persons not traced did not respond to contact attempts and were assigned a final outcome of

“Unable to Locate.” Of the 368 persons traced by DIS, 10% (38) were current with care, 33% (121) were confirmed NIC, and the remaining 57% (209) were assigned various other outcomes. These “other” outcomes included “moved” and “HIV-negative or unconfirmed.” Among the 61 individuals who tested HIV-negative (45) or deemed to be HIV-unconfirmed (16), 38 had confirmed hepatitis C infection per health department viral hepatitis registry; 48, although entered in the HIV registry, had no HIV confirmatory test reports (e.g., Western Blot or fourth generation Multispot) in the registry. Persons confirmed to be HIV-negative/unconfirmed were excluded from further analyses.

Overall (Table 1), the median age of persons presumed NIC was 30 years (interquartile range = 16 years). Proportionally, most were male (77%), black/non-Hispanic (53%) or Hispanic (31%), US-born (64%), and reported

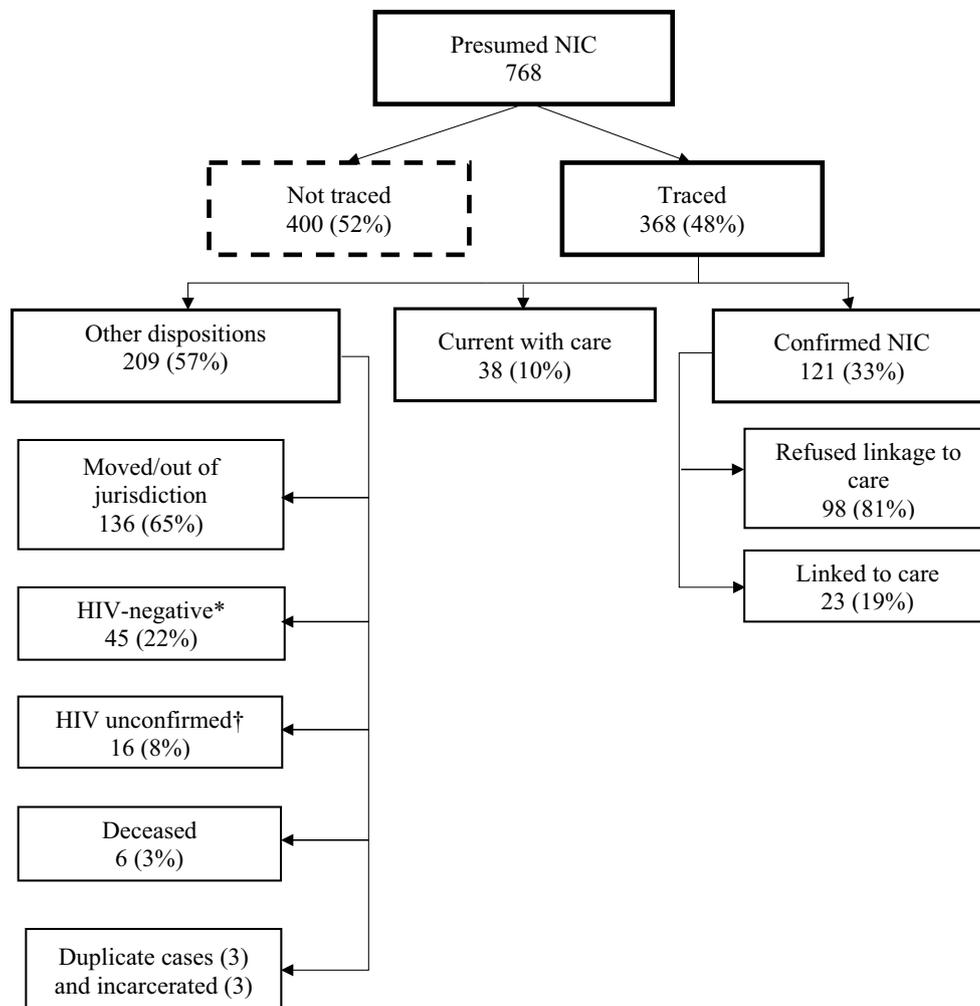


Fig. 1 Flow chart of PLWH presumed never in care (NIC) selected from the HIV surveillance registry and assigned for linkage to care outreach in New York City, January 2013–December 2016. *Persons who believed they were HIV negative because they never received positive HIV test results. They were found to be HIV-negative fol-

lowing HIV screening and detection tests. †Person who believed they were HIV negative but refused to undergo additional HIV testing in order to rule out HIV infection or re-confirm that they are HIV-positive so they can be linked to care

Table 1 Sociodemographic, HIV transmission risk and diagnosis characteristics of persons traced versus not traced

Characteristics	Presumed NIC* (N=707)		Traced (N=307)		Not traced (N=400)		P**
	N	%	N	%	N	%	
	Age at diagnosis (median, IQR)	30	16	29	18	30	
Gender							
Male	542	77	238	78	304	76	0.42
Female	156	22	67	22	89	22	
Transgender	9	1	2	1	7	2	
HIV transmission risk							
MSM	328	46	149	49	179	45	0.41
IDU	39	6	14	5	25	6	
Heterosexual	116	16	54	18	62	16	
Other/unknown	224	32	90	29	134	34	
Race/ethnicity							
Non-Hispanic White	87	12	47	15	40	10	0.07
Non-Hispanic-Black	372	53	165	54	207	52	
Hispanic	217	31	84	27	133	33	
Other/unknown	31	4	11	4	20	5	
Country of birth							
US-born	454	64	211	69	243	61	0.02
Non US-born	199	28	81	26	118	33	
Unknown	54	8	15	5	39	10	
Ever incarcerated	46	7	23	7	23	6	0.35
History of IDU	36	5	12	4	24	6	0.21
Time since HIV diagnosis							
< 1 year	77	11	53	17	24	6	<0.001
1–3 years	179	25	97	32	82	21	
> 3 years	451	64	157	51	294	74	
CD4/VL labs within 7 days of diagnosis	216	31	123	40	93	23	<0.001
Interviewed for partner services	134	19	80	26	54	14	<0.001

NIC never in care, MSM men who have sex with men, IDU injection drug use, US United States

*Excluded persons found to be HIV not infected (45) and unconfirmed (16); **Comparison of persons traced versus not traced

male-to-male sex HIV transmission risk (46%). Sixty-four percent of persons presumed NIC had been HIV-diagnosed > 3 years at the time of assignment for D2C intervention; 31% had CD4/VL reports within 0–7 days of their diagnosis date, and approximately one-fifth had been interviewed by DIS for partner services. Significantly higher proportions of persons traced versus not traced were US-born (69% vs. 61%, $P=0.02$), had shorter time since diagnosis to initiation of D2C intervention (< 1 year: 17% vs. 6%; 1–3 years: 32% vs. 21%, $P<0.001$), had HIV-related laboratory reports within 0–7 days of diagnosis (40% vs. 23%, $P<0.001$), and a partner services interview (26% vs. 14%, $P<0.001$).

Compared to persons with diagnosis > 3 years before the D2C intervention, the adjusted model showed that the odds of being traced were higher among individuals who had < 1 year (aOR = 3.37, CI 1.93–5.87) or 1–3 years' time (aOR = 1.67, CI 1.14–2.46). Persons who received

CD4/VL tests within 0–7 days of diagnosis (aOR = 1.88, CI 1.33–2.67) and persons interviewed for partner services at the time of diagnosis (aOR = 1.61, CI 1.05–2.48) were significantly more likely to be traced than persons lacking these activities.

Linkage to Care

Eighty-one percent of persons (N=98) traced and confirmed to be NIC refused a DIS assistance with linkage to care (Table 2). Nineteen percent (N=23) were linked to care as defined by a verified clinic visit and/or CD4 or VL report in the registry within 3 months of linkage to care appointment. We found no significant sociodemographic differences between persons linked versus not linked to care. However, significantly (all $P<0.001$) higher proportions of persons linked versus not linked to care were diagnosed < 1 year

Table 2 Sociodemographic, HIV transmission risk and diagnosis characteristics of persons confirmed NIC linked to care versus not linked

Characteristics	Confirmed NIC (N=121)		Linked to care (N=23)		Not linked (N=98)		P*
	N	%	N	%	N	%	
Age at diagnosis (median, IQR)	33	19	28	20	34	20	0.12
Gender							
Male	85	70	18	78	67	68	0.56
Female	35	29	5	22	30	31	
Transgender	1	1	0	0	1	1	
HIV transmission risk							
MSM	42	35	13	57	29	30	0.09
IDU	5	4	1	4	4	4	
Heterosexual	24	20	2	9	22	22	
Other/unknown	50	41	7	30	43	44	
Race/ethnicity							
White/non-Hispanic	9	3	3	13	6	6	0.48
Black/non-Hispanic	78	65	14	61	64	65	
Hispanic	28	23	6	26	22	22	
Other/unknown	6	5	0	0	6	6	
Country of birth							
US-born	85	70	18	78	67	68	0.79
Non US-born	28	23	4	18	24	24	
Unknown	8	7	1	4	7	7	
Ever incarcerated	10	8	3	13	7	7	0.40
Time since HIV diagnosis							
< 1 year	24	20	11	48	13	13	<0.001
1–3 years	38	31	4	17	34	35	
> 3 years	59	49	8	35	51	52	
CD4/VL labs within 7 days of diagnosis	52	43	20	87	32	33	<0.001
Previously interviewed for partner services	35	29	8	35	27	28	0.49

NIC never in care, MSM men who have sex with men, IDU injection drug use, US United States

*Comparison of persons linked versus not linked to care

prior to contact attempt for NIC intervention (48% vs. 13%) or had CD4/VL tests report in the registry performed within 0–7 days of their diagnosis (87% vs. 33%).

Survey of Persons Confirmed NIC

Of the 121 persons confirmed to be NIC, 88% (105) responded to the DIS-administered survey assessing their health care seeking behaviors in the past 12 months and their reasons for NIC (Table 3). In the 12 months prior to being traced, 62% reported consistently residing in NYC, 25% were given an HIV diagnosis, 20% had been to a primary care physician, and 10% had been to a hospital emergency room. Frequent reasons given by clients for being NIC were not believing one's diagnosis (30%) and lacking medical insurance (18%). Seventeen percent reported a prior offer by DIS, health care providers or family/friends to obtain an HIV care appointment since their HIV diagnosis. Forty-four percent reported not being informed of

their HIV positive result; of these, the median time since HIV diagnosis was 2.3 years (IQR 4.1 years).

Of the nine NIC persons who reported not being aware of their HIV diagnosis, five had been diagnosed at facilities characterized as screening, diagnostic and referral sites in the registry; these sites do not provide HIV clinical care. Two were diagnosed by private physicians and one while an inpatient. The diagnosing provider for the one remaining person could not be ascertained by the report in the registry.

DIS used reasons given for being NIC to identify referral options for linkage to care and social services. Secondary analyses revealed that only relatively small proportions of NIC persons who expressed barriers to care and social services accepted DIS offers of linkage to care and services: 9% (4/43) who did not believe or were previously unaware of their diagnosis; 32% (6/19) who had no health insurance; and 38% (3/8) who were unstably housed.

Table 3 Assessment of health care and HIV care seeking, and coping with HIV diagnosis among persons confirmed to be NIC and agreed to be interviewed (N=105)

Questions	N	%
Residency and awareness of HIV diagnosis in past 12 months		
Continuously lived in New York City	65	62
Was told I was HIV+ in the past 12 months	26	25
Have been to a primary care provider, hospital or clinic	21	20
Have been to an emergency room	11	10
Have received homeopathic/natural medicine	5	5
Reasons for never being in HIV care (NIC)		
Did not believe that I was infected with HIV	34	30
Lack insurance	19	18
Depressed/had mental health/substance use issues	11	10
Not aware of my HIV diagnosis	9	9
Did not trust health care workers	8	8
Lack stable housing	7	7
Felt ashamed about my HIV status	6	6
Busy with social obligations	3	3
At the time of HIV diagnosis, received assistance with HIV care appointment from the following entities		
Public health agency	11	10
Diagnosing provider or other health care workers	5	5
Family, friends, others	2	2
Since HIV diagnosis, disclosed HIV status to		
No one	46	44
Family/friends	12	11
My spouse/partner	4	4
Refused to answer	18	17

Discussion

We used the NYC HIV registry to identify presumed HIV care-naïve persons with the aim of stemming prolonged delay in initiating care through identifying their reasons for NIC and facilitating their linkage to care. Despite exhaustive efforts, a mere 19% of persons confirmed NIC were linked to care by DIS. Clients' acceptance of linkage to care was associated with being diagnosed ≤ 1 year prior to being traced or having had CD4/VL tests performed within 0–7 days of diagnosis.

Previous reports [16, 17] on the outcomes of linkage to care efforts have not distinguished persons who established and subsequently disengaged from HIV care from persons who were NIC, however, Molitor et al. [19.] found that only 29% of their study sample who were NIC linked to HIV care once contacted. Our analyses in NYC suggest that there are distinct groups of HIV-diagnosed persons—those that either initiated care but were subsequently lost to follow-up [16] or those who were care-naïve (the current analysis). Persons who initiated care but were subsequently lost to follow-up were significantly more likely than persons who were NIC

since HIV diagnosis to accept DIS assistance with linkage to HIV care (57% vs. 19%). Overall, the two groups of care experienced and care-naïve persons were similar with regards to socio-demographic make-up (age at diagnosis, race/ethnicity, country of origin, HIV transmission risk). However, the similarity in these groups on the duration from last contact with a provider (HIV care or HIV diagnosis) to contact with a DIS have important implications for HIV care and prevention planning. The time since last HIV care and HIV diagnosis (both < 1 year) for the two groups appear to be an important predictor of successful reengagement or linkage to care of OOC or NIC person respectively following public health intervention.

Studies have assessed the reasons for persons not promptly linking to HIV care and treatment soon after diagnosis [16, 20–23]. A key barrier is patients not wanting to engage in care because they feel well or did not believe their diagnosis. Only 10 and 20% percent of our NIC sample interviewed reported using a hospital emergency room and going to a medical provider, respectively, in the past year. Other patient-related factors include the time and costs associated with clinic attendance and stigma related to their HIV infection. Structural factors that impede prompt initiation of HIV care include multiple clinic visits to complete initial assessments (CD4/VL tests, social services, health insurance application) required for establishing outpatient care. Our findings along with evidence of personal and structural barriers to prompt care initiation support the piloting, evaluation and adoption of initiatives [24–29] by public health and clinical practitioners to “rapid start” or “jumpstart” ART for persons newly diagnosed with HIV, immediately, or within 7–30 days following diagnosis.

Rapid start of ART entails blood-draw for CD4, VL tests and increasingly HIV genotyping, and counseling patients on the necessary steps for HIV care. As part of the laboratory tests, patients receive explanations for the reasons for the blood tests, including the further confirmation of their diagnosis, staging of disease, drug resistance, and using the test results to inform their future care and treatment plan. The observed positive effect of having had HIV-related laboratory testing within 0–7 days of diagnosis and linkage to care among our sample could be attributed to these additional affirmations of their diagnosis through provider communication on the reasons for the blood-draw for CD4 and VL tests and the utility of the test results. Moreover, early results of the rapid start programs show that most persons tested for CD4/VL on the same day or within 0–7 days of diagnosis, were ultimately timely linked to care and treatment [25–30].

Nonetheless, it is not possible for all persons testing HIV-positive for the first time to receive immediate referral for blood-draw and/or initiate ART within days or weeks of diagnosis. Sites or situations in which patients are tested

for HIV, such as during an in-patient hospital stay, or a diagnostic-only facility, can delay linkage to outpatient HIV care [23, 24]. Further, persons whose providers ordered a conventional blood test for HIV without rapid HIV testing for preliminary HIV test results may not know their HIV serostatus for days or weeks, if ever. The clients in our sample who reported being unaware of their HIV-positive test results were mostly diagnosed by private providers who may not have used HIV rapid testing technology, were diagnosed during in-patient hospital stays or at diagnostic-only sites. Persons diagnosed by non-HIV treating providers or during in-patient stay need additional support to connect to outpatient providers through telephone referrals or appointment slips, which may take repeated attempts over a long period of time and additional effort to be successful.

To achieve prompt linkage to care and rapid ART initiation for newly diagnosed patients, these structural and personal factors must be addressed. Providers recommending or administering HIV diagnostic tests will need to inform their patients that if testing positive, they will need further clinical assessments, including CD4/VL testing and care initiation. Providers who infrequently diagnose patients with HIV or use non-rapid HIV testing technology should be made aware (where available) of the local health department partner services and D2C programs, and community-based patient navigation and case management for HIV-positive individuals. In addition, public health jurisdictions should endeavor to catalogue available resources through the health departments and community-based organizations for facilitating HIV linkage to care and make these widely accessible to providers and patients via websites and public call-lines (e.g., 311 in NYC). Provider training and outreach for providers on CDC guidelines pertaining to the HIV testing algorithm may increase the use of the rapid antibody test, which would help decrease the proportion of HIV-infected individuals who are unaware of their HIV-positive test result.

A limitation of our intervention is that DIS staff can only offer facilitated referrals for linkage to care and social services. Given the high proportions of persons who did not believe their HIV diagnosis or refused linkage to care, enhanced D2C approaches are needed. Unresolved social, economic and domestic issues that impede access to and engagement in care may persist for individuals who refused linkage to care, and therefore cannot access provider/facility's case management or social work services. DIS typically do not possess the technical training or licensure to systematically assess and resolve clients' psychosocial conditions and social services needs. Therefore, bringing HIV-related services to community settings (e.g., home) [31, 32] may be an effective and acceptable strategy for some clients refusing DIS referrals.

Public health jurisdictions may consider the addition of community nurses and social workers to provide home-based

HIV testing, home-based ART initiation and general screening for overall health and psychosocial evaluation when needed. Studies and demonstration projects, including rapid ART start programs, have found that collaborative efforts of health care providers such as patient navigators, DIS and nurses promptly following diagnosis can improve linkage to care [24, 25, 27, 28]. Community health nurses involved in D2C projects can engage individuals who are unwilling or unable to visit a provider in-person, administer field-based general medical screening and blood draw for CD4/VL testing, and provide confirmation and explanation of HIV diagnosis and care. A social worker can identify needs and facilitate applications for health insurance, housing, substance use and mental health services. This attention to and resolution of the medical and psychosocial barriers to linkage to care can pave the way for eventual establishment of care for NIC patients.

Our study highlights the challenges of linkage to care for persons never in HIV care since diagnosis. Among our study sample, the likelihood of refusal to link to care increased with additional years since diagnosis and the absence of HIV-related laboratory testing within 1 week of diagnostic testing. Intensified measures to improve early linkage to care must include informing patients of the need for additional laboratory assessments and clinical follow-up at the time of HIV testing, and prompt linkage to outpatient HIV clinical care.

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Compliance with Ethical Standards

Conflict of interest The authors declare no conflict of interest.

Ethical Approval No institutional review board approval was necessary because this is a secondary analysis of data collected as part of the New York City Department of Health and Mental Hygiene routine case and partner services program.

Informed Consent For this type of study, no formal consent is necessary.

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