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Assessing the Effectiveness of Data-to-Care Strategies for Improving HIV Care Outcomes: A Systematic Review

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Abstract

Data-to-Care (D2C) is a strategy that uses HIV surveillance data or other data sources to identify out-of-care (OOC) persons with HIV (PWH) and link or re-engage them in care to improve viral suppression (VS). While some evidence suggests D2C is effective, no comprehensive systematic review has been published. This review aims to determine the effectiveness of D2C. A systematic search in five databases (i.e., MEDLINE, EMBASE, PsycINFO, CINAHL, Sociological Abstracts) identified 3,868 U.S. studies published between January 2009 and January 2021 that described

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D2C interventions and measured HIV care outcomes. Two reviewers screened titles/abstracts, reviewed full reports for eligibility, and abstracted data. Risk of bias was assessed using the Mixed Methods Appraisal Tool, and included studies were synthesized quantitatively and qualitatively (Protocol registered on PROSPERO ID=CRD42020173095). Thirty-four studies with 30 unique interventions were identified. Two different meta-analyses, each with six interventions, found that D2C approached significance in improving engagement in care (Relative Risk (RR) [95% CI]: 1.18 [0.99 to 1.41]) and VS (RR [95% CI]: 1.44 [0.99 to 2.09]). Studies that could not be incorporated into the meta-analyses, also showed improvements in engagement in care (median percent [IQI]: 63% [45% to 81%], 18 interventions) and VS (median percent [IQI]: 39% [25% to 57%], 14 interventions). Overall, this systematic review suggests that D2C may enhance HIV care outcomes, emphasizing the need for effective strategies to identify and engage OOC persons in care.

Keywords

HIV care continuum; HIV surveillance; data-to-care; intervention; linkage/re-engagement to care; out of care

INTRODUCTION

In 2019, the U.S. Department of Health and Human Services (HHS) announced the *Ending the HIV Epidemic [EHE] in the U.S.* initiative which aims to reduce new HIV infections in the United States by 90% by 2030 [1]. A key pillar of EHE is to treat people with HIV rapidly and effectively to reach sustained viral suppression (VS) [2,3]. People with HIV (PWH) with undetectable viral loads (VL) have no risk of transmitting HIV to sexual partners, making treatment a powerful prevention tool [3,4]. Thus, identifying strategies that enhance treatment for PWH and helping them remain virally suppressed are key for achieving national goals.

Data-to-Care (D2C) is a public health strategy that uses HIV surveillance data and/or other data sources (e.g., electronic medical records) to identify people with HIV (PWH) who are out-of-care (OOC) and/or not virally suppressed to link or re-link them to care [5]. The primary goal of D2C is to decrease the number PWH who are OOC by connecting them to HIV medical services, ultimately leading to higher rates of VS. To implement D2C initiatives, programs use several approaches to identify persons presumed to be OOC. Example approaches include: health department models that use state level surveillance data; healthcare provider models that use clinic-based patient medical records; and combination models that incorporate aspects of both health department and healthcare provider models [4,6].

Studies on D2C surveillance show gaps in the completeness of surveillance data, prompting recommendations for new approaches to address these gaps [7]. For example, these surveillance data sources may incorrectly identify PWH as OOC; however, once the list is cleaned to show who is truly out of care, then multiple strategies are used to engage people into HIV care. Engagement often involves a combination of strategies including patient navigation, appointment reminders, psychosocial support, and help with transportation, including accompanying PWH to appointments [5,8]. Improving OOC surveillance accuracy and tailoring engagement activities are important steps to helping PWH become virally suppressed [6,9]. Previous reviews have examined D2C as a strategy to re-engage OOC PWH [8,10,11], but this systematic review is the first to our knowledge to only focus on D2C.

The objectives of this systematic review are to describe D2C activities and their effectiveness for engagement in care, retention in care, and VL suppression among PWH. This review also explores outcome differences among persons with different demographic characteristics (e.g., age, sex, race/ethnicity, or HIV transmission risk). Lastly, this review will summarize successes and challenges of implementing D2C programs.

METHODS

The review was conducted by a D2C workgroup in the Centers for Disease Control and Prevention (CDC) Division of HIV Prevention (DHP) from 2019–2024. This report followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) Guidelines and was registered in the international database of prospectively registered systematic reviews in health and social care (PROSPERO), CRD42020173095 in April 2020 [12,13].

Search Strategy

We developed a systematic literature search strategy to locate citations on D2C methods and activities. Subject matter experts provided 13 citations that represented D2C research activities (see Appendix 1). A librarian reviewed these citations to develop a list of relevant keywords, phrases, and index terms. The search was initially developed in MEDLINE (OVID) database. The finalized MEDLINE search was tested and translated to the proprietary indexing systems in 4 databases (platforms): CINAHL (EBSCOhost), EMBASE (OVID), PsycInfo (OVID) and Sociological Abstracts (ProQuest) and included HIV terms (HIV, HV Infection, etc.) cross referenced with D2C terms (D2C, diagnose, surveillance). The search was run in the 5 databases between January 2009 – January 2021, last search January 12, 2021 (see Appendix 1). No language or publication limits were applied.

Additionally, we performed a supplemental manual search through conference abstracts and citation indexes. The following conferences were searched: American Public Health Association (APHA), Conference on Retroviruses and Opportunistic Infections (CROI), International Association of Providers of AIDS Care (IAPAC) International Conference on HIV Treatment and Prevention Adherence, National HIV Prevention Conference (NHPC), and United States Conference on AIDS (USCA). We also conducted forward and backward searches by examining reference lists of included citations and citation indexes Scopus and Google Scholar for publications of the first three authors, respectively.

Eligibility Criteria

Included interventions were studies conducted in the U.S. that evaluated a D2C strategy and measured HIV care outcomes or described HIV care statuses. The strategy had to have two components to be determined as D2C: 1) use clinic (e.g., electronic medical records), surveillance (e.g., HIV surveillance registry), or other data sources to identify recent or previously diagnosed PWH who are OOC or not virally suppressed; and 2) use staff (e.g., patient navigators or disease intervention specialists) to locate, support, and link PWH to appropriate medical care and social services.

The D2C strategy needed to report one of the following HIV care outcomes: engagement in care (i.e., link or re-engage), time to engagement in care, retention in care (e.g., ≥2 laboratory tests ≥90 days apart), VS, time to VS; and/or HIV care status categories (in care elsewhere, deceased, incarcerated, moved out of jurisdiction, not located, or other [i.e., composite status or statuses that could not be aggregated together]). Previous systematic reviews have noted the substantial heterogeneity in definitions of OOC populations, relinked populations, and HIV care outcomes in the literature [8,10,11]. For comprehensiveness, we accepted author definitions.

Study eligibility criteria were intentionally broad because of limited literature on D2C. There were no exclusion criteria for type of participant or study design; studies completed in the US with individuals diagnosed with HIV and appearing to be OOC were included. We included conference abstracts, but if a peer-reviewed full-text article became available with the same data, then we excluded the conference abstract. Two or more publications that described and analyzed the same intervention were examined for study duration, location, population, and outcomes; those with no unique data were considered duplicates and excluded. For related publications with unique data, the publication with more comprehensive outcomes was chosen as primary, and the secondary publication(s) were included in specific analyses (i.e., from a group of related interventions, only one intervention was included per analysis).

Study Selection and Data Abstraction

Two coders, trained in systematic review methods, independently screened titles/abstracts and full reports in DistillerSR [14] to determine inclusion using the eligibility criteria. Coders reconciled conflicts via discussion, and a third coder assisted with resolution as needed. The following was defined and abstracted for included studies: study characteristics; related interventions; D2C intervention steps; OOC and relinkage definitions; primary and adjunct data sources; demographics; outcomes; and author’s conclusions. Discrepancies were resolved using the same process described above (see Tables 1 and 2).

For abstraction of the intervention and study characteristics, information was collected verbatim and edited for concision. D2C intervention steps, usually in the order reported, are brief descriptions of the strategy authors identified and intervened on the intended OOC population. We collected demographics for truly OOC populations, or initial OOC populations (i.e., before list of PWH OOC was cleaned) if the truly OOC population data were not available. Demographic variables abstracted verbatim from the paper were sample size, age, sex, race/ethnicity, and HIV risk category, which included men who have sex with men (MSM), people who inject drugs (PWID), heterosexual, and blood transfusion (see Tables 1 and 2). We accepted the author’s conclusions of the effectiveness of the D2C intervention.

Study Quality

Two trained coders independently assessed study quality with the Mixed Methods Appraisal Tool (MMAT), which appraises methodological quality of five study design categories: qualitative research, randomized controlled trials (RCTs), non-randomized control trials (referred to as nRCTs or cohort), quantitative descriptive studies (referred to as post-only), and mixed methods studies [15]. Two screening questions regarding clarity of research questions and availability of data to address questions are followed by five questions specific to each study design [15,16]. Items were scored as 1 for 'yes' and 0 for 'no'. An appraisal score was calculated for each intervention dividing the total points scored by five (total points possible). The total score represents the overall strength of the studies. The score within each study design was also examined.

Data Analysis

We conducted meta-analyses with interventions that reported comparison data to determine intervention effectiveness for engagement in care and VS outcomes using the statistical software Rstudio (2023) [17]. Other outcomes with comparative data were limited, effect size types varied, and results could not be aggregated; therefore, those outcomes are reported in Appendix 2 and 3. The meta-analyses for two outcomes (engagement and VS) included cohort study designs. We used effect size types of unadjusted relative risk (RR), or adjusted RR if no unadjusted RR was reported. If authors provided proportion data per condition group, we calculated and converted into RRs using standard formulas [18]. Random-effects models were used to calculate aggregated effects for two outcomes that reported sufficient comparative data (i.e., 5 or more studies per analysis) [19–21]. An RR of more than one indicates a greater likelihood that study participants in the exposed or intervention condition engaged in care or became virally suppressed.

For both outcomes in the meta-analyses, we assessed heterogeneity across interventions using I^2 statistic [20,22]. We were unable to conduct subgroup analyses to explore heterogeneity due to the small number of studies. To assess how each intervention influenced the overall effect size estimate, we performed a *leave one out* analysis, which involves running multiple meta-analyses by removing one intervention per analysis.

For post-only studies and HIV care status outcomes, we aggregated and calculated median percentages and confidence intervals (CIs) for each outcome of three or more studies. For studies that could not be aggregated together, we qualitatively reported the direction of the results. For HIV care status outcomes (e.g., in care elsewhere, deceased), we collected total sample size, total sample size description, specific HIV care status, and number of people categorized in that status. We reported descriptive statistics (i.e., number of people in the HIV care status divided by total sample size) for these outcomes.

The following information were the decisions we made for all outcomes. If an intervention reported two measures within the same outcome, then we included the more comprehensive measure (e.g., for re-engaged in care, we included "kept clinic appointment and a CD4 or VL test within a specified timeframe" in the analysis and did not include "kept clinic appointment" only). If a comparative study design provided unique post-only data, as well, then we included the unique data in the corresponding outcome analysis. We used the longest follow-up available for each measure or the 12-month follow-up when greater than two years. If a follow-up period could not be determined, we considered it to be post-intervention. If studies only provided a statistical analysis that was not a proportion or RR (e.g., Odds Ratio [OR], Hazards Ratio [HR]), then we qualitatively reported it in the results as "additional evidence." Intervention outcomes that could not be quantitatively aggregated (e.g., HIV surveillance data quality or stratified analysis by demographics) are qualitatively described.

Outcomes

Primary and secondary intervention outcomes included in this systematic review are defined in Table 1.

RESULTS

The PRISMA study flow diagram summarizes the selection process of each intervention (see Figure 1). Thirty-four studies [6,7,9,23–53] were included in this review (and 1 study reported on two interventions, [37] with 30 unique interventions (see Table 2). The majority of study designs were quantitative post-only study designs (19 studies) [6,7,24,26–28,31,32,34–38,42–44,48,51,52] or quantitative cohort (11 studies) [23,25,29,30,33,39,40,45,47,50,53]; three were nRCTs [9,41,49] and one study was a RCT [46]. All studies focused on populations that were OOC, two studies included a newly diagnosed population who were never linked to care [23,27], and one study included a population in care but not virally suppressed [6]. Twenty-four studies reported demographic data on OOC PWH [7,9,23,25,28,29,31,32,34,36,37,39–41,43–45,47–53]; 10 did not [6,24,26,27,30,33,35,38,42,46].

Intervention condition results were typically compared to a group that was either a control/standard of care, a group in a larger jurisdiction, or a group in-care (see Table 3). Overall, review findings showed positive effect size estimates of various magnitudes for all outcomes for different aggregated analyses (i.e., meta-analyses, median percentages, and descriptive statistics).

Description of D2C Interventions

D2C interventions were implemented in all four regions of the U.S.: 10 unique interventions in the Northeast [9,30,36–40,46,50,51], eight in the West [7,25,29,31,33,45,48,53], seven in the South [24,26,34,41,44,47,49], two in the Midwest [35,43], and three across different regions [27,28,42]. D2C interventions typically involve several steps aimed at identifying a comprehensive list of PWH who are truly OOC and implementing activities to encourage them to engage in HIV care services (see Table 2). Initial intervention steps involved investigating and cleaning the often-inaccurate list of people who are initially deemed OOC to find those truly OOC (see Table 1). Data were cleaned through several rounds of matching between national or state-level databases (e.g., surveillance) and local databases (EMRs). For people identified as truly OOC, relinkage staff intervened with an activity to link or re-engage them in HIV care. These engagement activities varied by intervention, but generally included using multiple methods to contact people (e.g., phone, email, home visits) and reminders to start or return to care. Staff would proactively identify barriers to care and provide resources and referrals to help individuals access and adhere to HIV care.

Engagement in Care

Six interventions with quantitative cohort designs were included in the engagement in care meta-analysis that resulted in an overall positive estimate that approached significance of RR=1.18 (95% CI: 0.99 to 1.41), I^2=70% [23,25,29,47,50] (see Figure 2 and Table 3). Sensitivity analyses did not substantially change the overall effect size or heterogeneity for the outcome. Seven interventions with comparative data that could not be aggregated in the meta-analysis also reported positive effect estimates of people that engaged in care [9,37,40,41,46,49] (see Appendix 2). Eighteen post-only interventions that reported an engagement in care outcome, resulted in a pooled median percent (IQI) of 63.0% (45.4% to 81.1%) of people that engaged in care (see Table 4) [7,24,26–28,31,33,34,36,38,40–44,47,48,51].

Five interventions with comparative data reported a time to HIV care outcome [23,29,33,50] and found a shorter or similar time to HIV care in the intervention group (see Appendix 2). Four interventions with post-only data reported a time to HIV care outcome [28,29,40,50] that resulted in engagement in less than 100 days (see Appendix 2).

Retention in Care

Five interventions with comparative data reported a retention in care outcome [9,29,40,45,46] (see Table 3). Two of the five interventions measured retention as engagement in continuous care ≥2 HIV care visits ≥3 months apart in 12 months: RR: 2.4 (95% CI: 1.5 to 3.8) [29], and ≥2 HIV laboratory tests at least 90 days apart in 12 months: RR: 1.63 (95% CI: 1.3 to 2.0), [45]. One intervention measured retention in care as receiving laboratory tests within 1 year OR (95% CI): 1.89 (1.44 to 2.48) [46]. Two interventions reported the percentage of people who were retained in care, one intervention compared the intervention group to the state of Massachusetts (54% vs 57%; $p = 0.56$) [40], and the other intervention compared the intervention group to New York State residents outside the pilot area, n (%) (127 (54.5%) vs 20 (17.1%); $p < 0.05$) [9].

The pooled median percent (IQI) for a retention in care outcome across seven interventions with post-only data was 48.0% (38.0% to 54.7%) of people who were retained in care [7,32,34,40,51–53] (see Table 4). Six of seven interventions measured retention as ≥2 HIV laboratory tests at least 60 or 90 days apart.

Viral Suppression

Six interventions with quantitative cohort designs were included in the VS meta-analysis that resulted in an overall positive estimate that approached significance of RR=1.44 (95% CI: 0.99 to 2.09), I^2=91% [25,29,39,45,47,53] (see Figure 3 and Table 3). Sensitivity analyses did not substantially change the overall effect size or heterogeneity for VS. All interventions measured VS as VL <200 c/mL within a timeframe, typically 6–12 months. Two interventions with comparative data that could not be included in the meta-analysis also reported positive effect estimates of people that became virally suppressed [40,46] (see Appendix 3). Fourteen post-only interventions that reported a VS outcome, resulted in a pooled median percent (IQI) of 38.8% (25.3% to 56.9%) [24,26,27,33–35,38–40,44,45,47,50,51] of people who became virally suppressed (see Table 4).

One intervention with comparative data reported a time to VS outcome and showed a shorter time to VS in the intervention condition compared to the control, although not significant, HR (95% CI): 1.18 (0.83 to 1.68) [33] (see Table 3). Two interventions with post-only data reported a time outcome [34,50], measured as time from diagnosis to VS [34], and as date of reengagement to VS [50]. Both interventions found no difference between condition groups for time to VS [34,50] (see Table 4).

Outcome Stratification by Demographics

For comparative data, we collected evidence on outcomes stratified by key demographic characteristics: age, sex, race/ethnicity, or HIV transmission risk. Four interventions reported a stratification of one or more demographics for any of the outcomes. All four found no difference by any characteristic [23,30,33,45] (see Table 7).

HIV Care Status

Information collected from the different data sources allows individuals initially identified as OOC to be updated and categorized into an accurate HIV care status (see Table 5). We aggregated the data within seven main categories: truly OOC, current to care, deceased, incarcerated, not located, out of jurisdiction, or other (see Table 1). The truly OOC category is mutually exclusive with the ‘other’ but not with the remaining five categories. Across 26 interventions, an overall median percent of people found to be truly OOC was 40.2% (IQI: 18.7 to 59.3%) [6,7,9,24–29,31,33–38,40–45,47,48,50,53]. Across 20 interventions, a pooled median percent of people found to be ‘current to care’ was 24.1% (IQI: 15.3 to 36.0%) [6,7,9,24,27–29,33,36–38,40,42–45,47,48,50,53]. Across 18 interventions, an overall median percent of people not located was 17.3% (IQI: 8.3 to 29.0%) [7,9,26–29,31,33–35,37,38,44,45,48,50,52,53]. Across 16 interventions, a pooled median percent of people located outside the jurisdiction was 10.0% (IQI: 5.4 to 33.0%) [6,7,9,27–29,31,33,36–38,44,48,50,51,53]. Across 18 interventions, an overall median percent of people found to be deceased was 2.7% (IQI: 1.6 to 4.7%) [6,7,9,24,27,28,31,33,34,37,38,40,43,44,48,50,51,53]. Lastly, across eight interventions, a pooled median percent of people found to be incarcerated was 1.7% (IQI: 0.5 to 3.0%) [6,29,34,43,48,50,53].

Relinkage Staff, Data Sources and Surveillance Quality

Relinkage staff were D2C program staff who used data sources to locate and contact PWH identified as OOC and conducted the engagement activities. The relinkage staff carried many D2C titles such as disease intervention specialists, patient navigators, public health department staff, and many other health professions. The relinkage staff used a variety of activities to effect engagement. Most activities were aimed to address structural barriers such as transportation, appointment scheduling, or other societal barriers.

The intensity of HIV care activities varied by intervention implementation of D2C. A greater care intensity used multiple engagement methods of activities with a higher frequency of communication with PWH who were OOC. A lower care intensity emphasized the importance of HIV care and referred individuals to additional support services rather than provide the services. We did not categorize interventions into different HIV care intensities because engagement activity details were not always reported by authors.

Many primary data sources and adjunct data sources were used in the first part of the D2C strategy; these sources varied and overlapped across interventions (see Tables 1 and 2). For primary data sources used to identify OOC persons, 15/34 (44%) studies used a surveillance database only [9,23,26–28,30–33,36,38,39,42,47,52], 6/34 (18%) used clinical EMR only [34,35,37,48,49,53], 12/34 (35%) used a combination of surveillance and clinical EMR [6,7,24,25,29,40,41,43–45,50,51], and one study did not report a primary data source as it was an abstract with limited information [46]. For adjunct data sources used to identify location information of OOC persons, 6/34 (18%) studies used a surveillance database only [7,28,30,32,47,50], 2/34 (6%) used clinical EMR only [34,36], 8/34 (24%) used a combination of surveillance and clinical EMR [9,27,31,33,45,48,51,53], 6/34 1(8%) used surveillance and another type of database (e.g., online person search/location tools, online public records) [6,37,38,42,44,52], and 12/34 (35%) did not report an adjunct data source [23–26,29,35,39–41,43,46,49].

Using data sources to identify PWH OOC and update their records for individuals who received medical care and have laboratory tests takes coordination, organization, and sharing of personal identifying information across databases. Some included interventions explicitly described an improvement in data quality. The improvement in data quality mainly involved concordance or facilitation between a state or national surveillance database and health center database to help create a complete health profile of individuals who are OOC or fall into another HIV care status [24,27,29,40,41,47,53]; policies requiring clinical data to be shared across the state for evidence of care [34,50]; and establishing points of contact to follow-up and update specific records or charts [6,36,48,53] (see Table 6).

Study Quality Assessment

Table 8 presents findings from assessing study quality. Of the 35 studies (which includes one study with two interventions [37]), one was an RCT [46], 14 were nRCTs (which includes cohort studies) [9,23,26,29,30,33,39–41,45,47,49,50,53], and 20 were post-only studies [6,7,24,26–28,31,32,34–38,42–44,48,51,52]. The RCT study scored ‘No’ for appropriate randomization. All 14 nRCT studies scored ‘Yes’ for appropriate measures for both the outcome and the intervention. Seven of 14 nRCT studies did not account for confounders in the study design and analysis, leading to potential increases in bias [23,29,40,41,45,47,50]. Of the 20 post-only studies, all included a representative sample of the target population increasing the validity of the study, except for one [43]. Eleven of 20 were scored as having a low risk of non-response bias [7,26–28,32,35–37,44,51,52], while the remaining 9 were high [6,24,31,34,37,38,42,43,48]. All 20 post-only studies reported having appropriate measures (see Table 8).

DISCUSSION

Modeling studies demonstrate that the most efficient way to reduce HIV transmission in the U.S. is to focus on ensuring PWH become and stay virally suppressed [54–56]. As PWH who are diagnosed but not retained in medical care account for an estimated two-thirds of HIV transmissions [57], effective and efficient strategies to locate and reconnect those lost to HIV care will be essential for achieving national HIV elimination goals. Our review provides positive evidence that D2C can be effective at locating and re-engaging people with HIV who have never linked or have fallen OOC so that they can become VS. Marginally significant effect estimates may be due to variability in D2C component strategies and study outcome measures. We are aware of the dated search yield, but due to resource constraints, did not include the most recently published D2C intervention evaluations that could boost the positive effectiveness found [58]. Nevertheless, positive effect size estimates across all outcomes demonstrate the large potential for impact on national HIV reduction goals and speaks to the value of continued efforts to refine and improve D2C activities and evaluations.

Despite their heterogeneity, the foundation of all D2C programs is the use of data to identify those in need of attention. Initially implemented by health departments using surveillance data, persons OOC were identified by absence of reported laboratory data (HIV VL and CD4 information). As previously noted, surveillance lists of persons without reported lab data typically contain inaccuracies, requiring much time and resources to clean them. Demonstration and other projects implementing D2C through health departments have made clear that only a small proportion of persons on an original OOC list are truly OOC [6]. Equally important is that surveillance data are not timely due to the interval between recommended monitoring tests (every three-to six-months) and subsequent reporting of these tests to the health department. By the time someone appears on the surveillance-based OOC list, they have already been OOC for some time, which has been shown to present more challenges to reengagement and retention [40]. For these reasons, D2C strategies have evolved towards collaborative models. For example, integrating surveillance data with recent clinic-based data (such as recently missed appointments), or prioritizing locating those persons more recently lost to care [24,37,58,59]. In addition, the prioritization process – that is, prioritizing who to locate from the OOC list -- has been successfully used to foster health equity goals in D2C programs for racial and ethnic minoritized persons and MSM [7].

D2C that involves use of pharmacy data (e.g., prescription claims, refill timing) to identify persons who have failed to fill their antiretroviral therapy prescriptions represents an emerging model that can address some of D2Cs limitations [60,61]. In this *D2C-Rx* model, persons who have or are at risk of falling OOC can be identified in near real time. This may help to minimize treatment interruption by identifying people before they fall out of care. It can also allow for the activation of a series of interventions by pharmacists or others on the collaborative clinical team who support medication adherence and retention in care [61–63].

This systematic review has both strengths and limitations. To our knowledge, it is the first review to exclusively focus on D2C. In addition to synthesizing findings on D2C interventions, it also summarizes data on care statuses for persons not truly OOC. We explored heterogeneity in the D2C models using sensitivity analyses, but a limitation is that we did not explore other explanations such as differences in study outcome measures or definitions of OOC. Also, we did not examine the possibility of publication bias, and studies included in this review did not capture studies published after 2021.

Overall, this review suggests that D2C programs may improve HIV care outcomes. D2C programs are inherently variable and must be tailored to the operational and structural features, as well as capacity of the health department. As a result, different implementation challenges may underlie differences in outcomes across programs for retention and viral control [64]. A review of D2C programs has noted the inclusion of multiple reengagement strategies employed alongside identification of persons OOC, including appointment help, patient navigation, alerts, motivational interviewing, and enhanced partner services [8]. However, strategies needed for short-term engagement (e.g., appointments transportation, education, and motivation) are not always the same as those needed for longer-term retention. Persons experiencing structural barriers and other competing needs, such as housing and food instability, substance use, and mental illness, often require more intensive engagement activities [65,66]. Indeed, longitudinal data indicate engagement in care and VS among persons reengaged in care progressively decline over time [51]. Intensive case management with supportive counseling and social services may be necessary to retain clients of D2C services in care and on treatment. A focus on longer-term outcomes for persons re-engaged in care through D2C may be necessary to see the full potential of this public health strategy.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

REFERENCES:

1. CDC. Ending the HIV Epidemic in the U.S. (EHE). Available from: https://www.cdc.gov/ehe/php/about/index.html. Accessed 20 August 2024.
2. CDC. Ending the HIV Epidemic in the U.S. (EHE) Goals. Available from: https://www.cdc.gov/ehe/php/about/goals.html. Accessed 20 August 2024.
3. CDC. Selected national HIV prevention and care outcomes in the United States, 2019 (July 2019). Available from: https://stacks.cdc.gov/view/cdc/81314. Accessed 28 April 2025.
4. National Institute of Allergy and Infectious Diseases (NIH). HIV Undetectable=Untransmittable (U=U), or Treatment as Prevention. Available from: https://www.niaid.nih.gov/diseases-conditions/treatment-prevention. Accessed 20 August 2024.
5. Sweeney P, DiNenno EA, Flores SA, et al. HIV data to care-using public health data to improve HIV care and prevention. J Acquir Immune Defic Syndr. 2019;82(Suppl. 1):S1–S5. [PubMed: 31425388]
6. Sweeney P, Hoyte T, Mulatu MS, et al. Implementing a data to care strategy to improve health outcomes for people with HIV: a report from the care and prevention in the United States demonstration project. Public Health Rep. 2018;133(Suppl. 2):60s-74s. [PubMed: 30457958]
7. Buchacz K, Chen MJ, Parisi MK, et al. Using HIV surveillance registry data to re-link persons to care: the RSVP Project in San Francisco. PLoS One. 2015;10(3):e0118923. [PubMed: 25748668]
8. Higa DH, Crepaz N, Mullins MM, et al. Strategies to improve HIV care outcomes for people with HIV who are out of care. AIDS. 2022;36(6):853–862. [PubMed: 35025818]
9. Tesoriero JM, Johnson BL, Hart-Malloy R, et al. Improving retention in HIV care through New York's expanded partner services data-to-care pilot. J Public Health Manag Pract. 2017;23(3):255–263. [PubMed: 27902561]

10. Blanco N, Lavoie MC, Koech E, et al. Re-engagement into HIV care: a systematic review. AIDS Behav. 2022;26(1):132–146. [PubMed: 34245395]
11. Risher KA, Kapoor S, Daramola AM, et al. Challenges in the evaluation of interventions to improve engagement along the HIV care continuum in the United States: a systematic review. AIDS Behav. 2017;21(7):2101–2123. [PubMed: 28120257]
12. Nji MAM, Gunn J, Higa DH, et al. Assessing the effectiveness of data-to-care activities for improving HIV care outcomes: a systematic review. PROSPERO 2020 CRD42020173095. Available from: https://www.crd.york.ac.uk/PROSPERO/view/CRD42020173095.
13. Page MJ, McKenzie JE, Bossuyt PM, et al. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. BMJ. 2021;372:n71. [PubMed: 33782057]
14. DistillerSR. Version 2.35. DistillerSr Inc.; 2023. Available at: https://www.distillersr.com/. Accessed 20 August 2024.
15. Hong QN, Pluye P, Fabregues S, et al. Mixed Methods Appraisal Tool (MMAT), version 2018. Registration of Copyright (#1148552). Available from: https://www.nccmt.ca/knowledge-repositories/search/232#:~:text=Hong%2C%20Q.N.%2C%20Pluye%2C%20P,Intellectual%20Property%20Office%2C%20Industry%20Canada. Accessed 20 August 2024.
16. Li H, Qian D, Griffiths S, Chung RY, Wei X. What are the similarities and differences in structure and function among the three main models of community health centers in China: a systematic review. BMC Health Serv Res. 2015;15:504. [PubMed: 26554813]
17. Posit Team. RStudio: Integrated Development Environment for R. Posit Software, PBC, Boston, MA. Available from: https://posit.co/. Accessed 20 August 2024.
18. Higgins JPT, Li T, Deeks JJ. Chapter 6: Choosing effect measures and computing estimares of effect. Cochrane Handbook for Systematic Reviews of Interventions Verstion 6.4, 2023. Available from: https://training.cochrane.org/handbook/current/chapter-06. Accessed 20 August 2024.
19. Borenstein M, Hedges LV, Higgins JP, Rothstein HR. A basic introduction to fixed-effect and random-effects models for meta-analysis. Res Synth Methods. 2010;1(2):97–111. [PubMed: 26061376]
20. Deeks JJ, Higgins JPT, Altman DG, on behalf of the Cochrane Statistical Methods Group. Chapter 10: Analysing data and undertaking meta-analyses. Cochrane Handbook for Systematic Reviews of Interventions Version 6.4, 2023. Available from: https://training.cochrane.org/handbook/current/chapter-10. Accessed 20 August 2024.
21. Dettori JR, Norvell DC, Chapman JR. Fixed-effect vs random-effects models for meta-analysis: 3 points to consider. Global Spine J. 2022;12(7):1624–1626. [PubMed: 35723546]
22. Borenstein M, Higgins JP, Hedges LV, Rothstein HR. Basics of meta-analysis: I(2) is not an absolute measure of heterogeneity. Res Synth Methods. 2017;8(1):5–18. [PubMed: 28058794]
23. Anderson S, Henley C, Lass K, Burgess S, Jenner E. Improving engagement in HIV care using a data-to-care and patient navigation system in Louisiana, United States. J Assoc Nurses AIDS Care. 2020;31(5):553–565. [PubMed: 31899701]
24. Arey AL, Cassidy-Stewart H, Kurowski PL, Hitt JC, Flynn CP. Evaluating HIV surveillance completeness along the continuum of care: supplementing surveillance with health center data to increase HIV data to care efficiency. J Acquir Immune Defic Syndr. 2019;82(Suppl. 1):S26–s32. [PubMed: 31425392]
25. Avoundjian T, Golden MR, Ramchandani MS, et al. Evaluation of an emergency department and hospital-based data exchange to improve HIV care engagement and viral suppression. Sex Transm Dis. 2020;47(8):535–540. [PubMed: 32404856]
26. Avoundjian T, Lewis C, Peyton D, et al. Integrating HIV and sexually transmitted disease (STD) surveillance to direct partner services and improve HIV care engagement in Jackson, Mississippi. Sex Transm Dis. 2018;45(Suppl. 2):S31.
27. Beltrami J, Dubose O, Carson R, Cleveland JC. Using HIV surveillance data to link people to HIV medical care, 5 US states, 2012–2015. Public Health Rep. 2018;133(4):385–391. [PubMed: 29750891]
28. Bertolli J, Garland PM, Valverde EE, Beer L, Fagan JL, Hart C. Missed connections: HIV-infected people never in care. Public Health Rep. 2013;128(2):117–126. [PubMed: 23450876]

29. Bove JM, Golden MR, Dhanireddy S, Harrington RD, Dombrowski JC. Outcomes of a clinic-based surveillance-informed intervention to relink patients to HIV care. J Acquir Immune Defic Syndr. 2015;70(3):262–268. [PubMed: 26068720]
30. Braunstein SL, Coeytaux K, Sabharwal CJ, et al. New York City HIV care continuum dashboards: using surveillance data to improve HIV care among people living with HIV in New York City. JMIR Public Health Surveill. 2019;5(2):e13086. [PubMed: 31219053]
31. Buskin SE, Kent JB, Dombrowski JC, Golden MR. Migration distorts surveillance estimates of engagement in care: results of public health investigations of persons who appear to be out of HIV care. Sex Transm Dis. 2014;41(1):35–40. [PubMed: 24326579]
32. Chang EJ, Fleming M, Nunez A, Dombrowski JC. Predictors of successful HIV care re-engagement among persons poorly engaged in HIV care. AIDS Behav. 2019;23(9):2490–2497. [PubMed: 30980279]
33. Dombrowski JC, Hughes JP, Buskin SE, et al. A cluster randomized evaluation of a health department data to care intervention designed to increase engagement in HIV care and antiretroviral use. Sex Transm Dis. 2018;45(6):361–367. [PubMed: 29465679]
34. Donovan J, Sullivan K, Wilkin A, et al. Past care predicts future care in out-of-care people living with HIV: results of a clinic-based retention-in-care intervention in North Carolina. AIDS Behav. 2018;22(8):2687–2697. [PubMed: 29611094]
35. Goldman E, Union S, McClendon T, Veltman J. Home care: reaching our lost to follow-up patients and overcoming barriers to care utilizing nontraditional care models. Open Forum Infect Dis. 2019;6(Suppl. 2):S474–S475.
36. Hague JC, John B, Goldman L, et al. Using HIV surveillance laboratory data to identify out-of-care patients. AIDS Behav. 2019;23(Suppl. 1):78–82. [PubMed: 28265804]
37. Hart-Malloy R, Brown S, Bogucki K, Tesoriero J. Implementing data-to-care initiatives for HIV in New York state: assessing the value of community health centers identifying persons out of care for health department follow-up. AIDS Care. 2018;30(3):391–396. [PubMed: 28791877]
38. Hart-Malloy R, Shrestha T, Pezzulo MC, et al. Data to care opportunities: an evaluation of persons living with HIV reported to be “current to care” without current HIV-related labs. J Acquir Immune Defic Syndr. 2019;82(Suppl. 1):S20–S25. [PubMed: 31425391]
39. Hewitt RG, Williams D, Adule R, Feldman I, Alsumidaie M. Enhanced care coordination improves HIV viral load suppression rates. Am J Manag Care. 2019;25(6):e167–e172. [PubMed: 31211548]
40. Kunzweiler C, Kishore N, John B, et al. Using HIV surveillance and clinic data to optimize data to care efforts in community health centers in Massachusetts: the Massachusetts partnerships for care project. J Acquir Immune Defic Syndr. 2019;82(Suppl. 1):S33–S41. [PubMed: 31425393]
41. Magnus M, Herwehe J, Gruber D, et al. Improved HIV-related outcomes associated with implementation of a novel public health information exchange. International journal of medical informatics. 2012;81(10):e30–38. [PubMed: 22883431]
42. Mulatu MS, Hoyte T, Williams KM, et al. Cross-site monitoring and evaluation of the care and prevention in the United States Demonstration Project, 2012–2016: selected process and short-term outcomes. Public Health Rep. 2018;133(Suppl. 2):87s-100s. [PubMed: 30457956]
43. Ridgway JP, Almirol E, Schmitt J, Wesley-Madgett L, Pitrak D. A clinical informatics approach to reengagement in HIV care in the emergency department. J Public Health Manag Pract. 2019;25(3):270–273. [PubMed: 30180113]
44. Saafir-Callaway B, Castel AD, Lago L, et al. Longitudinal outcomes of HIV- infected persons re-engaged in care using a community-based re-engagement approach. AIDS Care. 2020;32(1):76–82. [PubMed: 31129991]
45. Sachdev DD, Mara E, Hughes AJ, et al. “Is a bird in the hand worth 5 in the bush?”: a comparison of 3 data-to-care referral strategies on HIV care continuum outcomes in San Francisco. Open Forum Infect Dis. 2020;7(9):ofaa369. [PubMed: 32995350]
46. Shamasunder S, Lucas C, Shaw S, et al. Collaborative data-to-care model improves HIV care outcomes in PLWH in Philadelphia. Top Antivir Med. 2020;28(1):16.
47. Sharp J, Angert CD, McConnell T, et al. Health information exchange: a novel re-linkage intervention in an urban health system. Open Forum Infect Dis. 2019;6(10):ofz402. [PubMed: 31660364]

48. Sitapati AM, Limneos J, Bonet-Vázquez M, Mar-Tang M, Qin H, Mathews WC. Retention: building a patient-centered medical home in HIV primary care through PUFF (Patients Unable to Follow-up Found). J Health Care Poor Underserved. 2012;26(Suppl. 3):81–95.
49. Sohail M, Rastegar J, Long D, et al. Data for Care (D4C) Alabama: clinic-wide risk stratification with enhanced personal contacts for retention in HIV care via the Alabama quality management group. J Acquir Immune Defic Syndr. 2019;82(Suppl. 3):S192–S198. [PubMed: 31764254]
50. Udeagu C, Huang J, Eason L, Pickett L. Health department-HIV clinic integration of data and human resources to re-engage out of care HIV-positive persons into clinical care in a New York City locale. AIDS Care. 2019;31(11):1420–1426. [PubMed: 30821484]
51. Udeagu CC, Shah S, Misra K, Sepkowitz KA, Braunstein SL. Where are they now? Assessing if persons returned to HIV care following loss to follow-up by public health case workers were engaged in care in follow-up years. AIDS Patient Care STDS. 2018;32(5):181–190. [PubMed: 29750551]
52. Udeagu CC, Webster TR, Bocour A, Michel P, Shepard CW. Lost or just not following up: public health effort to re-engage HIV-infected persons lost to follow-up into HIV medical care. AIDS. 2013;27(14):2271. [PubMed: 23669157]
53. Wohl AR, Dierst-Davies R, Victoroff A, et al. Implementation and operational research: the navigation program: an intervention to reengage lost patients at 7 HIV clinics in Los Angeles County, 2012–2014. J Acquir Immune Defic Syndr. 2016;71(2):e44–50. [PubMed: 26484741]
54. Chen YH, Farnham PG, Hicks KA, Sansom SL. Estimating the HIV effective reproduction number in the United States and evaluating HIV elimination strategies. J Public Health Manag Pract. 2022;28(2):152–161. [PubMed: 34225307]
55. Jacobson EU, Hicks KA, Carrico J, et al. Optimizing HIV prevention efforts to achieve EHE incidence targets. J Acquir Immune Defic Syndr. 2022;89(4):374–380. [PubMed: 35202046]
56. Sansom SL, Hicks KA, Carrico J, et al. Optimal allocation of societal HIV prevention resources to reduce HIV incidence in the United States. Am J Public Health. 2021;111(1):150–158. [PubMed: 33211582]
57. Skarbinski J, Rosenberg E, Paz-Bailey G, et al. Human immunodeficiency virus transmission at each step of the care continuum in the United States. JAMA Intern Med. 2015;175(4):588–596. [PubMed: 25706928]
58. Fanfair RN, Khalil G, Williams T, et al. The Cooperative Re-Engagement Controlled Trial (CoRECT): A randomised trial to assess a collaborative data to care model to improve HIV care continuum outcomes. Lancet Reg Health Am. 2021;3:100057. [PubMed: 36777404]
59. Lewis S, Morrison M, Randall LM, Roosevelt K. The partnerships for care project in Massachusetts: developing partnerships and data systems to increase linkage and engagement in care for individuals living with HIV. J Acquir Immune Defic Syndr. 2019;82(Suppl. 1):S47–s52. [PubMed: 31425395]
60. Byrd KK, Camp NM, Iqbal K, Weidle PJ. Pharmacy data as an alternative data source for implementation of a data to care strategy. J Acquir Immune Defic Syndr. 2019;82(Suppl. 1):S53–s56. [PubMed: 31425396]
61. Weidle PJ, Brooks JT, Valentine SS, Daskalakis D. The future of pharmacist-delivered status-neutral HIV prevention and care. Am J Public Health. 2023;113(3):256–258. [PubMed: 36603170]
62. Byrd KK, Hardnett F, Clay PG, et al. Retention in HIV care among participants in the patient-centered HIV care model: a collaboration between community-based pharmacists and primary medical providers. AIDS Patient Care STDS. 2019;33(2):58–66. [PubMed: 30648888]
63. Byrd KK, Hou JG, Bush T, et al. Adherence and viral suppression among participants of the patient-centered Human Immunodeficiency Virus (HIV) care model project: a collaboration between community-based pharmacists and HIV clinical providers. Clin Infect Dis. 2020;70(5):789–797. [PubMed: 30953062]
64. Elder H, Lang SG, Villanueva M, et al. Using the exploration, preparation, implementation, sustainment (EPIS) framework to assess the Cooperative Re-Engagement Controlled Trial (CoRECT). Front Public Health. 2023;11:1223149. [PubMed: 38106893]

65. Carey JW, Roland KB, Bessler PA, Tesfaye CL, Randall LA, Frew PM. Overcoming challenges to HIV medical care-seeking and treatment among data-to-care program clients in Baton Rouge and New Orleans, Louisiana. J Assoc Nurses AIDS Care. 2023;34(1):71–82. [PubMed: 36524875]

66. Roland KB, Carey JW, Bessler PA, et al. “Take care of their hierarchy of needs first”: strategies used by data-to-care staff to address barriers to HIV care engagement. AIDS Care. 2023;35(5):764–771. [PubMed: 35611755]

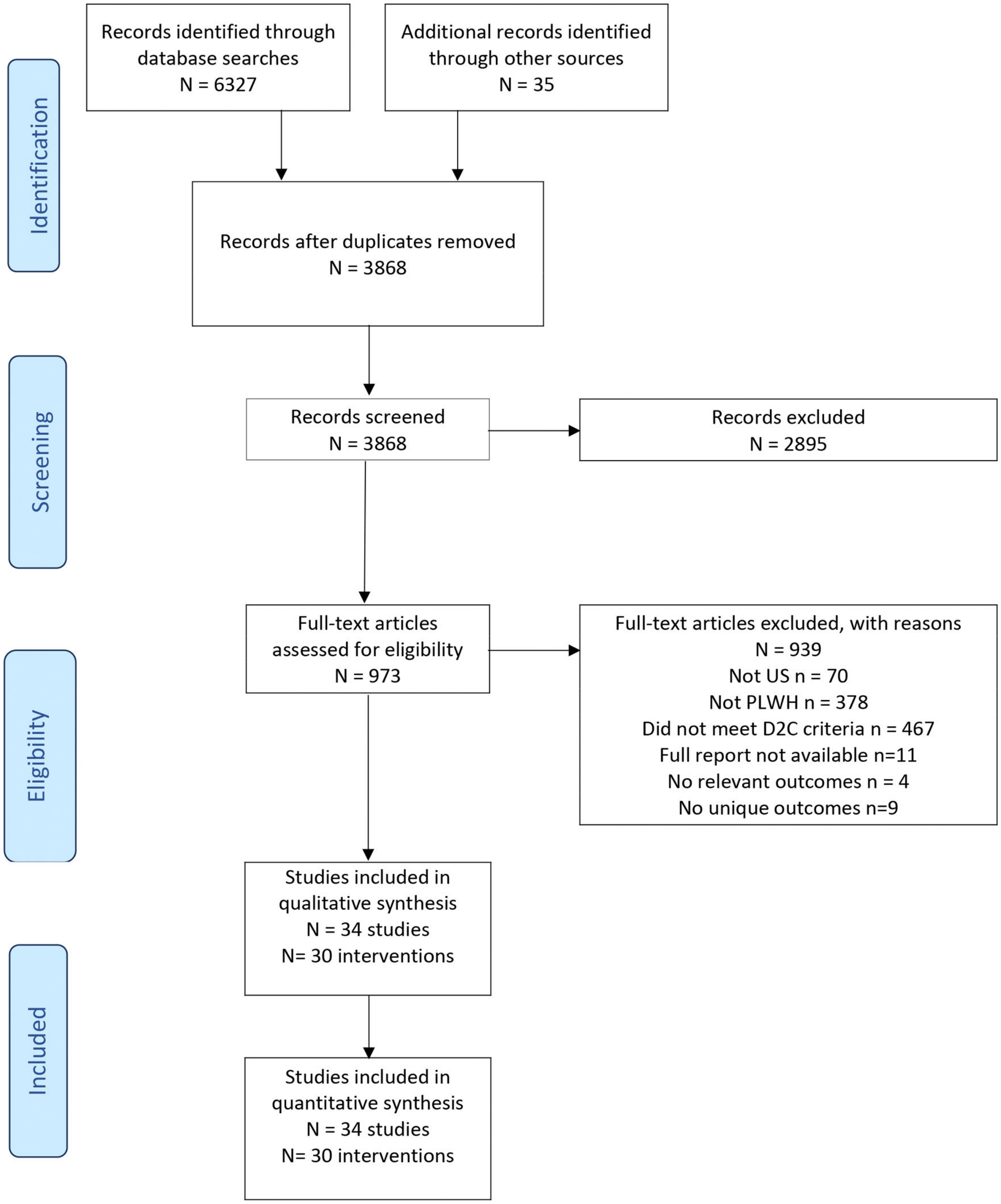

Figure 1: PRISMA

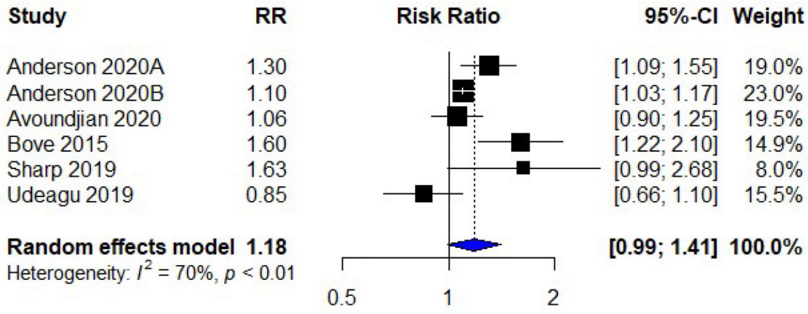

Figure 2: Engagement in Care

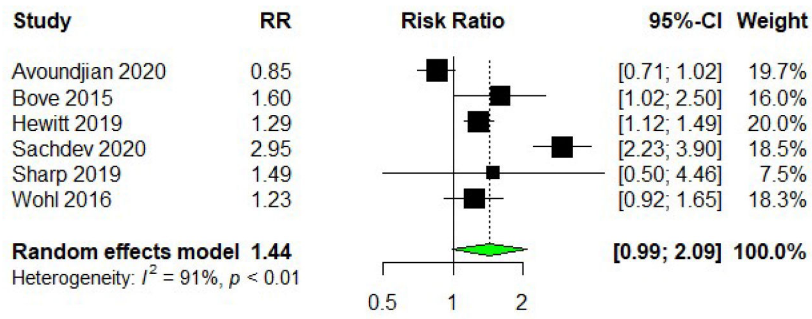

Figure 3: Viral Suppression

Table 1:

Definitions and Defined Outcomes

The following definitions were used to consistently capture study information and data of interest:	
Terms	**Definitions**
Geographic location	A state and/or city in the USA
Intervention duration	The start and end of the intervention period
Out of Care (OOC)	Authors' definitions usually involving gap in medical visit or lab measurement with or without a time variable
Relinkage to care	Authors' definitions usually involving attending a medical visit, lab measurement with or without a time variable
Staff performing relinkage	Any staff participating in engaging PWH who are OOC
Primary data sources	Databases used to identify the initial list of people who are OOC (e.g., HIV surveillance data, electronic medical records).
Adjunct data sources	Databases used to find contact information for the people on OOC list, as well as categorizing people into a status (e.g., moved, died).
Age	Reported by author
Race/ethnicity	Reported by author
Sex	Reported by author
HIV risk category	Reported by author
HIV risk category: MSM	The proportion of men who have sex with men (MSM) reported by author.
HIV risk category: PWID or IDU	The proportion of people who inject drugs or who engage in injection drug use (IDU) reported by author.
The following are the primary and secondary intervention outcome definitions used to consistently capture study data:	
Primary Outcomes	**Definitions**
Engagement in care	An HIV health care visit or documented CD4 count, viral load or genotype test, as well as author-provided definitions; time to HIV care as defined by author.
Retention in care	Two or more HIV health care visits or documented laboratory test results within a timeframe.
Viral Suppression (VS)	A viral load test result of < 200 copies/mL at the most recent viral load test during the assessment time frame (8), as well as author-provided definitions; time to HIV VS as defined by author.
HIV Care Status Outcomes	**Definitions** Status determined after investigation using primary data sources (e.g., electronic medical records, surveillance data, or self-report) and/or availability
Truly OOC	Persons not found to be in another HIV care status (e.g., current to care), or status is not yet confirmed or determined.
Current to care	Persons found to be engaged in HIV care elsewhere.
Deceased	Persons found to be deceased typically through death records or EMR.
Incarcerated	Persons found to be confined in local, state, or federal prison systems.
Not Located	Persons not found.
Out of Jurisdiction	Persons found residing outside of the designated study area.
Other Status	Persons found in a status that could not be aggregated in one of the six major categories above (e.g., HIV negative, ineligible, composite status)
Secondary Outcomes	**Definitions**
HIV surveillance data quality improvement	A change from current HIV surveillance or clinic/local-level data collection to a new process that helps improve data accuracy, efficiency, or general gaps in information.

Table 2:

Data Abstraction

Description of included interventions						
Author **Year**	**Geographical Location** **Study Design** **Project Name**	**Brief Description** **Duration/Time Periods**	**Definition of OOC** **Data Source**	**Definition of Relinkage to Care** **Staff Performing Relinkage**	**Age** **Race** **Ethnicity** **Sex** **HIV Risk Category**[*]	**Authors' Conclusion**[**]
Anderson; 2020 [23] **Related Citations:** Mulatu; 2018[a] [42] and Sweeney; 2018 [6]	New Orleans, LA, Baton Rouge, LA, Shreveport, LA Quantitative non-randomized study: Cohort LA Links	1. LA Links uses HIV surveillance data to generate weekly line lists of PWH who were newly diagnosed and NIC, or previously diagnosed and NIC 2. Eligible PWH are shared with LCCs trained in medication management, medical case management, and HIV treatment adherence counseling who attempt to contact individuals on their lists to enroll them in the program 3. Once enrolled, LCCs assist individual PWH for ≥90 days with care linkage, treatment adherence counseling, and referrals for critical support and prevention services. October 2011-October 2015	Newly diagnosed: No CD4 T-cell or VL test 6–12 months after diagnosis, or Previously diagnosed: a 12–36-month gap between CD4 T-cell or VL tests and not newly diagnosed or identified as being in treatment failure (having 2 recent VL tests with >1,000 copies/mL LA OPH SHP surveillance database Adjunct data sources: None	CD4 T-cell or VL test after diagnoses category (newly or previously) and NIC in the same study period Trained LCCs	N=361, newly diagnosed, intervention group Age: (mean) 33.7 Race: (%) Black/African American: 77.6 White: 15.5 Other: 6.9 Ethnicity: (%) Hispanic/Latino: 4.7 Sex: (%) Male: 79.8 Female: 19.7 Not specified: 0.6 N=3,038, previously diagnosed, intervention group Age: (mean) 43.1 Race: (%) Black/African American: 71.2 White: 24.4 Other: 4.4 Ethnicity: (%) Hispanic/Latino: 2.9 Sex: (%) Male: 68.1	LA Links may be an effective intervention to link and reengage individuals in HIV care. An intervention using surveillance data to identify and contact out-of-care PWH coupled with navigation services and treatment adherence increases the likelihood of care engagement.

Description of included interventions

Author **Year**	**Geographical Location** **Study Design** **Project Name**	**Brief Description** **Duration/Time Periods**	**Definition of OOC** **Data Source**	**Definition of Relinkage to Care** **Staff Performing Relinkage**	**Age** **Race** **Ethnicity** **Sex** **HIV Risk Category**[*]	**Authors' Conclusion**[**]
					Female: 30.5 Not specified: 1.3	
Arey; 2019 [24]	MD Quantitative descriptive study: incidence or prevalence without a comparison group P4C	The intervention was an enhanced D2C nested in the P4C project. 1. MDH performed a full EHR match with the MD eHARS to identify a baseline list of PWH patients at each clinic. Cases were reviewed to confirm HIV status and if engaged in care elsewhere. 2. MDH conducted P4C conferences monthly at health centers to assign presumed OOC to care investigators for linkage. Linkage to care updates were appended to patients' records. PRISM also used to inform linkage to care status. 3. MDH identified strategies to improve VL suppression for patients in care, used to update EHR laboratory data and HIV surveillance data. August 2016 to December 2017	Patients without a CD4 count or VL test in 13 months in either system. eHARS and EMR Adjunct data sources: PRISM	NR MHD staff; P4C health centers staff	Demographics: NR	Using HIV surveillance data in conjunction with clinic data improves ascertainment of HIV care status and consequently improves on D2C.
Avoundjian, 2020 [25]	Seattle, WA Quantitative non-randomized study: Cohort PHSKC-UW Medicine real-time data exchange	1. The PHSKC-UW Medicine real-time data exchange scanned the UW Medicine EDW every 5 minutes to identify patients presenting in the ED/IP M-F 8a-6p at any of three UW hospitals. 2. If identified as OOC the data exchange sent an SMS notification to the relinkage team who receives real-time patient information through the UW Medicine network 3. The relinkage team contacts the nurse to check on patient status, and when possible, meets with the patient in the ED or hospital to discuss HIV care reengagement, identify barriers to care, assist with follow-up appointments, and link to supportive services. July 20, 2015-July 20, 2017	Any previous positive HIV laboratory test result and a most recent VL ≥200 copies/mL UW Medicine EDW, a relational database that organizes EHR data from UW Medicine network of hospitals for research and programmatic use); PHSKC's eHARS Adjunct data sources: None	Engagement: VL test within 3 months after an eligible ED visit/IP admission PHSKC HIV care relinkage team, consists of DIS with HIV expertise	N=242, post-intervention Age: n (%) 19–29: 32 (13) 30–39: 56 (23) 40–49: 86 (36) ≥50: 68 (28) Race: n (%) Hispanic/Latinx: 31 (13) Black: 76 (31) White: 109 (45) Other: 26 (11) Sex: n (%) Male: 199 (82) Female: 37 (15) Not specified: 6 (3) HIV risk category: n (%) IDU: 94 (39)	Real-time data exchange with ED/IP hospitals was associated with improved viral suppression but not increased care engagement. However, results may reflect secular trends from other interventions.
Avoundjian; 2018 [26] Abstract	Jackson, MS Quantitative descriptive study:	1. Routine merge of data sources to identify OOC PWH from the Jackson area diagnosed with early syphilis, gonorrhea, or chlamydia in the past 14 days.	Most recent VL greater than or equal to 1,000 copies/mL or no VL/CD4 in the past year	Attending an HIV care appointment after DIS contact	N=55, OOC Demographics: NR	Integrating HIV and STD surveillance data may be a promising new

Description of included interventions

Author **Year**	**Geographical Location** **Study Design** **Project Name**	**Brief Description** **Duration/Time Periods**	**Definition of OOC** **Data Source**	**Definition of Relinkage to Care** **Staff Performing Relinkage**	**Age** **Race** **Ethnicity** **Sex** **HIV Risk Category**[*]	**Authors' Conclusion**[**]
	incidence or prevalence without a comparison group MSDH HIV and STD Data Merge	2. Algorithm matched HIV and STD surveillance records on last name, first name, and DOB 3. DIS contacted OOC persons to provide STD partner services and promote reengagement in HIV care. 4. Used HIV surveillance data to determine whether identified cases achieved viral suppression within 6 months of DIS contact June 2017 – January 2018	MSDH HIV and STD Surveillance Data Adjunct data sources: None	DIS		method to prioritize surveillance based D2C investigations identify and relink OOC PWH.
Beltrami; 2018 [27]	AK, HI, MN, MD, WA Quantitative descriptive study: incidence or prevalence without a comparison group Comprehensive HIV Prevention Program FOA Demonstration Project	1. HD surveillance staff members from 5 HDs analyzed their surveillance data to identify newly diagnosed HIV persons presumed to be OOC. 2. Prevention program staff members contacted the medical providers of the record or located the clients presumed OOC to help provide access to care. March 2012-December 2015	Newly diagnosed HIV presumed not to be in care on the absence of data CD4 cell count and VL, timing varied by HD HIV surveillance data Adjunct data sources: clinic records; STD surveillance databases	Attending an appointment with an HIV medical provider within 90 days of HIV diagnosis HD surveillance staff; HD and organization-based prevention program staff members	N=1,269, newly diagnosed with HIV Demographics: NR	Using HIV surveillance data to link newly diagnosed person to care was impactful in the clinic and public health overall. This project highlighted the importance of complete and up to date information to the HD surveillance systems from providers and labs.
Bertolli; 2013 [28]	IN, NJ, WA, New York City, NY, and Philadelphia, PA Quantitative descriptive study: incidence or prevalence without a comparison group Never in Care Pilot	1. HD sampled adults with HIV from December 2006-December 2009 and reported to eHARS by February 28, 2010. 2. Staff investigated eligibility by searching CD4 and VL reports for evidence of care and checking diagnosis dates with available records. 3. Routine matching of surveillance data with vital statistics data interstate 4. Eligible adults were contacted by mail, phone, and home visits using contact information from surveillance record, diagnostic service providers, or other means available. 5. Contact attempts continued until 6 months from initial contact, after which case was closed. 6. Once in contact, interviewers screened respondents. Ineligible individuals received referrals to medical services 7. Eligible respondents invited to participate in	HIV diagnosis ≥90 days previously, and no reported CD4 or VL tests (except for tests in the same month and year as the HIV diagnosis) eHARS Adjunct sources: vital statistics data; interstate efforts; surveillance record; diagnostic service provider; other means available to HDs for case investigation	CD4 or VL tests reported to surveillance after the interview HD staff/ interviewers	N=1,962, people interviewed and not interviewed Age: n (%) 18–29: 785 (40) 30–39: 481 (24.5) 40–49: 481 (24.5) ≥50: 216 (11) Race: n (%) Hispanic: 284 (14.5) American Indian/Alaska Native: 2 (0.1) Asian/Pacific Islander: 10 (0.5) Non-Hispanic Black: 1,197 (61)	HIV case surveillance records triggered follow-up and voluntary interviews that provided useful leads for improving linkage to care

Description of included interventions

Author Year	Geographical Location Study Design Project Name	Brief Description Duration/Time Periods	Definition of OOC Data Source	Definition of Relinkage to Care Staff Performing Relinkage	Age Race Ethnicity Sex HIV Risk Category*	Authors' Conclusion**
		interview and fingerstick blood draw 8. Incoming surveillance reports of CD4 and VL tests were prospectively monitored via eHARS through August 31, 2010, to determine if respondents had entered care after interview 9. All people contacted were encouraged to seek HIV medical care and given information about benefits of care (a CDC produced brochure) as well as referral to medical care. December 2006-December 2009 (HIV diagnosis), February 28, 2010-August 31, 2010			Non-Hispanic White: 363 (18.5) Multirace: 88 (4.5) Unknown: 20 (1) Sex: n (%) Male: 1,481 (75.5) HIV risk category: n (%) MSM: 716 (36.5) MSM+IDU: 69 (3.5) IDU: 128 (6.5) Heterosexual: 755 (38.5) Undetermined: 294 (15)	
Bove; 2015 [29]	Seattle, WA Quantitative non-randomized study: Cohort Madison Clinic Relinkage Program	1. Madison Clinic data manager identifies patients for relinkage outreach semiannually using a clinic database that collates information from EHR, paper intake forms, and case management databases. Clinic database includes all patients who have completed ≥1 visit at the clinic since 1994 regardless of HIV status or visit type. 2. A list of patients who meet the OOC criteria is sent to PHSKC to be matched with HD HIV surveillance data to identify patients who transferred HIV care, moved away, died, or are incarcerated 3. LS investigates each eligible case, attempts to contact patients, and assists with scheduling and completing a medical visit to the Madison Clinic. 4. LS searches the EHR and electronic case management records for each patient's status and attempts to contact each patient using a hierarchical method: a) three attempts at phone contact, b) one attempt to contact by email, c) attempt to contact outside agencies with a filed Release of Information form in EHR, d) attempt to call designated emergency contact without discussing reason, clinic name, or hospital name 5. If unsuccessful, LS refers case to PHSKC HIV care relinkage outreach team for additional outreach efforts. 6. If successful, LS inquires if patient has been absent from HIV medical care ≥1 year, and states interest in helping patient relink to care	Patients that are HIV-infected, have not died or transferred care, completed ≥1 visit in the past 1000 days, and have not completed a visit for ≥12 months prior to extraction date. Madison Clinic's database which collates EHR, intake forms, and case management records Adjunct sources: PHSKC health department HIV surveillance; Death records	Successfully completed an appointment at any time during the 12 months LS, case managers, and medical providers	N=1,399, intervention and historic control Age: n (%) <30: 123 (8.8) 30–39: 324 (23.2) 40–49: 497 (35.5) >50: 455 (32.5) Race: n (%) White: 843 (60.3) Black: 295 (21.1) Multiple: 10 (0.7) Native American: 51 (3.6) Pacific Islander: 3 (0.2) Missing: 197 (14.1) Ethnicity: n (%) Hispanic: 168 (12.0) Missing: 1,231 (88.0) Sex: n (%) Male: 1,165 (83.3) Female: 232 (16.6) Not specified: 2 (0.1) HIV risk category: n (%) MSM: 571 (40.8) MSM-IDU: 177 (12.7)	We demonstrated that a clinic-based relinkage program conducted in collaboration with a local health department significantly decreased the time to HIV care re-engagement and increased the likelihood that patients would relink to care compared to a historical control group. However, the absolute effect of the intervention was small

Description of included interventions

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		7. LS works with patient, case manager, medical provider, clinic triage and clerical staff to schedule follow-up appointments 8. LS reminds patients of appointments and follows up to determine whether the relinkage appointment was completed, declined to return to the clinic for care, or referred to PHSKC for further outreach. 9. LS's contact is majority via phone, and when needed, offers to meet outside clinic, assists with transportation, or visits hospitalized patients 10. LS tracks contact attempts and interactions in a designated relinkage database November 1, 2011-November 1, 2013			IDU: 103 (7.4) Heterosexual: 223 (16.0) Transfusion: 2 (0.1) Unknown/missing: 323 (23.1)	
Braunstein; 2019 [30]	New York, NY Quantitative non-randomized study: Cohort HIV CCD initiative	1. CCDs are facility-level performance reports derived from HIV surveillance data, displaying indicators on timely linkage to care (LTC), VL, and VL below transmission threshold (BTT). 2. CCDs are released twice annually, in June and December. June CCDs contain data for July-June of the previous year, and December CCDs contain data for January-December of the previous year. 3. CCDs are sent by email to each facility's leadership. 4. CCDs contain facilities' performance on LTC and VLS over the most recent 12 months. For evaluation, reports include comparisons to previous data and national and local targets highlighted with goal lines. 5. Facilities receive data on proportion of newly diagnosed patients linked at their facility vs. at other NYC facilities. 6. Facilities are provided with rank plots reflecting LTC and VLS performance for all CCD sites during same period, allowing for comparison against peers' performance. 7. NYC HIV surveillance data are lagged to account for reporting delays as well as standard dissemination timeline, such that data for the previous calendar year are released in December each year. 8. CCDs released in 2016 and 2017, the VLS target moved to 90% from 85% in response to	NR New York City HIV surveillance registry Adjunct sources: None	Timely LTC: any VL, CD4, or genotype test ordered by provider within 8–91 days of HIV diagnosis and reported to DOHMH. New York Health Department	N=21 sites N=≥1,000 patients	The CCD initiative fosters collaboration among HIV-care stakeholders, including providers, the Health Department, and patients. This effort empowers providers to continuously raise their standards to ensure timely care of newly diagnosed patients, achieve undetectable VL for all PWH, and ultimately prevent forward transmission of HIV in New York City.

Description of included interventions

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		substantial improvements among sites; however, for easier comparison across years, the VLS was kept at 85% 9. Low-performing facilities are those whose VLS or LTC is at least 10 percentage points below 85% target. December 2012 (includes 2011 lagged data)-December 2017 (includes 2016 lagged data)				
Buchacz; 2015 [7]	San Francisco, CA Quantitative descriptive study: incidence or prevalence without a comparison group RSVP	1. Vital status of PWH verified monthly with local and California vital statistics departments, and yearly with the National Death Index and the Social Security Death Master File. 2. Information on place of residence for PWH in San Francisco collected at initial HIV diagnosis and updated 18–24 months through medical record review and laboratory reports. 3. SFDPH surveillance staff have confidential access to EMRs of reported HIV cases at the county public hospital, public health clinics, and private medical facilities. 4. Eligible persons were a) aged ≥18 years and alive on the index date, b) no HIV VL test result or CD4 cell count reported for 9 months before index date, c) had an HIV VL >200 copies/mL at last measurement obtained Jan 20, 2011-July 20, 2011, "qualifying VL," d) living in GBA, defined as San Francisco, Alameda, Contra Costa, San Mateo, Main, Solano, Napa, Sonoma, Santa Clara, and Santa Cruz, e) had last HIV VL or CD4 cell count test within GBA, f) able to speak English, g) not incarcerated when contacted for an interview 5. Contacted cases by calling each telephone number ≤10 times; if unsuccessful, an invitation was sent to contact SFDPH regarding a "health survey." A confidential RSVP telephone line was established for eligible cases to return calls. 6. Upon telephone contact, confirmed person's identity by self-reported data of birth, then scheduled the 30-minute baseline interview. 7. Participants offered assistance with reengaging in HIV care from SFDPH linkage and navigation program (LINCS) and invited to participate in follow-up interview 3 months later.	No reported VL or CD4 cell count results in the past 9 months used as a proxy for being "OOC" and had an HIV VL >200 copies/mL at last measurement obtained 9 to 15 months prior to index date of April 20, 2012 (January 20, 2011-July 20, 2011). SFDPH eHARS Adjunct sources: EMRs at the county public hospital, public health clinics, and many private medical facilities; SFDPH STD report database, California State databases of support services in San Francisco (shelter and substance abuse); Lexis/Nexis	Re-linked to HIV care within 12 months after index data as evidenced by new HIV VL or CD4 cell count results in eHARS. SFDPH staff and LINCS staff	N=434, eligible for RSVP Age: median (IQR) 45 (37–51) Race: n (%) Non-Hispanic White: 229 (53) Non-Hispanic Black: 86 (20) Non-Hispanic Asian/Pacific Islander: 22 (5) Hispanic: 82 (19) Other: 13 (3) Unknown: 2 (0) Sex: n (%) Male: 392 (90) Female: 42 (10) HIV risk category: n (%) MSM: 366 (84) Heterosexual: 27 (6) IDU: 27 (6) Other/Unknown: 14 (3)	Despite the project's modest yield, majority of interviewed persons accepted referral to the LINCS program, and some benefited from LINCS services with re-engaging to HIV care.

Description of included interventions

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		8. Participants could meet with LINCS staff for health insurance assistance, appointments for HIV care reengagement, and referrals to ancillary services. 9. After 12 months, "matched back" records to the San Francisco eHARS data to determine if contacts misclassified as OOC or viremic, and if contacts re-linked to HIV. April 20, 2012-April 20, 2013 (12 months)				
Buskin; 2014 [31]	King County, WA Quantitative descriptive study: incidence or prevalence without a comparison group NOTICE	1. Annually, study staff created lists of and investigated dispositions for individuals reported to HARS with no evidence of CD4 or VL testing in the past 12 months or longer. 2. Individuals found to be in HARS in error or who had never lived in King County were removed. 3. Remaining individuals were categorized into 4 outcomes: relocations, deaths, unknown status, and continued local residence. Investigations continued until a disposition explaining the lack of CD4/VL testing was found, or until staff exhausted all reasonable avenues for investigation. 4. Two main sources (Accurint and MRR-PH) were used to investigate each case, if no clear disposition was found through other means. 5. If MRR-PH and Accurint reviews indicated a patient's residence in the area, staff contacted the patient's last known medical provider to confirm the patient's care engagement, residence, and vital status. 6. Presumably OOC residents were contacted and referred to medical care. 2007 – 2012	Presumed to be living with HIV/AIDS in King County, WA, who had no laboratory results (CD4 or VL) reported to HIV surveillance for at least 1 year between 2006 and 2010 HARS Adjunct data sources: Social Security Death Index; Medical Monitoring Project; local HIV quality assurance part of Ryan White Care Act; care needs assessments by local HIV planning council; Accurint; medical record review of a large public health hospital (MRR-PH); last known medical provider	Receiving medical care after the initiation of their NOTICE investigation, based on subsequent reporting of CD4/VL, medical record review, provider report, or self-report NOTICE staff	N=2,545, PWHA living in King County and no labs ≥12 months Age: n (%) <20: 10 (<1) 20–29: 128 (5) 30–39: 489 (19) 40–49: 1041 (41) 50–59: 656 (26) ≥60: 221 (9) Race/Ethnicity: n (%) Latino/Hispanic: 229 (12) American Indian/ Alaskan Native: 25 (1) Asian/Pacific Islander: 74 (3) Black/African American: 444 (17) White: 1659 (65) Multiple/Unknown: 44 (2) Sex: n (%) Female: 241 (9) Male: 2304 (91) HIV risk category: n (%) MSM: 1747 (69) IDUs: 129 (5) MSM-IDU: 257 (10) Heterosexual: 217 (9)	Investigations of individuals without laboratory results reported to HIV surveillance identified large numbers of people who are no longer living in the area. Our findings suggest that current estimates of the HIV care cascade may be too pessimistic and that individual case investigations are required to accurately define the size and composition of the population of PWH in local areas.

Description of included interventions

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					Other: 25 (1) Unknown: 170 (7)	
Chang; 2019 [32] **Related Citations:** Dombrowski; 2018[a] [33]	King County, Seattle, WA Quantitative descriptive study: incidence or prevalence without a comparison group CAPP	1. PHSKC surveillance team used HIV surveillance data to identify individuals with a last known residence in King County who appeared to be poorly engaged in HIV care. 2. HD DIS contacted the last known medical provider for each case then attempted to contact the individual and offer enrollment in CAPP. 3. Baseline CAPP included a structured interview to assess barriers in care and development of individualized plan to re-engage in HIV medical care. DIS assisted CAPP participants with re-engaging in care using a combination a health systems navigation, brief counseling, and referral to support services. 4. Psychosocial factor study (PSF): From 10/2012 to 1/2014, DIS offered all CAPP participants to participate in exploratory study to assess several psychosocial factors in greater depth using validated measurement instruments administered by CASI. March 2012-May 2016	"poorly engaged in HIV care": having no CD4 or viral load reported to surveillance for ≥12 months or a viral load of >500 copies/mL at last report ≥6 months after HIV diagnosis HIV surveillance Adjunct sources: None	Evidence of either continuous care engagement or viral suppression in the 12 months after the initial D2C encounter HD DIS	N=408 Age: n (%) <34: 100 (25) 35–44: 117 (29) 45–54: 144 (35) >55: 45 (11) Missing: 2 (1) Race: n (%) Non-Hispanic White: 217 (53) Non-Hispanic Black: 86 (21) Hispanic: 69 (17) Other: 31 (8) Missing: 5 (1) Sex: n (%) Male: 350 (86) Female: 53 (13) Not specified: 5 (1) HIV risk category: n (%) MSM: 225 (55) MSM+IDU: 85 (21) IDU: 39 (10) Heterosexual with presumed positive partner: 30 (7) Other: 2 (0.5) Missing: 1 (0.3) No identified risk: 26 (6)	All participants in a countywide D2C program over approximately 4 years, only 50% successfully reengaged in care in the year following the initial D2C encounter
Dombrowski; 2018[a] [33] **Related Citations:** Chang; 2019 [32]	King County, Seattle, WA Quantitative non-randomized study: Cohort CAPP	1. Randomly clustered participants based on last known medical provider 2. Two DIS investigated and searched all available databases. If this did not yield a disposition, DIS contacted medical provider 3. DIS contacted eligible individuals by phone and offered a face-to-face meeting (~45 min) that included a structured interview to identify and	"Poorly engaged in HIV care": diagnosed with HIV for ≥6 months. Criteria changed as community standard and guideline recommendations evolved	Cases identified as having a 12 month gap in laboratory reports: date of first VL or CD4 reported HD DIS	• N=997, met CAPP poorly engaged criteria Demographics: NR	We found no significant effect of a health department Data to Care intervention on viral suppression or relinkage to care.

Description of included interventions

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		address barriers to care and treatment 4. DIS assisted patients with HIV care re-engagement, and counseling sessions conducted at the PHSKC STD Clinic, in the field, or by phone 5. If participant consented, DIS sent letters summarizing the encounter to the participant's medical provider and case manager 6. DIS routinely attempted to contact all participants one month after baseline to assess whether they had seen their medical provider and offer additional assistance May 1, 2011-September 18, 2013 (Group 1 May 1, 2011-June 24, 2012; Group 2 July 25, 2012-September 18, 2013)	Group 1: VL>500 copies/mL and CD4<350 cells/mm^3 at the time of last report in prior year ("recent unsuppressed VL"), Group 2: "Recent unsuppressed VL OR no CD4 or VL in the past year or 2 eHARS (county) Adjunct data sources: HIV/STD public health databases; electronic health records; death records; Lexis Nexis database			
Donovan; 2018 [34]	NC Quantitative descriptive study: incidence or prevalence without a comparison group NC-LINK Retention Project	1. EHR and CAREW used to generate a monthly list of OOC in each clinic. 2. Clinic staff further reviewed the list to eliminate persons who were known to have a future scheduled appointment or moved, died or incarcerated. 3. Retention staff attempted to locate, contact, and reschedule the presumed OOC primarily via phone calls then letters or database searches for HIV care reengagement. 4. A list of uncontacted PWH was forwarded to the Division of Public Health team of State Bridge Counselors for further intervention including home visits. 5. After contact with patient was successful, actions taken to aid the patient with care engagement were tracked as service in CAREWare. January 1, 2013 to December 31, 2014	Lack of attendance at a medical visit in the prior 6–9 months and had no known future appointment scheduled with an HIV medical provider Clinical EMR; NC CAREWare (Ryan White Service data system) (clinic data only) Adjunct sources: Clinic scheduling system; EMR	VL result in eHARS within 90 days of the referral Clinic retention staff (patient navigators and case manager); Public health department states bridge counselors	N=1,118, out of care Age: n (%) 18–29: 459 (41) 30–39: 352 (31) 40–49: 232 (21) ≥50: 75 (7) Race: n (%) Black: 794 (71) White/Non-Hispanic: 260 (23) Hispanic:32 (3) Other/Multiple: 32 (3) Sex: n (%) Male:783 (70) Female:329 (29) Not specified: 6 (1) HIV risk category: n (%) MSM: 449 (40) Heterosexual: 548 (49)	Clinic-based retention interventions are simple and can be performed with existing staff in most clinics. They may be helpful in ensuring continuity of care among PLW by reducing or eliminating OOC period as prior patterns of care persist. Data sharing may increase accuracy and validity of OOC list.

Description of included interventions

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					PWID:104 (9) Other:17(2)	
Goldman; 2019 [35] Abstract	Detroit, MI Quantitative descriptive study: incidence or prevalence without a comparison group WSUPG ID Clinic Homecare Program	1. WSUPG ID clinic identified 95 clients that were virally unsuppressed and lost to care for 12 months. 2. Program was advertised internally to the Detroit Public Health Departments' Data to Care Program, Link Up Detroit, and to community-based organizations 3. WSUPG staff called OOC clients and offered homecare 4. Referred patients were seen by a NP/MA team supervised by an infectious disease attending primary care provider 5. HIV medical homecare utilized outpatient care standards, including lab draws and counseling 6. Patients could also text/call provider directly on the program cell phone September 20, 2017-September 20, 2018	Virally unsuppressed and lost to care for 12 months WSUPG clinic records Adjunct data sources: None	NR WSUPG ID clinic staff	N=41, OOC and reachable NR	Homecare offers a new, innovative healthcare delivery system which is effective at achieving viral suppression in a challenging patient population and is a successful strategy to re-engage patients in care.
Hague; 2019 [36]	MA Quantitative descriptive study: incidence or prevalence without a comparison group MDPH surveillance driven linkage and retention intervention	1. Electronic laboratory data routinely reported to the surveillance program within MDPH was used to identify patients who were presumed to be OOC at the 3 health facilities. 2. Line lists of presumed OOC were forwarded to the health facilities to confirm HIV care status based on medical records. 3. The confirmed care status of each presumed OOC was sent back to MDPH after investigating the laboratory-generated line lists by searching medical records and discussing patients care status with clinicians and case managers. 4. The feedback about patients' care status informed the subsequent months line list. 5. Patients confirmed OOC were attempted to be relinked to care by facility staff. June 2013-May 2014	Absence of CD4 and/or VL test for at least 6 months, using laboratory tests as a proxy for an HIV care visit Electronic laboratory reports from MHASP (HIV surveillance data) Adjunct data sources: medical records and other clinical information	Patients having a subsequent laboratory test at 3 and 6 months Health care facility staff	N=421, confirmed OOC Age: n (%) 20–29: 21 (5) 30–39: 76 (18) 40–49: 122 (29) 50–59: 151 (36) ≥60: 51 (12) Race: n (%) Non-Hispanic white: 139 (33) Non-Hispanic black: 134 (32) Hispanic/Latino 143 (34) Other/unknown: 5 (1) Sex: n (%) Male: 261 (62) Female: 160 (38) HIV risk category: n (%) MSM: 93 (22)	It is essential to have clinical staff confirm the care status of patients who are presumed to be OOC based on surveillance data.

Description of included interventions

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					IDU: 126 (30) MSM/IDU: 14 (3) Heterosexual: 88 (21) Presumed Heterosexual: 50 (12) Other/Unknown: 50 (12)	
Hart-Malloy; 2019[a] [38] **Related Citations:** Hart-Malloy A; 2018 [37] and Tesoriero; 2017[a] [9]	NYS, excluding NYC Quantitative descriptive study: incidence or prevalence without a comparison group ExPS/HD Model	1.Partner Services field investigation assignments generated on persons ≥18 years presumed to be NIC through an electronic surveillance system. 2. Trained staff use same system to enter information on outcome of investigations, including care status. 3. Investigation steps vary, but often begin with a phone call to individuals' last known medical provider. 4. If further investigation is needed, individuals are contacted via phone calls, texts, and home visits to identify their status (i.e., currently in care, NIC, living in another state, deceased, or medically unable to respond). 5. For persons confirmed to be NIC, staff work with the individual to minimize barriers to care and ensure lasting relinkage to care. September 2013-May 2016	No CD4, viral load, or nucleotide sequence from genotype resistance testing for a period of 13–24 months, and not seeing a provider NYS HIV surveillance system (state) Adjunct data sources: online search tools	HIV viral load test after case assignment Trained Partner Services staff	N=755, NIC Age: n (%) 18–29: 107 (14.2) 30–39: 143 (18.9) 40–49: 214 (28.3) 50–59: 213 (28.2) >60: 78 (10.3) Race: n (%) White, non-Hispanic: 188 (25.1) Black, non-Hispanic: 314 (41.9) Hispanic: 123 (16.4) Other: 124 (16.6) Sex: n (%) Male: 481 (63.7) Female: 274 (36.3) High Risk Category: n (%) Heterosexual sexual contact: 275/672 (40.9) MSM: 284/671 (42.3) History of IDU: 85/675 (12.6) MSM/IDU: 25/676 (3.7) Other: 3/755 (0.4)	Although findings suggest that most persons reporting being in care might be taking HIV medications, this analysis showed that a proportion of individuals show a decline of viral load suppression status over time.
Hart-Malloy A; 2018 [37] **Related Citations:** Hart-Malloy; 2019[a] [38] and	NY Quantitative descriptive study: incidence or prevalence without a	Detailed information cited for (114) Tesoriero, 2017 1. Utilized state HD surveillance data to identify presumed OOC PWH and assign them to a county health department's ExPS trained advocates. 2. Advocates searched data sources, contacted last known medical provider, mailed non-disease	No HIV-specific laboratory results reported in a specific time frame (9-months for NYC and 13–24-months for rest of state)	Confirmed follow-up HIV medical appointment HD DIS staff, Trained ExPS advocates	N=348, confirmed OOC Demographics: NR	While re-linkage success for the Combination Model was lower compared to the HD Model (63% vs 78%) it is unclear if

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Tesoriero; 2017[a] [9]	comparison group ExPS/HD Model	specific letter, and conducted a home visit to the last known address. 3. Located PWH were interviewed, confirmed to be OOC, asked why they were OOC, and were offered to be relinked to care. September 1, 2013-September 1, 2016	State HIV surveillance database Adjunct data sources: Regional Health Information databases, conducted vital status verification matches, searched jail and prison directories, conducted LexisNexis Accurint for Government search, used online search engines and networking sites			there is a true difference between the models (though not statistically significant), or if these individuals were more difficult to re-link to care.
Hart-Malloy B; 2018 [37]	NY Quantitative descriptive study: incidence or prevalence without a comparison group HICAPP/ Combination Model	Regional-level initiative working in partnership with 6 federally qualified CHC 1. Providers at CHC identify individuals presumed OOC from current caseload, and submit these cases to the HD for re-linkage efforts 2. HD staff use information available and patients meeting OOC definition are assigned to a HD Partner Services field worker 3. Field workers work with CHC to assist in investigation processes through case conferencing January 1, 2015-September 1, 2016	Absence of a recent HIV-related medical visit at facility (no visit for at least 9-months) and no HIV-specific laboratory results (VL, CD4 count, antiviral resistance test for at least 9-months CHC medical records Adjunct data sources: Vital status and HIV-specific laboratory results reported to surveillance; online record searches (Accurint)	Confirmed follow-up HIV medical appointment DIS, Trained CHC field staff	N=19, confirmed OOC Demographics: NR	While re-linkage success for the Combination Model was lower compared to the HD Model (63% vs 78%) it is unclear if there is a true difference between the models (though not statistically significant), or if these individuals were more difficult to re-link to care.
Hewitt; 2019 [39]	NY Quantitative non-randomized study: Cohort Enhanced Care Coordination and Support	1. MetroPlus received a cross-references list between the NYSDOH HIV Surveillance Registry and an active roster of all Medicaid managed care recipients a. Names of individuals who were enrolled in MetroPlus anytime in the prior 4 years were included. b. Monthly, MetroPlus reconciled the list with its active enrollment roster. 2. OOC members were the Target Population (TP) for the street outreach intervention. MetroPlus partnered with Alliance for Positive Change ASO	No VL test or primary care provider visit in the prior 9 months and/or no ART refill in the prior 6 months NYS HIV surveillance registry; Medicaid active roster Adjunct data sources: None	Presence of a viral load value within 90 days after the program initiation date (Jan 1, 2016) Trained peer educators, trained peer counselors, and care coordinators	N=1,429, targeted OOC population Age: median 47 Sex: % Female: 42 High Risk Category: % History or current substance disorder: 48	Individuals who are unengaged in HIV care and/or with an unsuppressed VL can achieve care engagement and VL suppression with intensified outreach, care coordination, and peer support by a Medicaid managed care plan.

Description of included interventions

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		and used trained peers to seek OOC members by phone or face-to-face interaction. 3. Upon making contact, peers discussed returning to care with the member & with member consent assisted with appointment making and escort to HIV primary care appointment. 4. Members who were engaged in care but not virally suppressed were the TP for the peer care connection intervention. Care coordinators worked with trained peer educators and peer counselors to seek members through phone or face-to-face interactions. a. Activities included: educational workshops, creative arts workshops, individual adherence counseling, referrals to community programs, and other support services. b. Members from the street outreach intervention engaged in care, were included in the peer care connection intervention.August 2015–2017				
Kunzweiler; 2019 [40]	MA Quantitative non-randomized study: Cohort MA P4C	This project was a partnership between MDPH and 6 CHCs. 1. MDPH epidemiologists created a list for each CHC of OOC patients using surveillance data. 2. CHCs also generated a list of OOC patients using medical data. 3. MDPH epidemiologists performed comparisons of the lists. a. Patients were removed if identified as: retained in care, deceased, not residing in MA, not receiving care at the CHC, or incarcerated or if patients were clinically stable. 4. MDPH had monthly case reconciliation conference calls which included: a. Discussing patients on combined OOC list. b. Updating OOC list with CHC newly diagnosed patients felt to be OOC or in danger of being OOC. 5. OOC patients were assigned to MDPH field epidemiologists who attempted to contact patients by telephone, text messages, letters, or home visits and recorded the results. 6. Failure to contact a patient within 30 days lead to case closure. If contact was successful, follow-up continued for up to 90 days.	Absence of CD4 or VL test in the previous 6 months; absence of CD4 or VL test within 3 months of being diagnosed; no HIV clinic visit in the past 6 months; no clinic visits within 3 months of being diagnosed MDPH surveillance data; CHC clinic data Adjunct data sources: None	CD4 or VL test performed MDPH field epidemiologists	N=83, identified as OOC Age: n (%) 18–29: 16 (19.3) 30–49: 45 (54.2) ≥50: 22 (26.5) Race/ethnicity: n (%) Non-Hispanic White:19 (22.9) Non-Hispanic Black: 38 (45.8) Hispanic: 25 (30.1) Other/unknown: 1 (1.2) Sex: n (%) Male:58 (69.9) Female: 25 (30.1) HIV Risk Category: n (%) MSM: 23 (27.7) IDU and MSM/IDU: 19 (22.9) Heterosexual or	Although rates of re-engagement, retention, and viral suppression were low, the MA P4C D2C procedures provided a means for accurate ascertainment of OOC status.

Description of included interventions

Author **Year**	**Geographical Location** **Study Design** **Project Name**	**Brief Description** **Duration/Time Periods**	**Definition of OOC** **Data Source**	**Definition of Relinkage to Care** **Staff Performing Relinkage**	**Age** **Race** **Ethnicity** **Sex** **HIV Risk Category**[*]	**Authors' Conclusion**[**]
		7. CHCs agreed to accept OOC patients for same- or next-day appointments. 8. Field epidemiologists called to schedule appointments, accompanied patients to appointments, provided reminders, and arranged transportation. They confirmed patient attendance at the clinic visit within 3 days of appointment and documented the outcome. a. Field epidemiologists followed up on patients who failed to keep scheduled appointments and provided additional support to facilitate engagement in HIV care. October 2015 and June 2017			presumed heterosexual: 13 (15.7) Other/Unknown: 28 (33.7)	
Magnus; 2012 [41]	Louisiana Quantitative non-randomized study LaPHIE	1. Bidirectional exchange of information between the State's public health agency and LSU Health Care Services Division (LSU HCSD) to allow real-time identification of OOC persons when seeking care for any health concern within the integrated delivery network (IDN) 2. LSU HCSD is an IDN of 7 safety-net hospitals supplying HIV medical treatment to 60–75% of PWHA who receive HIV-specific care in Louisiana 3. In 2009, the network's use of shared EMR and existence of statewide name-based public health surveillance data led to the creation of the LaPHIE 4. When an OOC HIV-infected patient registers at any ambulatory clinic, ER department, or inpatient unit within the IDN, LaPHIE immediately generates an automated alert to providers in the LSU HCSD EMR 5. Providers are alerted of the patient's OOC status and provide clinical decision support to engage in HIV-specific care 6. Actions taken by provider are documented within the structured EMR and patients are followed for outcomes through both the LSU HCSD and Louisiana Office of Public Health (OPH) surveillance systems, which collaboratively manage LaPHIE 7. Persons who enter care and have a CD4 or VL testing performed are removed from LaPHIE until absence from care causes re-entry; persons receiving counseling, but no CD4 or VL test, are	Identified by LaPHIE with no CD4 or VL monitoring in >1 year LaPHIE. which statewide public health surveillance data and LSU HCSD EMR data Adjunct sources: None	CD4 or VL testing performed IDN providers (physicians, nurses, advanced practice nurses, or physician assistants)	• N=419, OOC identified by LaPHIE • Age: n (%) ◦ <35: 194 (46.4) ◦ ≥35: 225(53.6) • Race: n (%) ◦ Black/African American: 285 (68.0) ◦ White and other: 134 (32.0) • Sex: n (%) ◦ Male: 264 (63.0) ◦ Female: 154 (36.8) • HIV risk category: n (%) ◦ MSM: 58 (13.8) ◦ IDU: 16 (3.8) ◦ Heterosexual: 90 (21.5) ◦ No identified risk/ unknown: 204 (48.7)	A health care delivery-public health information exchange can effectively facilitate engagement, re-engagement, and retention of out-of-care HIV-infected persons in specialty care

Description of included interventions

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		removed for a specified time period and re-entered in the dataset prompting a new alert when seeking care; alerts continue to appear until patients receive CD4 or VL, or specifically indicate they are in care elsewhere or are not interested in care. February 1, 2009-July 31, 2011				
Mulatu; 2018[a] [42] **Related Citations:** Sweeney; 2018 [6] and Anderson; 2020 [23]	IL LA MS MO NC TN VA GA (not included in D2C section) Quantitative descriptive study: incidence or prevalence without a comparison group CAPUS Demonstration Project	The CAPUS demonstration project consists of multiple programs all focusing on identifying HIV infections, linking to/reengaging PWH to care and prevention services. One of the programs used was D2C within 7 of the 8 states. 1. HIV surveillance is used to identify PWH who are not in care 2. The "not in care" list is cross checked with additional data systems (care and prevention program data) for care verification 3. The "not in care" list is prioritized and shared with field staff members to locate and offer linkage to/reengagement in care 4. Any new information identified from the field is shared with the surveillance program to improve data quality. September 30, 2012-September 29, 2016	NR HIV Surveillance Data Adjunct data sources: Ryan White HIV/AIDS Program services; Commercial people-locating databases; care or prevention program data	Attending their first HIV medical appointment after being OOC for at least the previous 6 months and is confirmed by documented VL test or CD4 count Trained HD field staff members	N=18,806, presumed NIC Demographics: NR	D2C can be challenging while also creating opportunities. Incomplete or delayed data for surveillance along with problems with the integration of surveillance, care, and prevention data are all major challenges. CAPUS grantees were able to identify these problems and strengthen all their data systems in reporting and integrations to help produce a high percentage of PWH to be linked to/reengaged with care.
Ridgway; 2019 [43]	Chicago, IL Quantitative descriptive study: incidence or prevalence without a comparison group EMR-based algorithm program	1. EMR algorithm identified patients who met one of the following criteria: a) laboratory evidence of HIV(+) antibody test or detectable HIV VL, b) HIV infection listed in past medical history or problem list section of EMR, c) prescription for antiretroviral therapy (except patients prescribed tenofovir-emtricitabine alone for HIV PrEP) 2. Electronic algorithm generates EMR-based report daily to identify PWH in ED or inpatient hospital 3. Determined if patient was engaged in care based on self-report or documentation of an undetectable HIV VL in EMR. 4. If unable to determine patient's care status, submitted name and date of birth to CDPH to	Documentation of an undetectable HIV VL in EMR. ED and hospitalized EMR Adjunct sources: Chicago Department of Public Health electronic HIV surveillance database; eHARS (national)	Re-engagement in HIV care: attending a HIV care appointment Trained HIV care navigator	N=393, PWH, status could be confirmed Age: mean (SD) 41.3±12.8 Race: n (%) Black: 365 (92.9) White: 21 (5.3) Other/Unknown: 7 (1.8) Sex: n (%) Male: 256 (65.1)	By creating an electronic algorithm to identify PWH OOC and utilizing a trained HIV care navigator, we successfully reengaged two-thirds of HIV-positive patients seen in the ED or hospitalized at our institution.

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		query the Chicago electronic surveillance database and eHARS for matching and determined the date and location of patient's most recent HIV care. The patient's care status was shared with the health care facility. 5. For PWH not engaged in care, a trained HIV care navigator met with patients either in person during the ED or inpatient encounter or via telephone after medical visit. Performed a needs assessment, verified the patient's insurance status, scheduled an IV care appointment with a provider of choice, and provided referrals for additional supportive services (e.g., housing, case management, behavioral health) 6. Care navigator confirmed attendance at scheduled HIV care appointment. Patients followed from time of medical encounter until successfully reengaged in care (January 31, 2018). July 1, 2016-August 31, 2017 (recruitment)-January 31, 2018				
Saafir-Callaway; 2020 [44]	Washington, DC Quantitative descriptive study: incidence or prevalence without a comparison group RB	RB was a joint effort by DC DOH and Ryan White supported clinics. 1. Ryan White Clinical providers assembled a list of PWH considered OOC based on clinic records and forwarded to DC DOH. 2. DC DOH matched these lists to HIV surveillance, ADAP, and Ryan White service data to confirm HIV care status. 3. The list of those who remained OOC was sent back to clinical providers for re-engagement efforts. 4. Ryan White clinical providers attempted to contact and re-engage those OOC through phone calls, letters, e-mail, in-person conversations, and text messages among other strategies over 60-day recapture period (RB). 5. After RB, the clinics returned a list to DC DOH of OOC with a contact log and reengagement disposition for each participant. The DC DOH reviewed and summarized final OOC status for each participant. 6. Persons categorized as not re-engaged were matched to the HIV surveillance system to	No evidence of a VL result, CD4 result, or care visit for the immediate past 6–12 months Ryan White Clinical Providers (clinic data) Adjunct sources: HIV surveillance DC DOH; Ryan White Services Data System; ADAP data (city)	At least one CD4 or VL test result during the 6, 12, and 18 months post-RB Ryan White CARE Act-funded primary care providers	N=103, reengaged or not reengaged at RB Age: n (%)? 20–29: 16 (15.5) 30–39: 26 (25.2) 40–49: 25 (24.3) 50–59: 17 (16.5) ≥60: 7 (6.8) Missing: 12 (11.7) Race: n (%) White: 5 (4.9) Black: 80 (77.7) Hispanic: 4 (3.9) Other: 2 (1.9) Missing: 12 (11.7) Sex: n (%) Male: 70 (68.0) Female: 21 (20.4) Missing: 12 (11.7)	Despite successful reengagement of only 10% of persons with an attempted contact during RB, majority of people identified as OOC were engaged in care, had significant increases in their CD4 counts, and were VS for up to 18 months post-RB

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		determine if they re-engaged in care on their own (i.e., updated laboratory results, CD4 and HIV VL, recorded)April 1, 2013-October 2014			HIV risk category: n (%) MSM: 44 (42.7) IDU: 11 (10.7) MSM/IDU: 2 (1.9) Heterosexual contact: 25 (24.3) Risk not identified: 9 (8.7) Missing: 12 (11.7)	
Sachdev; 2020 [45]	San Francisco, CA Quantitative non-randomized study: Cohort LINCS by referral	1. HIV care providers at large public health clinics referred PWH suspected of fallen out of care to LINCS 2. LINCS received referrals from health care providers, HIV surveillance, and a clinical EMR registry matched to surveillance 3. HIV surveillance epidemiologists used viral loads or CD4 criteria to identify patients in eHARS for referral. 4. Provider referrals included patients who had no evidence of care postdiagnosis, did not access care over many months, or who were not adherent to medication 5. The registry included all PWH receiving care in 3 public health clinics where LINCS navigators were embedded 6. The registry was matched to eHARS to exclude person who did not meet inclusion criteria, moved outside San Francisco, died, or had been assigned to LINCS in past year 7. The final matched lists were sent to LINCS; LINC staff checked eHARS to determine current not-in-care status before starting outreach 8. LINCS navigators attempted to locate individuals within 30 days of assignment using access to multiple electronic systems 9. Navigators worked with PWH for up to 90 days and would offer a warm hand-off to a long-term case manager for ongoing support as needed 10. Navigators provided a range of field-based services to address barriers to care, including benefits navigation, appointment reminders, accompaniment to clinic, motivational interviewing, and modified ART and Access to Services strength-based case management	VL>1,500 copies/mL within last 4 months or no VL in >15 months Providers; eHARS, the state HIV surveillance system Adjunct sources: clinical EMR match utilized a registry developed through HRSA HIV Ryan White; local STD surveillance database; public health hospital EMR; other disease intervention searching tools	Attend a re-linkage appointment with an HIV care provider LINC navigators	N=954, referred to LINCS Age: n (%) 13–24: 18 (1.9) 25–39: 300 (31.4) 40–49: 276 (28.9) ≥50: 360 (37.7) Race: n (%) White: 242 (25.4) African American: 362 (37.9) Latino: 274 (28.7) Other: 76 (8.0) Sex: n (%) Male: 788 (82.6) Female: 114 (11.9) Not specified: 52 (5.5) HIV risk category: n (%) MSM: 459 (48.1) PWID: 142 (14.9) MSM-PWID: 276 (28.9) Heterosexual contact: 58 (6.1) Other/unknown: 19 (2.0)	Across all 3 referral strategies, over a quarter (28%) of enrolled PWH had no evidence of prior viral suppression, and 54% of these patients achieved viral suppression within 12 months after the intervention. D2C re-linkage efforts improved retention, VS, and durable VS

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		2015–2017				
Shamasunder; 2020 [46] Abstract	Philadelphia, PA Quantitative study: RCT Collaborative HD/ Medical Provider D2C	1. Identified OOC, specifics unknown 2. DISs assisted patients with reengagement August 2016-December 2017	No care in 6 months following in-care at a participating clinic during previous 12-months NR Adjunct data sources: None	Re-engagement: CD4/VL within 90 days DIS	N=449, randomized Age: n (%) NR Race: n (%) Black: 292 (65) Sex: n (%) Male: 341 (76) HIV risk category: n (%) MSM: 189 (42)	Results indicate that a collaborative data-to-care intervention can improve re-engagement in care, retention in care, and viral suppression among PWH who are OOC
Sharp; 2019 [47]	Atlanta, GA Quantitative non-randomized study: Cohort Georgia Public Health Information Exchange (GPHIE)	Modeled after Louisiana LaPHE 1. GPHIE is a bidirectional health information sharing platform between GDPH and GHS that utilizes data traditionally collected for surveillance in the delivery of patient care 2. The GDPH OOC list is updated regularly and matched against patient registrations in GHS in real time 3. An HIE alert is automatically generated when a match occurs, and the GPHIE alert must be sent to a physician provider 4. At GHS, the alert is sent to 2 clinicians who notify 1 of 2 ED social workers who are trained in motivational interviewing and experience working with PWH 5. The social workers explain the GHPIE system to the patient, ascertain if patient is engaged in HIV care; if not, then the social workers educate the patient, assesses barriers to care, offers relinkage support, either to the prior site of care or the Grady HIV clinic (also known as Infectious Disease Program (IDP) 6. Patients can walk into IDP to initiate enrollment and see a prescribing physician within 72 hours without an appointment 7. The social workers facilitate handoff to IDP health educator or another clinic, and follow up with reminder calls	All persons diagnosed with HIV and reported to GDPH who had no CD4 or HIV-1 RNA tests during the last 14 months GPHIE system (the Georgia HIV Surveillance database); OOC watch list Adjunct sources: Grady Health Registration System	Any visit with an HIV provider within GHS and/or any CD4 or HIV RNA results within the GDPH database during the 6-month follow-up period GHS linkage: known visit with a provider at IDP up in GHS or GDPH database Trained Georgia Health System (GHS) social workers	N=98, OOC Age: mean (SD) 41.0±12.3 Race: n (%) African American: 91 (93) Non-African American: 6 (6) Sex: n (%) Male: 69 (70) Female: 29 (30) HIV risk category: n (%) NR	HIEs successfully identify OOC PWH and provide an opportunity for real-time, (re)linkage to care interventions and programs; an HIE-informed social worker-driven intervention may improve outcomes for OOC patients who receive linkage support in the ED

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		8. No overnight or weekend services, but if EMR indicates the patient was previously seen at IDP, the social workers notify IDP health educator to pursue re-linkage interventions (e.g., calling patient, discussing recent ED visit, reasons for OOC, encouraging return to clinic, and attempt to solve barriers) 9. The electronic medical record (EMR) indicates the patient was previously seen at IDP; the SW will notify the IDP Health Educator who has jurisdiction to then pursue re-linkage interventions. January 1, 2017-January 31, 2018 (generated an HIE alert) – July 31, 2018 (data from EMR records were continued to be collected)				
Sitapati; 2012 [48]	San Diego, CA Quantitative descriptive study: incidence or prevalence without a comparison group PUFF	1. Core training of a new team PUFF retention specialist included training in multiple electronic systems, cross-training for adherence and enrollment processing, health education, and substance abuse education; and meet with staff to understand patient barriers within clinic operations 2. The CQI committee and PUFF specialist developed the PUFF toolbox which consisted of an algorithmic approach to locate lost patients, a stigma-avoidance script, a secure patient Access tracking database, a private and secure PUFF telephone voicemail, *Staying in Care* flyers 3. The PUFF specialist met weekly with the associate director to review successes and failures with implementation and developed solutions to problems 4. The CQI committee created processes matching outreach with provider care (e.g., refining appt length, matching with available provider, communicating with providers that a PUFF patient had been scheduled, identifying enrollment paperwork requirements) 5. PUFF specialist recorded organizational barriers, then discussed with CQI committee; spoke with health care personnel to problem solve the issues (i.e., health information technology, access to care, effective communication)	Poorly retained: Active clinic patients with at least one visit in the calendar year who had gaps in care for ≥6 months EMR Adjunct sources: EMR; Sheriff inmate log website; Social security death index; County inpatient psychiatric unit; Pharmacy on record	Returned to care PUFF specialist	N=716, poorly retained Age: n (%) 13–24: 14 (2.0) 25–44: 348 (48.6) 45–64: 346 (48.3) ≥65: 8 (1.1) Race: n (%) Black: 98 (13.7) Hispanic: 179 (25.0) White: 390 (54.5) Other/Unknown: 49 (6.8) Sex: n (%) Female: 93 (13.0) Male: 620 (86.6) Not specified: 3 (0.4) HIV risk category: n (%) Heterosexual: 136 (19.0) IVDU: 103 (14.4) MSM: 432 (60.3) Other/Unknown: 45 (6.3)	Our PUFF project demonstrated that a low-budget program can effectively improve retention in an urban primary care HIV clinic. We found that a combination of an effective retention toolbox and allocated retention specialist were significantly important in our success.

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		February 1, 2010 and September 1, 2010; Duration unclear				
Sohail; 2019 [49]	AL Quantitative non-randomized study D4C-AL	1. D2C-AL required shifting of data reporting from clinic-level aggregate data to individual-level missed-visit data 2. D4C-AL began clinic-wide risk stratification based on the count of missed visits for each individual PWH in the period of 12 months before their next scheduled appointment: low (0 missed visits), intermediate (1–2 missed visits), and high-risk (≥3 missed visits) 3. A worklist is generated assigning each patient to their risk category and matching with the clinic scheduling system for upcoming appointments 4. At the D4C-1917 clinics, enhanced personal reminder phone calls were made for individuals in the intermediate and high-risk categories; low risk individuals do not receive enhanced personal contact reminders. The calls reminded of upcoming appointment, ask about any barriers limiting attendance, and assist with overcoming barriers by providing resources such as transportation, food assistance, and housing through building supportive relationships 5. Missed visit follow-up calls made by linkage and retention coordinator within 48 hours, regardless of risk category to inquire about missed visit reason, link to resources to assist with attendance barriers, and reschedule the appointment 6. Individuals in the high-risk group are referred for the best available retention in care resources available in each clinical setting (e.g., intensive case management, peer mentoring, and outreach) 7. The process of clinic-wide risk stratification is repeated monthly, with iterative updating individual-level missed-visit risk level and worklist to guide intervention delivery April 2018-February 2019	PWH with ≥1 missed visits in prior 12 months EMR and clinic visit scheduling system Adjunct sources: None	NR D4C-1917 clinic staff: linkage and retention coordinator	N=395, D4C-1917 clinics Age: Median (IQI) 45.9 (34.6 to 55.3) Race: n (%) Non-Hispanic White: 143 (36.2) Non-Hispanic Black: 235 (59.5) Other: 17 (4.3) Unknown: 0 (0) Sex: n (%) Male: 308 (78.0) Female: 84 (21.3) Not specified: 3 (0.8) HIV risk category: n (%) Heterosexual: 129 (32.7) IVDU: 28 (7.1) Homosexual: 221 (56.0) Unknown: 17 (4.3)	The observed difference in missed visits in the D4C-1917 provides initial evidence to support this approach.
Sweeney; 2018 [6]	IL LA TN	Focusing on 4 of the 8 CAPUS grantees who initiated their D2C programs earlier and reported complete data when CAPUS was implemented.	No evidence of VL or CD4 laboratory test within a certain period	Attended the first HIV medical care appointment and/or	N=16,391, PWH initially presumed NIC	CAPUS implementation identified gaps in

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Related Citations: Mulatu; 2018[a] [42] and Anderson; 2020 [23]	VA Quantitative descriptive study: incidence or prevalence without a comparison group CAPUS	1. HDs generated listings of presumed OOC PWH through surveillance data and other sources. IL generated monthly, LA generated weekly, TN generated annually, and VA generated bi-annually. 2. Every program cleaned data before determining eligibility for follow-up, included electronic or manual matching of preliminary listings of OOC PWH to remove people. 3. Programs prioritized PWH by high incidence regions, detectable VLs or OOC for a long time, regions not previously covered by other funded projects. 4. HDs distributed the listing to linkage care coordinators, DIS, or other designated HD staff who attempted to contact PWH to confirm care status while tracking contact attempts. 5. HD staff initiated face-to-face or telephone contact to assess individuals' needs and barriers to HIV medical care, often referring OOC PWH to navigation services before or while being linked to care. 6. HD staff accompanied PWH to initial medical appointments and offered assistance afterwards. 7. Program staff entered new D2C information into the surveillance database to correct erroneous information, increase data completeness 2013–2016 (IL, LA, TN); 2014–2016 (VA)	(6–36 months) eHARS (IL, LA, TN); HIV laboratory registry and PRISM (LA); Care Markers Database (combines data from multiple sources) (VA) Adjunct sources: RWP HIV Program; Tenn Care; internet search tools, online public records; commercially available people search tools	evidence of CD4 or VL test results Surveillance-based service providers; HD staff; Linkage to care coordinators; D2C specialists	Demographics NR N=1,559, PWH in care with virologic failure Demographics NR	data and set the groundwork for establishing new data-sharing processes, procedures, and partnerships to improve data quality. The 4 health departments established procedures for using surveillance and other data to improve linkage to HIV medical care and health outcomes for PWH.
Tesoriero; 2017[a] [9] **Related Citations:** Hart-Malloy; 2019[a] [38] and Hart-Malloy A; 2018 [37]	Upstate New York, NY (4 counties) Quantitative non-randomized study ExPS	1. Used HIV surveillance laboratory data to identify presumed OOC PWH and assign them to a county health department's ExPS trained advocates. 2. Advocates searched databases, conducted vital status verification matches, contacted last known medical provider, mailed non-disease specific letter, and conducted a home visit to the last known address. 3. Located PWH were interviewed, confirmed to be OOC, asked why they were OOC, and were offered to be relinked to care. September 1, 2013-August 31, 2014	No prognostic or diagnostic laboratory results (VL, CD4, or genotype) in the prior 13 to 24 months HIV surveillance databased (state) Adjunct data sources: Regional Health Information Database, Jail and Prison Directories, LexisNexis Accurint for Government searches, online search	HIV-specific laboratory work (CD4, VL, or resistance) reported to NYS in the 6 months following case closure; ExPS advocate verified that the patient attended 1 or more medical appointments after case assignment ExPS advocates	N=1,155, presumed OOC Age: n (%)<20: 7 (0.6) 20–29: 160 (13.9) 30–39: 194 (16.8) 40–49: 319 (27.6) 50–59: 316 (27.4) >60: 155 (13.4) Missing: 4 (0.3) Race: n (%) White, non-Hispanic: 322 (27.9) Black, non-Hispanic: 467 (40.4)	DTC can be effective when conducted outside large metropolitan areas and/or closed health care systems. It can also be effectively incorporated into existing Partner Services programs

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			engines and networking sites, medical providers		Other: 147 (12.7) Hispanic: 192 (16.6) Unknown: 27 (2.3) Sex: n (%) Female: 340 (29.4) Male: 809 (70) Not specified: 5 (0.4) Missing 1 (0.1) HIV risk category: n (%) MSM: 430 (37.2) IDU: 195 (16.9) MSM/IDU: 52 (4.5) Heterosexual: 357 (31) Other: 2 (0.2) Unknown or missing: 119 (10.3)	
Udeagu 2019[a] [50] **Related Citations:** Udeagu; 2018[a] [51] and Udeagu; 2013 [52]	New York City, NY Quantitative non-randomized study: Cohort eD2C; Originally named rD2C	The eD2C initiative used the rD2C strategy combined with a review of HIV clinic medical records. 1. DOHMH analyst compiled a monthly list of presumed OOC patients with locating information from DOHMH data sources. 2. DIS searched further to confirm known or obtain new locating information, removing patients with care per clinic record. 3. The updated OOC list was transferred to the clinic patient navigator to cross-reference with clinic medical records for care verification. 4. Patient navigator used the final list to begin outreach to OOC patients via phone calls and home visits, offering same-day clinic appointments if possible. Persons who refused re-engagement or preferred to attend another clinic were referred to DIS. 5. DIS re-approached persons who refused the navigator's assistance via phone calls and home visits. DIS also re-attempted to locate persons who were not initially located. 6. Throughout this process, bi-weekly case management by DOHMH D2C and clinic staff reviewed active investigation statuses and cross-reference new lists of patients presumed OOC	No VL or CD4 cell count in NYC surveillance registry for ≥9 months NYC HIV surveillance registry; HIV clinic medical records Adjunct sources: DOHMH program and public social service and subscriptions databases	NR DIS, and clinic patient navigator	N=184, eD2C Age: n (%): NR Race/Ethnicity: n (%) Non-Hispanic Black: 153 (84) Non-Hispanic White: 2 (1) Hispanic: 26 (14) Other: 2 (1) Sex: n (%) Male: 95 (52) Female: 89 (48) HIV risk category: n (%) MSM: 38 (21) IDU: 19 (10) Heterosexual: 94 (51) Other/non identified: 33 (18)	Data and personnel shared between DOHMH and an HIV clinic may be a powerful force in re-engaging and retaining PWH in HIV care. This study supports the feasibility of gaining efficiencies in the process via an integrated public health department-HIV clinic collaborative approach.

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		March 2016-October 2017				
Udeagu; 2018[a] [51] **Related Citations:** Udeagu; 2019[a] [50] and Udeagu; 2013 [52]	New York City, NYQuantitative descriptive study: incidence or prevalence without a comparison groupD2C Initiative (later renamed rD2C)	Additional details are described in Udeagu, 2013 (4001) 1. NYC DOHMH FSU case workers use the registry to identify presumed OOC PWH for follow-up. 2. Population included PWH ≥13 years of age, presumed OOC, and re-engaged in HIV care during January 1, 2009-December 31, 2013, with any HIV CD4 or VL report in the registry from the date they re-engaged in care through December 31, 2015. 3. During reporting period, 2–3 case workers traced OOC-PWH, facilitated re-engagement in HIV care, and was assigned ≤20 OOC PWH OOC monthly. 4. Tracked FSU activities included: case assignment, contact attempts (e.g., letters, telephone, field visits, care appointments, PWH responses, activity dates), and outcomes (e.g., care linkage, refused care re-engagement). 5. Case workers used social service delivery and Internet-based subscription databases to confirm location information found in registry or through provider report, or to identify alternate contact information. 6. If contacted, PWH were interviewed to confirm care status and identify reasons for being OOC (e.g., lacking health insurance coverage, feeling well and not seeing need for HIV care). 7. Case workers worked with PWH to identify and secure appointments with the most suitable service providers. January 1, 2009-December 31, 2015	No laboratory reports ≥9 months before selection for follow-up NYC HIV surveillance registry Adjunct sources: FSU database (a case management database for tracking activities and outcomes of case workers' efforts to trace and re-engage OOC-PWH to care); data obtained through provider report; Internet-based subscription databases	OOC-PWH traced and given an appointment with an HIV provider, wo kept the appointment and had ≥1 report of a CD4 and/or VL in the registry ≤3 months of appointment date. Inconsistent engagement in care had no care in ≥1 of the follow-up years NY DOHMH FSU case workers	N=543, PWH in year 1 post-care re-engagement Age: n (%) 19–29: 65 (12) 30–49: 297 (55) ≥50: 181 (33) Race: n (%) Black/non-Hispanic: 321 (59) Hispanic: 184 (34) White/non-Hispanic: 34 (6) Other/unknown: 6 (1) Sex: n (%) Male: 322 (59) Female: 221 (41) Missing: 12 (11.7) HIV risk category: n (%) Heterosexual contact: 218 (40) IDU: 127 (23) MSM: 123 (23) Other/unknown: 75 (14)	High proportions of PWH re-engaged in care remained in care at some points during their eligible follow-up years. The proportions of PWH continuously engaged in care with ≥1 CD4/VL reports or retained in care with ≥2 CD4/VL reports (3 months apart) in each follow-up year decreased over time.
Udeagu; 2013 [52] **Related Citations:** Udeagu; 2019[a] [50] and	New York City, NYQuantitative descriptive study: incidence or prevalence without a comparison	1. NYC continuously updates a population-based registry of all persons diagnosed with AIDS since 1981 and HIV since 2000; it was used to identify PWH presumed LTFU. 2. Quarterly, a NYC HD analyst queried the registry to generate a list of PWH who had initiated care following diagnosis but had not had	No CD4 or VL during most recent 9 months NYC HIV surveillance registry (city) Adjunct sources: Other	Accepted an appointment were classified as 'linked to care'. PWH-LTFU who linked to care were also classified as	N=409, confirmed LTFU Age (groups (years)/ median): N (%) 13–19: 1 (<1) 20–29: 48 (12) 30–39: 90 (22)	Using surveillance data alone has limitations in identifying PWH-LTFU, also there is a need for real time data exchange between

Description of included interventions

Author **Year**	**Geographical Location** **Study Design** **Project Name**	**Brief Description** **Duration/Time Periods**	**Definition of OOC** **Data Source**	**Definition of Relinkage to Care** **Staff Performing Relinkage**	**Age** **Race** **Ethnicity** **Sex** **HIV Risk Category**[*]	**Authors' Conclusion**[**]
Udeagu; 2018[a] [51]	groupD2C Initiative (later renamed rD2C)	any care within the most recent 9-months, using CD4 or VL laboratory reports. 3. The generated list was narrowed down through matched data from NYC social services agencies on PWH presumed LTFU, NYC residence, and if their recent CD4 or VL test were ordered by Field Services program-affiliated clinical sites. 4. Additional locating information was gathered by caseworkers using other HD databases and by conducting medical record reviews at the last known NYC medical provider noted within the registry. 5. Caseworkers performed a stepwise approach to locate PWH-presumed LTFU via phone calls, mailed letters, and home visits. 6. Responsive PWH who agreed to meet with a case worker were assisted with identifying a provider, setting up an appointment, and provided transportation or transportation reimbursement to/from the appointment. Those who did not want assistance were encouraged to keep given appointments or to reach out to the caseworker in the future. July 2008-December 2010	databases within the HD; medical records; public and subscription online databases and search engines (e.g., correctional facility, metro search, Google, Spokeo)	'returned to care' if they had an HIV care visit confirmed through medical record review, or CD4/VL test report in the registry with draw date after date of linkage to care. Case workers of the HIV Field Service Unit	40–49: 171 (42) 50–59: 75 (18) >60: 24 (6) Race/ethnicity: N (%) Black, non-Hispanic: 274 (67) Hispanic: 123 (30) White, non-Hispanic: 9 (2) Asian/Pacific Islander: 1 (<1) Other: 2 (<1) Sex: N (%) Male: 266 (55) Female: 183 (45) Transmission risk: N (%) MSM: 62 (15) Heterosexual: 96 (24) IDU: 102 (25) Perinatal: 14 (3) Other: 3 (1) No identified risk: 130 (32) Other high-risk behaviors: N (%) IDU, past 12 months: 10 (2) Noninjecting drug use, past 12 months: 46 (11) Alcohol abuse, past 12 months: 19 (5) STD, past 12 months: 8 (2) Exchange money for drug or sex, ever: 23 (6) Incarcerated, ever: 75 (18)	laboratories, clinicians and local and or state departments. Health department caseworkers have helped more than half of PWH-LTFU reengage in HIV medical care. HIV prevention strategies must include efforts to re-engage PWH-LTFU in care, for treatment consideration under current treatment guidelines to improve their clinical status and decrease transmission risk
Wohl; 2016 [53]	Los Angeles County, CA Quantitative non-	1. At seven publicly funded Los Angeles County (LAC) HIV clinics with large number/percentages of OOC PWH, navigators worked with DHSP staff to verify eligibility using surveillance	No HIV care visits in the previous 6–12 months and last VL >200 copies/mL, no HIV care	Either 2 medical visits, or 1 medical and 1 case management visit.	N=78, enrolled in program Age: n (%)	The results demonstrate that most (94%) of patients with a history of

Description of included interventions

Author **Year**	**Geographical Location** **Study Design** **Project Name**	**Brief Description** **Duration/Time Periods**	**Definition of OOC** **Data Source**	**Definition of Relinkage to Care** **Staff Performing Relinkage**	**Age** **Race** **Ethnicity** **Sex** **HIV Risk Category**[*]	**Authors' Conclusion**[**]
	randomized study: Cohort Navigation Program	2. HD staff provided project coordination and oversight for locator information abstracted from databases, and shared patient locator information with Navigators. 3. Spanish bilingual navigators with HIV case management located patients and administered the intervention. Navigators completed a CDC-approved and modified Antiretroviral Treatment Access Study (ARTAS) and Retention in Care training. 4. Navigators met weekly with LAC's DHSP and AIDS Project Los Angeles staff to coordinate project activities, share patient locator information, and participate in clinical supervisions by a trained licensed social worker. 5. Navigators used DIS techniques, clinic records, DHSP surveillance, and laboratory database locator information to contact patients in the following order: phone, text, e-mail letter, and an in-person home visit. 6. 90-day ARTAS intervention was divided into 4 components: building the relationship, assessment, linking to resources/enhancing strengths, and disengagement. 7. Clients linked to medical care during intervention, with ongoing activities via telephone, text, or email reminders about Navigation visits. 8. Once a client completed the ARTAS intervention, clients were referred to a Ryan White-funded clinic. 9. If a lost patient declined to participate in the program, then Navigators assisted patients with appointment scheduling and referred high quality acuity patients to a MCC team. January 2012- February 2016	visits >12 months, newly diagnosed and never in care, or recently released from jail, prison, or other institution with no regular HIV medical provider (OOC or intermittent care) Ryan White medical outpatient program data (clinic) Adjunct data sources: Clinic medical record locator information; DHSP HIV surveillance databases; LexisNexis, jail/prison inmate locators (local, state, and federal), people-finder websites, and reverse phone number directories, local shelter and parks (if history of homelessness)	Bachelor-level navigators	18–29: 9 (12) 30–39: 18 (23) 40–49: 33 (42) ≥50: 18 (23) Race: n (%) White: 5 (6) African American: 14 (18) Latino: 55 (71) Mixed race/Other: 4 (5) Sex: n (%) Male: 61 (78) Female: 14 (18) Not specified: 3 (4) HIV risk category: n (%) Homosexual, gay/ lesbian: 39 (50) Bisexual: 5 (6) Heterosexual, straight: 34 (44)	poor retention in HIV care linked to care within 12 months of intervention enrollment and 82% of linked clients retained in care 12 months after linkage to care. The combined disease investigator services/ ARTAS model of reengagement was effective for locating and reengaging lost HIV clinic patients. Access to HIV surveillance data is critical for the efficient identification of persons truly in need of reengagement.

[*] Abstracted verbatim from paper

[**] paraphrased from author

[a] Primary study

Abbreviations for common terms used within Table 2: Antiretroviral Therapy (ART); Enterprise Data Warehouse (EDW); US national HIV/AIDS reporting system (HARS); Greater San Francisco Bay Area (GBA); AIDS Service Organization (ASO); Date of Birth (DOB); Medical Care Coordination (MCC); Nurse Practitioner/medical assistant (NP/MA); Louisiana Office of Public Health STD/HIV Program (LA OPH SHP); Social Worker (SW); Out-of-Care (OOC); Not in Care (NIC); Linkage Integration Navigation Comprehensive Services (LINCS); San Francisco Department of Public Health (SFDPH) linkage and navigation program; Infectious Disease Program (IDP); Antiretroviral Treatment Access Study (ARTAS);Georgia Health System (GHS); Louisiana State University Health Care Services Division (LSU HCSD); Linkage to care (LTC); Georgia Public Health Information Exchange (GPHIE); Louisiana Public Health Information Exchange (LaPHIE); Integrated delivery network (IDN); Los Angeles County (LAC); OPH – Office of Public Health (OPH); Target population (TP); Below transmission threshold (BTT); Chicago Department of Public Health (CDPH); Massachusetts Integrated HIV/AIDS Surveillance Program (MHASP);Psychosocial factor study (PSF); Georgia Department of Public Health (GDPH);Massachusetts Department of Public Health (MDPH); Maryland Head Department (MHD); New York State (NYS);Mississippi Department of Health (MSDH); New York State Department of Health (NYSDOH); Linkage-to-care coordinators (LCC); Medical record review of a large public health hospital (MRR-PH); Patient Reporting Investigation Surveillance Manager (PRISM); Wayne State University Physician Group (WSUP (ID)); AIDS Drug Assistance Program (ADAP); Viral Load (VL); People Living with HIV/People with HIV (PLWH/PWH); Health Departments (HD); Men who have Sex with Men (MSM); Disease Intervention Specialists (DIS); People who inject drugs (PWID); Injection Drug Use (IDU); Electronic Medical Record (EMR); Enhanced HIV/AIDS Reporting System (eHARS); Emergency Department (ED; Public Health Seattle and King County (PHSKC); Community Health Clinics/Centers (CHC); Linkage Specialist (LS); Not in Care (NIC), Electronic Health Records (HER); Lost to Follow-up (LTFU); Department of Health and Mental Hygiene (DOHMH); University of Washington (UW); Department of Health (DOH); Viral Load Suppression or Virally Suppressed (VLS); Division of HIV and STDs Program (DHSP); Field Service Unit (FSU); Continuous Quality Improvement (CQI); Inpatient (IP); Partnerships for Care (P4C); Modified Intent to Treat (mITT); Care and Antiretroviral Promotion Program (CAPP)

Table 3:

Comparative Outcomes

Outcomes for interventions with a comparison/control condition

Author; Year	Study Design	Intervention vs. Control/ Comparison Group	Data Sources	Intervention or Post-Test Sample Size	Comparison or Pre-Test Same Size	Outcome Measure	Measurement Time Points	Effect Size Type	Effect Size
Anderson; 2020 [23] **Related Citations:** Mulatu; 2018[a] [42] and Sweeney; 2018 [6]	Quantitative non-randomized study: Cohort	Newly diagnosed: Intervention vs. Control	LA OPH SHP surveillance database	361	482	Link to care	Post test	N (%) aHR (95% CI)	155 (42.9) vs. 159 (33.0); p<0.001 1.56 (1.24 to 1.96); p<0.001
				361	482	Time to link to care	Post test	Days	156 vs. 184
		Previously diagnosed: Intervention vs Control	LA OPH SHP surveillance database	3,038	2,676	Re-engaged in care	Post test	N (%) aHR (95% CI)	1,337 (44.0) vs. 1,070 (40.0); p<0.001 1.17 (1.08 to 1.27); p<0.001
				3,038	2,676	Time to Reengage in care	Post test	Days	133 vs. 141
						Link and re-engaged in care		Qualitative findings	We adjusted for sex in our analyses and did not find differences in program impact based on participant sex.
Avoundjian; 2020 [25]	Quantitative non-randomized study: Cohort	Post-intervention real-time alert with HIV relinkage team vs. Post-intervention real-time alert only	Enterprise Data Warehouse (EDW), a relational database that organizes HER data from UW Medicine network of hospitals for research and programmatic	145	95	Engagement in care: VL testing within 3 months after an eligible ED visit/IP admission	3 months	RR (95% CI)	1.06 (0.94 to 1.25)

Outcomes for interventions with a comparison/control condition

Author; Year	Study Design	Intervention vs. Control/ Comparison Group	Data Sources	Intervention or Post-Test Sample Size	Comparison or Pre-Test Same Size	Outcome Measure	Measurement Time Points	Effect Size Type	Effect Size
			use; PHSKC’s eHARS						
				145	95	VS: VL <200 c/mL in the 6 months after eligible visit	6 months	RR (95% CI)	0.85 (0.71 to 1.02)
Bove; 2015 [29]	Quantitative non-randomized study: Cohort	Intervention cohort vs. historical cohort	EHR intake form and case management records; PHSKC health department HIV surveillance	753	646	Time to relinked to care	12 months	aHR (95% CI)* HR (95% CI) *adjusted for age, income, with Cox Proportional hazards	1.7 (1.2 to 2.3) 1.6 (1.2 to 2.2)
				753	646	Relinked to care: at any time	12 months	N (%) aRR (95% CI)* RR (95% CI) *adjusted for age, income, with GEE	116 (15.4) vs. 64 (10.0) 1.6 (1.2 to 2.1); $p<0.05$ 1.6 (1.2 to 2.1); $p<0.05$
				753	646	Engaged in continuous care: ≥ 2 visits ≥ 3 months apart	12 months	N (%) aRR (95% CI)* RR (95% CI) *adjusted for age, income, with GEE	64 (8.5) vs. 23 (3.6) 2.4 (1.5 to 3.9); p=NS 2.4 (1.5 to 3.8); p=NS
				753	646	VS: HIV RNA <200 copies/mL	12 months	N (%) aRR (95% CI)* RR (95% CI)	50 (6.6) vs. 27 (4.2) 1.6 (0.97 to 2.6); p=NS 1.6 (1.0 to 2.5); $p<0.05$

Outcomes for interventions with a comparison/control condition									
Author; Year	**Study Design**	**Intervention vs. Control/ Comparison Group**	**Data Sources**	**Intervention or Post-Test Sample Size**	**Comparison or Pre-Test Same Size**	**Outcome Measure**	**Measurement Time Points**	**Effect Size Type**	**Effect Size**
								*adjusted for age, income, with GEE	
Braunstein; 2019 [30]	Quantitative non-randomized study: Cohort	HIV CCD post vs. pre	NYC HIV surveillance registry, NYC Vital Statistics Registry, National Death Index and Social Security Death Master File (national death data)	21 sites: 30,874 in care	21 sites: 28,253 in care	VLS, weighted average	60-months	(%)	89 vs. 73
				21 sites	21 sites	VLS, sites above 85% VLS target	60-months	N	16 vs. 0
				21 sites	21 sites	LTC, weighted average	60-months	%	77 vs. 76
				19 sites	21 sites	LTC, sites above 85% VLS target	60-months	N	4 vs. 2
Dombrowski; 2018[a] [33] **Related Citations:** Chang; 2019 [32]	Quantitative non-randomized study: Cohort	mITT, Recent unsuppressed VL and/or 12-month gap in lab reports Post-test vs Pre-test	eHARS (county)	822	822	Time to VS	End of observation period	HR (95% CI)	1.18 (0.83 to 1.68); p=NS
		mITT, 12 month gap in laboratory reports) Post-test vs Pre-test		276	276	Time to relinked to care	End of observation period	HR (95% CI)	0.99 (0.64 to 1.55); p=NS
		mITT, 12 month gap in laboratory reports) Post-test vs Pre-test		276	276	Time to VS	End of observation period	HR (95% CI)	0.79 (0.40 to 1.55); p=NS
		mITT, recent unsuppressed VL		546	546	Time to VS	End of observation period	HR (95% CI)	1.45 (0.96 to 2.19); p=NS

Outcomes for interventions with a comparison/control condition

Author; Year	Study Design	Intervention vs. Control/ Comparison Group	Data Sources	Intervention or Post-Test Sample Size	Comparison or Pre-Test Same Size	Outcome Measure	Measurement Time Points	Effect Size Type	Effect Size
		Post-test vs Pre-test							
Hart-Malloy A; 2018 and Hart Malloy B, 2018 [37] **Related Citations:** Hart Malloy; 2019[a] [38] and Tesoriero; 2017[a] [9]	Quantitative non-randomized study: Cohort	HICAPP/ Combination Model vs. ExPS/HD Model	CHC medical records State HIV surveillance database	19	348	Re-linked to HIV medical care	NR	N (%)	12 (63.2) vs. 273 (78.4); p=0.13
Hewitt; 2019 [39]	Quantitative non-randomized study: Cohort (sub-analysis)	Current vs Baseline for participants with comparable VLs who had an initial VL value within 90 days before or after program initiation date Post-test vs Pre-test	HIV surveillance registry	500	500	VS: <200 copies/mL	Post test	N (%)	237 (47.4) vs. 184 (36.8); p<0.01
		Current vs Baseline for participants with unsuppressed VL at baseline, which is a subset of the above comparable group Post-test vs Pre-test	HIV surveillance registry	316	316	VS: <200 copies/mL	Post test	N (%)	122 (38.6) vs. 0 (0); p<0.01
Kunzweiler; 2019 [40]	Quantitative non-randomized study: Cohort	MA P4C vs. statewide estimated (MA)	LA OPH SHP surveillance database	83	NR	Engaged in care	1 year	%	78 vs 74; p=0.41
				83	NR	Retained in care: ≥2 CD4 and/or VL tests	1 year	%	54 vs. 57; p=0.56

Outcomes for interventions with a comparison/control condition									
Author; Year	**Study Design**	**Intervention vs. Control/ Comparison Group**	**Data Sources**	**Intervention or Post-Test Sample Size**	**Comparison or Pre-Test Same Size**	**Outcome Measure**	**Measurement Time Points**	**Effect Size Type**	**Effect Size**
						completed ≥90 days apart within 1 year			
				83	NR	VS: <200 copies/mL	1 year	%	48 vs. 65; p<0.01
Magnus; 2012 [41]	Quantitative non-randomized study	OOC LaPHIE identified vs. In-care controls	LaPHIE. which statewide public health surveillance data and LSU HCSD EMR data	419	577	CD4<200 cells/mm^3	18 months	aOR (95% CI)* *adjusted for race, sex, age, insurance status, antiretroviral treatment, and date of first entry into cohort	3.22 (1.72 to 6.04); p<0.001
				419	577	CD4<200 cells/mm^3 at each successive 6-month interval	18 months	aOR (95% CI)* *adjusted for race, sex, age, insurance status, antiretroviral treatment, and date of first entry into cohort	0.91 (0.83 to 0.99); p<0.05
				344	577	VL>10,000 copies/mL	18 months	aOR (95% CI)* *adjusted for care status, race, sex, age, insurance status, antiretroviral treatment, and date of first entry into cohort	1.72 (0.95 to 3.14); p=NS
				344	577	VL>10,000 copies/mL at each successive 6-month interval	18 months	aOR (95% CI)* *adjusted for care status, race, sex, age, insurance status, antiretroviral treatment, and date of first entry into cohort	0.83 (0.73 to 0.93); p<0.01
				344	577	Prescribed any ART treatment	18 months	aOR (95% CI)*	0.86 (0.38 to 1.93); p=NS

Outcomes for interventions with a comparison/control condition

Author; Year	Study Design	Intervention vs. Control/ Comparison Group	Data Sources	Intervention or Post-Test Sample Size	Comparison or Pre-Test Same Size	Outcome Measure	Measurement Time Points	Effect Size Type	Effect Size
								*adjusted for care status, race, sex, age, insurance status, and date of first entry into cohort	
				344	577	Prescribed any ART treatment at each successive 6-month interval	18 months	aOR (95% CI)* *adjusted for care status, race, sex, age, insurance status, and antiretroviral treatment	0.89 (0.78 to 1.02); p=NS
Sachdev; 2020 [45]	Quantitative non-randomized study: Cohort	Post-LINC vs Pre-LINC	Providers; eHARS, the state HIV surveillance system	233	233	Retention in care	12 months	N (%) RR (95% CI)	134 (57.5) vs. 82 (35.2) 1.63 (1.34 to 2.00)
				233	233	VS: at least 1 VL <200 copies/mL at any time within the 12 months before LINCS enrollment or after LINCS closure	12 months	N (%) RR (95% CI)	124 (53.2) vs. 42 (18.0) RR2.95 (2.23 to 3.90)
Shamasunder; 2020 [46]	Quantitative study: RCT	Collaborative HD/Medical Provider D2C vs. standard of care	NR	449	449	Re-engaged in care: CD4/VL within 90 days	12 months	OR (95% CI)* *Controlling for race, birth sex, age, transmission category and disease stage at diagnosis	2.22 (1.69 to 2.92)
			NR	449	449	Retained in care: ≥2 CD4/VLs at least 90 days apart within 1 year	12 months	OR (95% CI)	1.89 (1.44 to 2.48)
			NR	449	449	VS: VL <200 c/mL within 1 year	12 months	OR (95% CI)	1.44 (1.10 to 1.90)
Sharp; 2019 [47]	Quantitative non-randomized study: Cohort	Social worker intervention vs. Usual care (parts unknown	GDPH database, GHS database, Georgia HIV	20	78	Relinked to care	6 months	aRR (95% CI)* *adjusted for age,	1.63 (0.99 to 2.68); p=0.0545

Outcomes for interventions with a comparison/control condition

Author; Year	**Study Design**	**Intervention vs. Control/ Comparison Group**	**Data Sources**	**Intervention or Post-Test Sample Size**	**Comparison or Pre-Test Same Size**	**Outcome Measure**	**Measurement Time Points**	**Effect Size Type**	**Effect Size**
		including referral to IDP health educator)	Surveillance database					sex, race/ethnicity, homelessness, substance use, and history of antiretroviral treatment	
				20	78	VS: HIV RNA <200 copies/mL	6 months	aRR (95% CI)	1.49 (0.50 to 4.46); p=0.4719
Sohail; 2019 [49]	Quantitative non-randomized study	D4C-1917 vs non-D4C-1917	EMR and visit scheduling system	395	3,464	Missed visits	Post-test	N (%)	Post-intervention: 73 (18.5) vs 797 (23.0); p=0.049
Tesoriero; 2017[a] [9] **Related Citation:** Hart-Malloy A; 2018 [37]	Quantitative non-randomized study	ExPS advocate intervention vs. NYS outside pilot	HIV surveillance databased	233	117	Re-engage in care: lab evidence of medical care	Post test	N (%)	195 (83.7) vs. 40 (34.2) p<0.001
				233	117	Retention in care: Presence of ≥2 HIV laboratory tests, separated by at least 1 week	Post test	N (%)	127 (54.5) vs. 20 (17.1) p<0.05
Udeagu; 2019[a] [50] **Related Citations:** Udeagu; 2018[a] [51] and Udeagu; 2013 [52]	Quantitative non-randomized study: Cohort	eD2C vs. rD2C	NYC HIV surveillance data; DOHMH program and public social service and subscriptions databases; HIV clinic medical records	184	3343	Re-engaged in care	Post-test	N (%) aOR (95% CI)* *adjusted for significant baseline characteristics	47 (25.5) vs. 999 (29.9); p=0.23 2.31 (1.23 to 4.36)
				187	3417	Days from cases assignment to 1st clinic appt	NR	Median (IQR)	25 (46) vs. 35 (49); p=0.08
Wohl; 2016 [53]	Quantitative non-randomized study: Cohort	Post-enrollment vs. Pre-enrollment	Ryan White medical outpatient program data (clinic)	60	76	VS at retention: <200 copies/mL	12 months	N (%)	38 (63.3) vs. 39 (51.3); p<0.01

[a] Primary study

Abbreviations for common terms used within Table 3: Antiretroviral Therapy (ART); Enterprise Data Warehouse (EDW); US national HIV/AIDS reporting system (HARS); Louisiana Office of Public Health STD/HIV Program (LA OPH SHP); Out-of-Care (OOC); Linkage Integration Navigation Comprehensive Services (LINCS); Infectious Disease Program (IDP);Georgia Health System (GHS); Louisiana State University Health Care Services Division (LSU HCSD); Linkage to care (LTC); Louisiana Public Health Information Exchange (LaPHIE); Georgia Department of Public Health (GDPH); New York State (NYS); Viral Load (VL); Health Departments (HD); Electronic Medical Record (EMR); Enhanced HIV/AIDS Reporting System (eHARS); Emergency Department (ED); Public Health Seattle and King County (PHSKC); Community Health Clinics/Centers (CHC); Electronic Health Records (EHR); Department of Health and Mental Hygiene (DOHMH); University of Washington (UW); Department of Health (DOH); Viral Load Suppression or Virally Suppressed (VLS); Partnerships for Care (P4C); Modified Intent to Treat (mITT); High Impact Care and Prevention Project (HICAPP)

Table 4:

Post-Only Outcomes

Outcomes for interventions with no comparison condition								
Author; Year	**Study Design**	**Data Source**	**Total Sample size**	**Sample population description**	**Outcome Measurement**	**Measurement Time Points**	**Effect Size Type**	**Effect Size**
Arey; 2019 [24]	Quantitative descriptive study: incidence or prevalence without a comparison group	eHARS; PRISM; and EHR	927	Final list: Confirmed HIV+ in P4C health centers	In care, but not VS	Post test	N (%)	213 (23.0)
			927	Final list: Confirmed HIV+ in P4C health centers	In care and VS	Post test	N (%)	555 (59.9)
Avoundjian; 2018 [26] Abstract	Quantitative descriptive study: incidence or prevalence without a comparison group	MSDH HIV and STD Surveillance Data	36	HIV+ with a new STD and identified as OOC: Assigned to DIS investigation	Attended an HIV care appointment after DIS contact	Post test	N (%)	9 (25.0)
			36	HIV+ with a new STD and identified as OOC: Assigned to DIS investigation	Achieved VS	Post test	N (%)	6 (16.7)
Beltrami; 2018 [27]	Quantitative descriptive study: incidence or prevalence without a comparison group	HIV surveillance data (national)	1,269	Data for 5 HDs: Newly diagnosed and eligible for relinkage	Linked to care	Post-test	N (%)	1,124 (88.6)
			298	Data for 2 HDs: Newly diagnosed	VS	Post-test	N (%)	250 (83.9)
Bertolli; 2013 [28]	Quantitative descriptive study: incidence or prevalence without a comparison group	eHARS, vital statistics data, interstate efforts to de-duplicate	2,367	Persons with HIV and no evidence of care entry who were contacted	Entered care (via CD4 or VL test)	Post test	N (%)	43 (1.8)
	Quantitative descriptive study: incidence or prevalence without a	eHARS, vital statistics data, interstate efforts to de-duplicate	2,367	Persons with HIV and no evidence of care entry who were contacted	Time to care (from interview to first CD4 or VL test)	Median 17 months (Range 1–29 months)	Median days	97

Outcomes for interventions with no comparison condition

Author; Year	Study Design	Data Source	Total Sample size	Sample population description	Outcome Measurement	Measurement Time Points	Effect Size Type	Effect Size
	comparison group							
Bove; 2015 [29]	Quantitative non-randomized study: Cohort	EHR intake form and case management records; PHSKC health department HIV surveillance	84	Contact attempted	Time to relinkage: Days from initial contact to first completed medical visit	12 months	Median (IQR)	78 (52 to 126)
Buchacz; 2015 [7]	Quantitative descriptive study: incidence or prevalence without a comparison group	SFDPH eHARS; local and California vital statistics departments; National Death Index; Social Security Death Master File; electronic medical records at the county public hospital, public health clinics, and many private medical facilities; SFDPH STD report database, California State databases of support services (shelter and substance abuse); Lexis/Nexis	50	Persons with HIV Interviewed, and confirmed to be eligible (no VL test or VS > 200 copies)	≥1 VL or CD4 cell count	12 months	N (%)	41 (82)
			50	Interviewed, and confirmed to be eligible	≥2 labs (VL or CD4 cell count) ≥90 days apart	12 months	N (%)	24 (48.0)
Buskin; 2014 [31]	Quantitative descriptive study: incidence or prevalence without a comparison group	HARS	959	Living in King County and eligible for intervention	Evidence of receiving medical care	Post-test	N (%)	877 (91.4)
Chang; 2019 [32] **Related Citations:** Dombrowski; 2018^{a} [33]	Quantitative descriptive study: incidence or prevalence without a comparison group	HIV surveillance	408	CAPP participants who appeared to be poorly engaged in HIV care	Successfully re-engaged in HIV care	12 months	N (%)	204 (50.0)

Outcomes for interventions with no comparison condition

Author; Year	Study Design	Data Source	Total Sample size	Sample population description	Outcome Measurement	Measurement Time Points	Effect Size Type	Effect Size
			408	CAPP participants who appeared to be poorly engaged in HIV care	Continuous care engagement only: Continuous care engagement as ≥2 CD4 count or HIV RNA results ≥60 days apart (DHHS consensus metric 2016)	12 months	N (%)	48 (11.8)
			408	CAPP participants who appeared to be poorly engaged in HIV care	Viral suppression only: Viral suppression as ≥1 HIV RNA <200 copies/mL and, using laboratory results as proxy measures for HIV care visits. ---Participants with no viral load results reported to surveillance were not virally suppressed	12 months	N (%)	19 (4.7)
			408	CAPP participants who appeared to be poorly engaged in HIV care	Continuous care engagement and viral suppression	12 months	N (%)	137 (33.6)
Dombrowski; 2018[a] [33] **Related Citations:** Chang; 2019 [32]	Quantitative non-randomized study: Cohort	eHARS (county)	822	mITT, Recent unsuppressed VL and/or 12-month gap in lab reports	VS	End of observation period	N (%)	301 (36.6)
			276	mITT, 12 month gap in laboratory reports	Relinked to care	End of observation period	N (%)	131 (47.5)
			276	mITT, 12 month gap in laboratory reports	Achieved VS	End of observation period	N (%)	77 (27.9)
			546	mITT, recent unsuppressed VL)	Achieved VS	End of observation period	N (%)	224 (41.0)
Donovan; 2018 [34]	Quantitative descriptive study: incidence or prevalence without a comparison group	Clinical EHR; NC CAREWare (Ryan White Service data system); (clinic data only)	712	Located	Returned to care	90 days	N (%)	415 (58.3)
			712	Located	Returned to care	180 days	N (%)	534 (75.0)
			712	Located	Returned to care	365 days	N (%)	593 (83.3)

Outcomes for interventions with no comparison condition

Author; Year	Study Design	Data Source	Total Sample size	Sample population description	Outcome Measurement	Measurement Time Points	Effect Size Type	Effect Size
			712	Located	Yes: Retention HAB definition: 2 visits/year >90 days apart); lab as marker	1 year	N (%)	393 (55.2)
			712	Located	HIV RNA suppression: <200 copies/mL	180 days	N (%)	364 (51.1)
			712	Located	HIV RNA suppression: <200 copies/mL	365 days	N (%)	454 (63.8)
			712	Located	Time from diagnosis, 1 year increase, to care	90 days	aPR	1.01 (0.999 to 1.020)
			712	Located	Time from diagnosis, 1 year increase, to VS	180 days	aPR	1.008 (0.997 to 1.019)
Goldman; 2019 [35] Abstract	Quantitative descriptive study: incidence or prevalence without a comparison group	WSUPG ID clinic records	70	WSUPGD ID Clinic Identified as OOC (n=41), + Detroit HD and CBO referrals (n=29)	Achieved virologic suppression at least once during enrollment	Post test	N (%)	24 (34.3)
			70	WSUPGD ID Clinic Identified as OOC (n=41), + Detroit HD and CBO referrals (n=29)	Achieved virologic suppression	6+ months	N (%)	17 (24.3)
Hague; 2019 [36]	Quantitative descriptive study: incidence or prevalence without a comparison group	Electronic laboratory reports from MHASP (HIV surveillance data)	421	Confirmed OOC	Re-engagement in care: subsequent laboratory	3 months	N (%)	232 (55.1)
			421	Confirmed OOC	Re-engagement in care: subsequent laboratory	6 months	N (%)	303 (72.0)
Hart Malloy; 2019[a] [38] **Related Citations:** Hart-Malloy A; 2018 [37] and Tesoriero; 2017[a] [9]	Quantitative descriptive study: incidence or prevalence without a comparison group	NY HIV surveillance system (state)	755	NIC	Relinked to care after case assignment	NR	N (%)	529 (70.1)

Outcomes for interventions with no comparison condition

Author; Year	Study Design	Data Source	Total Sample size	Sample population description	Outcome Measurement	Measurement Time Points	Effect Size Type	Effect Size
			755	NIC	People who relinked to care and did not relink to care: Individuals with subsequent VL test after case assignment	NR	N (%)	650 (86.1)
			755	NIC	Virally suppressed at subsequent VL test	NR	N (%)	277 (36.7)
Hewitt; 2019 [39]	Quantitative non-randomized study: Cohort	HIV surveillance registry	1,429	Target OOC population	VS	Post test	N (%)	584 (40.9)
Kunzweiler; 2019 [40]	Quantitative non-randomized study: Cohort	MDPH surveillance data; CHC clinic data	83	Identified as OOC post discussion	Received public health linkage services or re-engaged in care within 90 days	Post test	N (%)	44 (53.0)
			83	Identified as OOC post discussion	Time to received public health linkage services or re-engaged in care	Post test	Median days (IQI)	32 (13 to 53)
			83	Identified as OOC post discussion	Re-engaged in care	1 year	N (%)	65 (78.3)
			83	Identified as OOC post discussion	Time to re-engaged in care	1 year	Median days (IQI)	53 (24 to 97)
			83	Identified as OOC post discussion	Retained in care: ≥2 CD4 and/or VL tests completed ≥90 days apart within 1 year	1 year	N (%)	45 (54.2)
			83	Identified as OOC post discussion	VS: <200 copies/mL	1 year	N (%)	40 (48.2)
Magnus; 2012 [41]	Quantitative non-randomized study	LaPHIE. which statewide public health surveillance data and LSU HCSD EMR data	344	Identified by LaPHIE, OOC cases	At least one CD4 and/or VL tests after being identified	18 months	N (%)	293 (85.2)
Mulatu; 2018 [42]	Quantitative descriptive study: incidence or prevalence without a comparison group	HIV Surveillance Data	1,811	Forwarded for investigation, contacted, confirmed not in care	Linked services accepted and confirmed linked to/re-engaged with care	Post test	N (%)	851 (47.0)
			1,811	Forwarded for investigation, contacted, confirmed not in care	Linked services accepted and linkage status unknown	Post test	N (%)	43 (2.4)

Outcomes for interventions with no comparison condition

Author; Year	Study Design	Data Source	Total Sample size	Sample population description	Outcome Measurement	Measurement Time Points	Effect Size Type	Effect Size
Ridgway; 2019 [43]	Quantitative descriptive study: incidence or prevalence without a comparison group	ED and hospitalized EMR; Chicago Department of Public Health electronic HIV surveillance database; eHARS (national)	56	OOC, and eligible for re-engagement	Reengaged in care	14 months	N (%)	37 (66.1)
Saafir-Callaway; 2020 [44]	Quantitative descriptive study: incidence or prevalence without a comparison group	OOC list by providers, Ryan White CARE Act, HIV surveillance (city), ADAP data	103	Attempted contact by providers	Re-engaged in care	60-days	N (%)	57 (55.3)
			103	Attempted contact by providers	Engaged in care	6 months	N (%)	50 (48.5)
			103	Attempted contact by providers	Engaged in care	12 months	N (%)	41 (39.8)
			103	Attempted contact by providers	Engaged in care	18 months	N (%)	44 (42.7)
			103	Attempted contact by providers	Virally suppressed: (HIV VL < 200 copies/ml)	6 months	N (%)	29 (28.2)
			103	Attempted contact by providers	Virally suppressed	12 months	N (%)	23 (22.3)
			103	Attempted contact by providers	Virally suppressed	18 months	N (%)	29 (28.2)
Sachdev; 2020 [45]	Quantitative non-randomized study: Cohort	Providers; eHARS, the state HIV surveillance system	125	Achieved VS after LINCS enrollment and had enough follow-up time to evaluate durable VS	Durable VS: all VLs suppressed after the first suppressed VL	Post-test	N (%)	87 (69.6)
Sharp; 2019 [47]	Quantitative non-randomized study: Cohort	GDPH database, GHS database, Georgia HIV Surveillance database	20	OOC and contacted by social worker	Linked to care	30 days	N (%)	5 (25.0)
			20	OOC and contacted by social worker	Linked to care	6 months	N (%)	12 (60.0)
			20	OOC and contacted by social worker	VS	6 months	N (%)	4 (20.0)

Outcomes for interventions with no comparison condition

Author; Year	Study Design	Data Source	Total Sample size	Sample population description	Outcome Measurement	Measurement Time Points	Effect Size Type	Effect Size
Sitapati; 2012 [48]	Quantitative descriptive study: incidence or prevalence without a comparison group	EMR	716	Poorly retained in care	Return to care (n=116, with intervention; n=205, on own)	Post-test	N (%)	321 (44.8)
Sweeney; 2018[a] [6] [**All 4 state HDs**]	Quantitative descriptive study: incidence or prevalence without a comparison group	eHARS (IL, LA, TN); HIV laboratory registry and PRISM (LA); Care Markers Database (combines data from multiple sources) (VA)	1,479	Contacted by project/program staff members: Confirmed NIC and offered linkage or re-engagement services	Confirmed to be linked to HIV medical care	Post-test	N (%)	694 (46.9)
			1,479	Contacted by project/program staff members: Confirmed NIC and offered linkage or re-engagement services	Linkage to HIV medical care not yet determined	Post-test	N (%)	37 (2.5)
Sweeney[b]; 2018 [6] [**LA state HD**]	Quantitative descriptive study: incidence or prevalence without a comparison group	eHARS (IL, LA, TN); HIV laboratory registry and PRISM (LA); Care Markers Database (combines data from multiple sources) (VA)	434	Virologic failure: Contacted	Substantially improved VL	Post-test	N (%)	104 (24.0)
			434	Virologic failure: Contacted	Determination pending	Post-test	N (%)	11 (2.5)
Udeagu; 2019[a] [50] **Related Citations:** Udeagu; 2018[a] [51] and Udeagu; 2013 [52]	Quantitative non-randomized study: Cohort	NYC HIV surveillance data; DOHMH program and public social service and subscriptions databases; HIV clinic medical records	409	Confirmed OOC	Retention: Labs within 12 month FU: Any CD4 or VL (1 or more)	12 months	N (%)	232 (56.7)
			62	Confirmed OOC	Achieved VS: ≤200 copies/mL	Post-test	N (%)	30 (48.4)
			62	Confirmed OOC	Days from case assignment to 1st clinic appt	Post-test	Median (IQR)	25 (46)

Outcomes for interventions with no comparison condition

Author; Year	Study Design	Data Source	Total Sample size	Sample population description	Outcome Measurement	Measurement Time Points	Effect Size Type	Effect Size
			62	Confirmed OOC	Time from re-initiation of ART to VS (months)	Post-test	Median (IQR)	1 (4)
			62	Confirmed OOC	Date of care re-engagement to VS (months)	Post-test	Median (IQR)	1 (4)
Udeagu; 2018[a] [51] **Related Citations:** Udeagu; 2019[a] [50] and Udeagu; 2013 [52]	Quantitative descriptive study: incidence or prevalence without a comparison group	NYC HIV surveillance registry (the registry); FSU database; data obtained through provider report	1218	Traced (successfully contacted), confirmed OOC	Re-engaged in care: Kept clinic appointment	Post-test	N (%)	617 (50.7)
			1218	Traced (successfully contacted), confirmed OOC	Re-engaged in care: kept clinic appointment and CD4/VL captured within 3 months	Post-test NR	N (%)	581 (47.7)
			1218	Traced (successfully contacted), confirmed OOC	Time since OOC to re-engagement in care: <1 year	Post-test	N (%)	119 (9.8)
			1218	Traced (successfully contacted), confirmed OOC	Time since OOC to re-engagement in care: 1–3 years	Post-test	N (%)	333 (27.3)
			1218	Traced (successfully contacted), confirmed OOC	Time since OOC to re-engagement in care: >3 years	Post-test	N (%)	91 (7.5)
			519	Re-engaged: kept appointment and CD4/VL in registry within 3 months Not ITT analysis	Inconsistently engaged: may have re-engaged in and then exited care at various points	Post-test	N (%)	187 (36.0)
			519	Re-engaged: kept appointment and CD4/VL in registry within 3 months Not ITT analysis	Continuous engagement: ≥1 CD4/VL test	1 year follow-up	N (%)	444 (85.5)
			504	Re-engaged: kept appointment and CD4/VL in registry within 3 months Not ITT analysis	Continuous engagement: ≥1 CD4/VL test	2 years follow-up	N (%)	388 (77.0)
			328	Re-engaged: kept appointment and CD4/VL in registry within 3 months	Continuous engagement: ≥1 CD4/VL test	3 years follow-up	N (%)	237 (72.3)

Outcomes for interventions with no comparison condition

Author; Year	Study Design	Data Source	Total Sample size	Sample population description	Outcome Measurement	Measurement Time Points	Effect Size Type	Effect Size
				Not ITT analysis				
			239	Re-engaged: kept appointment and CD4/VL in registry within 3 months Not ITT analysis	Continuous engagement: ≥1 CD4/VL test	4 years follow-up	N (%)	159 (66.5)
			165	Re-engaged: kept appointment and CD4/VL in registry within 3 months Not ITT analysis	Continuous engagement: ≥1 CD4/VL test	5 years follow-up	N (%)	104 (63.0)
			519	Re-engaged: kept appointment and CD4/VL in registry within 3 months Not ITT analysis	Retained in care: continuous engaged people with ≥2 CD4/VL test, ≥3 months apart	1 year follow-up	N (%)	341 (65.7)
			504	Re-engaged: kept appointment and CD4/VL in registry within 3 months Not ITT analysis	Retained in care: continuous engaged people with ≥2 CD4/VL test, ≥3 months apart	2 years follow-up	N (%)	247 (49.0)
			328	Re-engaged: kept appointment and CD4/VL in registry within 3 months Not ITT analysis	Retained in care: continuous engaged people with ≥2 CD4/VL test, ≥3 months apart	3 years follow-up	N (%)	142 (43.3)
			239	Re-engaged: kept appointment and CD4/VL in registry within 3 months Not ITT analysis	Retained in care: continuous engaged people with ≥2 CD4/VL test, ≥3 months apart	4 years follow-up	N (%)	86 (36.0)
			165	Re-engaged: kept appointment and CD4/VL in registry within 3 months Not ITT analysis	Retained in care: continuous engaged people with ≥2 CD4/VL test, ≥3 months apart	5 years follow-up	N (%)	43 (26.1)
			519	Re-engaged: kept appointment and CD4/VL in registry within 3 months Not ITT analysis	VS: VL ≤200 copies/mL	1 year follow-up	N (%)	278 (53.6)

Outcomes for interventions with no comparison condition

Author; Year	Study Design	Data Source	Total Sample size	Sample population description	Outcome Measurement	Measurement Time Points	Effect Size Type	Effect Size
			504	Re-engaged: kept appointment and CD4/VL in registry within 3 months Not ITT analysis	VS: VL ≤200 copies/mL	2 years follow-up	N (%)	195 (38.7)
			328	Re-engaged: kept appointment and CD4/VL in registry within 3 months Not ITT analysis	VS: VL ≤200 copies/mL	3 years follow-up	N (%)	100 (30.5)
			239	Re-engaged: kept appointment and CD4/VL in registry within 3 months Not ITT analysis	VS: VL ≤200 copies/mL	4 years follow-up	N (%)	63 (26.4)
			165	Re-engaged: kept appointment and CD4/VL in registry within 3 months Not ITT analysis	VS: VL ≤200 copies/mL	5 years follow-up	N (%)	35 (21.2)
			78	Enrolled in program	Linked to care within 3 months	3 months	N (%)	53 (67.9)
			78	Enrolled in program	Linked to care within 6 months	6 months	N (%)	66 (84.6)
			78	Enrolled in program	Linked to care within 12 months	12 months	N (%)	73 (93.6)
Udeagu; 2013 [52] **Related Citations:** Udeagu; 2019[a] [50] and Udeagu; 2018[a] [51]	Quantitative descriptive study: incidence or prevalence without a comparison group	NYC HIV surveillance registry (Registry) (city); Registry matched with Local Vital Records, National Death Index, and Social Security Death Master File	409	Confirmed-LTFU	Linked to care	NR	N (%)	315 (77)
			409	Confirmed-LTFU	Returned to care: an HIV care visit confirmed via medical records or CD4 or VL via registry	NR	N (%)	240 (59)
			409	Confirmed-LTFU	Any CD4 or VL	NR	N (%)	232 (57)
			240	Returned to care	Retention: ≥2 clinic visits (CD4 or VL reports in registry) 1 year following return to care visit	12 months	N (%)	115 (48%)

Outcomes for interventions with no comparison condition

Author; Year	Study Design	Data Source	Total Sample size	Sample population description	Outcome Measurement	Measurement Time Points	Effect Size Type	Effect Size
			240	Returned to care	Time between outreach and return to care	NR	Mean days	48
			240	Return to care	Time between outreach and return to care: <1 month	NR	N (%)	93 (39)
			240	Return to care	Time between outreach and return to care: 1 month to 3 months	NR	N (%)	112 (47)
			240	Return to care	Time between outreach and return to care: 3 months to 6 months	NR	N (%)	33 (14)
			240	Return to care	Time between outreach and return to care: 6 months to 9 months	NR	N (%)	2 (<1)
Wohl; 2016 [53]	Quantitative non-randomized study: Cohort	Ryan White medical outpatient program data (clinic)	73	Enrolled in program and linked to care	Retained in care: a second VL test at least 90 days after linkage to care.	12 months	N (%)	60 (82.2)

[a] Primary study

Abbreviations for common terms used within Table 3: Antiretroviral Therapy (ART); US national HIV/AIDS reporting system (HARS); Out-of-Care (OOC); Not in Care (NIC); Linkage Integration Navigation Comprehensive Services (LINCS); San Francisco Department of Public Health (SFDPH) linkage and navigation program; Georgia Health System (GHS); Louisiana State University Health Care Services Division (LSU HCSD); Louisiana Public Health Information Exchange (LaPHIE); Massachusetts Integrated HIV/AIDS Surveillance Program (MHASP); Georgia Department of Public Health (GDPH);Massachusetts Department of Public Health (MDPH); Mississippi Department of Health (MSDH); Patient Reporting Investigation Surveillance Manager (PRISM); Wayne State University Physician Group (WSUP (ID)); AIDS Drug Assistance Program (ADAP); Viral Load (VL); Health Departments (HD); Disease Intervention Specialists (DIS); Electronic Medical Record (EMR); Enhanced HIV/AIDS Reporting System (eHARS); Emergency Department (ED); Public Health Seattle and King County (PHSKC); Community Health Clinics/Centers (CHC); Electronic Health Records (EHR); Lost to Follow-up (LTFU); Department of Health and Mental Hygiene (DOHMH); Viral Load Suppression or Virally Suppressed (VLS); Field Service Unit (FSU); Partnerships for Care (P4C); Modified Intent to Treat (mITT); Care and Antiretroviral Promotion Program (CAPP)

Table 5:

HIV Care Status Outcomes

Interventions with HIV care status (e.g., deceased, incarcerated, relocated, etc.)							
Author; Year	**Study Design**	**Data Source**	**Total Sample size**	**Sample population description**	**Outcome Measurement**	**Effect Size Type**	**Effect Size**
Arey; 2019 [24]	Quantitative descriptive study: incidence or prevalence without a comparison group	eHARS; PRISM; and EHR	778	Initial list: HIV+ in eHARS and EHR	HIV-	N (%)	26 (3.3)
			778	Initial list: HIV+ in eHARS and EHR	Duplicate	N (%)	1 (0.1)
			778	Initial list: HIV+ in eHARS and EHR	Confirmed HIV+	N (%)	751 (96.5)
			702	Confirmed HIV+ at initial case conference	Not in care	N (%)	53 (7.5)
			702	Confirmed HIV+ at initial case conference	In care (In care, not VS:200 and VS: 415)	N (%)	615 (87.6)
			702	Confirmed HIV+ at initial case conference	Deceased	N (%)	26 (3.7)
			702	Confirmed HIV+ at initial case conference	Other	N (%)	8 (1.1)
Avoundjian; 2020 [25]	Quantitative non-randomized study: Cohort	EDW; PHSKC’s eHARS	242	Out-of-care patient with real-time alert from ED visit/IP admission	Contacted by HIV relinkage team	N (%)	145 (60)
Avoundjian; 2018 [26] Abstract	Quantitative descriptive study: incidence or prevalence without a comparison group	MSDH HIV and STD Surveillance Data	55	HIV+ with a new STD and identified as OOC	Not assigned to DIS investigation	N (%)	19 (34.5)
			55	HIV+ with a new STD and identified as OOC	Assigned to DIS investigation: Open investigations	N (%)	4 (7.2)
			55	HIV+ with a new STD and identified as OOC	No need for DIS intervention	N (%)	18 (32.7)
			55	HIV+ with a new STD and identified as OOC	Not located	N (%)	2 (3.6)
			55	HIV+ with a new STD and identified as OOC	Referred to care	N (%)	12 (21.8)
Beltrami; 2018 [27]	Quantitative descriptive study: incidence or prevalence without a comparison group	HIV surveillance data	1,619	Data from 2 of 5 departments (1269+350): Newly diagnosed and presumed OOC	Eligible for linkage	N (%)	1,269 (78.4)

Interventions with HIV care status (e.g., deceased, incarcerated, relocated, etc.)

Author; Year	Study Design	Data Source	Total Sample size	Sample population description	Outcome Measurement	Effect Size Type	Effect Size
			1,619	Data from 2 of 5 departments (1269+350): Newly diagnosed and presumed OOC	Not eligible for linkage	N (%)	350 (21.6)
			350	Data from 2 of 5 departments newly diagnosed and presumed OOC	Already in care	N (%)	111 (31.7)
			350	Data from 2 of 5 departments newly diagnosed and presumed OOC	Not able to be located	N (%)	24 (6.9)
			350	Data from 2 of 5 departments newly diagnosed and presumed OOC	Moved	N (%)	18 (5.1)
			350	Data from 2 of 5 departments newly diagnosed and presumed OOC	Deceased	N (%)	3 (0.9)
Bertolli; 2013 [28]	Quantitative descriptive study: incidence or prevalence without a comparison group 5023	eHARS, vital statistics data, interstate efforts to de-duplicate	4,666	Persons with HIV with no evidence of care who were investigated and not contacted	Laboratory evidence of care entry	N (%)	1735 (37.2)
			4,666	Persons with HIV with no evidence of care who were investigated and not contacted	Not residing in area	N (%)	251 (5.4)
			4,666	Persons with HIV with no evidence of care who were investigated and not contacted	Deceased	N (%)	57 (1.2)
			4,666	Persons with HIV with no evidence of care who were investigated and not contacted	Unaware of HIV status or aware of <3 months	N (%)	18 (0.4)
			4,666	Persons with HIV with no evidence of care who were investigated and not contacted	Other ineligible reason (diagnosed before eligibility period, no English or Spanish, <18 years of age, having a CD4 or VL date before HIV diagnosis date)	N (%)	238 (5.1)
			4,666	Persons with HIV with no evidence of care who were investigated and not contacted	Contact: Not reached	N (%)	1,614 (34.6)
			4,666	Persons with HIV with no evidence of care who were investigated and not contacted	Contacted: Self-report already in care	N (%)	279 (6.0)
			4,666	Persons with HIV with no evidence of care who were investigated and not contacted	Contacted: Other ineligible reason (diagnosed before eligibility period, no English or Spanish, <18 years of age, having a CD4 or VL date before HIV diagnosis date)	N (%)	126 (2.7)
			4,666	Persons with HIV with no evidence of care who were investigated and not contacted	Contacted: Refused interview	N (%)	216 (4.6)

Interventions with HIV care status (e.g., deceased, incarcerated, relocated, etc.)							
Author; Year	**Study Design**	**Data Source**	**Total Sample size**	**Sample population description**	**Outcome Measurement**	**Effect Size Type**	**Effect Size**
			4,666	Persons with HIV with no evidence of care who were investigated and not contacted	Contacted: Interviewed	N (%)	132 (2.8)
Bove; 2015 [29]	Quantitative non-randomized study: Cohort	EHR intake form and case management records; PHSKC health department HIV surveillance	753	Identified as OOC	HD identified as ineligible for relinkage outreach (i.e., either moved or transferred care)	N (%)	347 (46.1)
			753	Identified as OOC	Case investigation, moved	N (%)	132 (17.5)
			753	Identified as OOC	Case investigation, engaged in care elsewhere	N (%)	30 (4.0)
			753	Identified as OOC	Case investigation, transferred to HIV care	N (%)	85 (11.3)
			753	Identified as OOC	Case investigation, incarcerated	N (%)	2 (0.3)
			753	Identified as OOC	Relinked before contact attempted	N (%)	40 (5.3)
			753	Identified as OOC	No contact info	N (%)	16 (2.1)
			753	Identified as OOC	Transferred to case manger	N (%)	17 (2.3)
			753	Identified as OOC	Contacts attempted	N (%)	84 (11.2)
Buchacz; 2015 [7]	Quantitative descriptive study: incidence or prevalence without a comparison group	SFDPH eHARS; local and California vital statistics departments; National Death Index; Social Security Death Master File; electronic medical records at the county public hospital, public health clinics, and many private medical facilities; SFDPH STD report database, California State databases of support services (shelter and substance abuse); Lexis/Nexis	434	Eligible for RSVP: no VL test or VS >200 copies	Living outside of GBA	N (%)	113 (26.0)

Interventions with HIV care status (e.g., deceased, incarcerated, relocated, etc.)

Author; Year	Study Design	Data Source	Total Sample size	Sample population description	Outcome Measurement	Effect Size Type	Effect Size
			434	Eligible for RSVP: no VL test or VS >200 copies	Had qualifying HIV VL test ordered by a provider outside of GBA	N (%)	39 (9.0)
			434	Eligible for RSVP: no VL test or VS >200 copies	Could not be located (incorrect or disconnected phone number or no response to mailed letter).	N (%)	79 (18.2)
			434	Eligible for RSVP: no VL test or VS >200 copies	Moved outside the GBA	N (%)	48 (11.1)
			434	Eligible for RSVP: no VL test or VS >200 copies	Located in GBA and not reachable (no return phone call)	N (%)	30 (7.0)
			434	Eligible for RSVP: no VL test or VS >200 copies	Reached and refused participation	N (%)	30 (7.0)
			434	Eligible for RSVP: no VL test or VS >200 copies	Reached and does not speak English	N (%)	4 (1.0)
			434	Eligible for RSVP: no VL test or VS >200 copies	Deceased	N (%)	6 (1.4)
			434	Eligible for RSVP: no VL test or VS >200 copies	Agreed to interview, but no show	N (%)	10 (2.3)
			434	Eligible for RSVP: no VL test or VS >200 copies	Interviewed, but found to be ineligible as lab results performed before index date (April 20, 2012)	N (%)	25 (5.8)
			434	Eligible for RSVP: no VL test or VS >200 copies	Interviewed and confirmed to be eligible	N (%)	50 (11.5)
Buskin; 2014 [31]	Quantitative descriptive study: incidence or prevalence without a comparison group	HARS	2,573	PLWHA, living in King County, and lab gaps ≥12 months	Deaths	N (%)	180 (7.0)
			2,573	PLWHA, living in King County, and lab gaps ≥12 months	Relocated:	N (%)	1,196 (46.5)
			2,573	PLWHA, living in King County, and lab gaps ≥12 months	Lost to follow-up (>5 years no contact)	N (%)	126 (4.9)
			2,573	PLWHA, living in King County, and lab gaps ≥12 months	Unknown	N (%)	84 (3.3)
			2,573	PLWHA, living in King County, and lab gaps ≥12 months	Errors: Duplicates: 10 Anonymous tests: 16 HIV-: 2	N (%)	28 (1.1)

Interventions with HIV care status (e.g., deceased, incarcerated, relocated, etc.)

Author; Year	Study Design	Data Source	Total Sample size	Sample population description	Outcome Measurement	Effect Size Type	Effect Size
			2,573	PLWHA, living in King County, and lab gaps ≥12 months	Living in King County and eligible for intervention	N (%)	959 (37.3)
Dombrowski; 2018[d] [33] **Related Citations:** Chang; 2019 [32]	Quantitative non-randomized study: Cohort	eHARS (county)	997 (822 presumed living in area)	Eligible for CAPP: Recent unsuppressed VL and/or 12-month gap in lab reports	Moved away	N (%)	145 (14.5)
			997 (822 presumed living in area)	Eligible for CAPP: Recent unsuppressed VL and/or 12-month gap in lab reports	Died	N (%)	30 (3.0)
			997 (822 presumed living in area)	Eligible for CAPP: Recent unsuppressed VL and/or 12-month gap in lab reports	VS reported before contact attempted	N (%)	161 (16.1)
			997 (822 presumed living in area)	Eligible for CAPP: Recent unsuppressed VL and/or 12-month gap in lab reports	Provider declined contact	N (%)	130 (19.7)
			997 (822 presumed living in area)	Eligible for CAPP: Recent unsuppressed VL and/or 12-month gap in lab reports	DIS successfully contact	N (%)	243 (24.4)
			997 (822 presumed living in area)	Eligible for CAPP: Recent unsuppressed VL and/or 12-month gap in lab reports	Unable to contact	N (%)	288 (43.6)
Donovan; 2018 [34]	Quantitative descriptive study: incidence or prevalence without a comparison group	Clinical EHR; NC CAREWare (Ryan White Service data system); (clinic data only)	1118	Initial OOC list reviewed by clinic staff	Deceased	N (%)	26 (2.3)
			1118	Initial OOC list reviewed by clinic staff	Incarcerated	N (%)	40 (3.6)
			1118	Initial OOC list reviewed by clinic staff	Missing outcomes	N (%)	14 (1.3)
			1118	Initial OOC list reviewed by clinic staff	OOC patients referred to clinic-based retention services: Not located	N (%)	326 (31.4)
			1118	Initial OOC list reviewed by clinic staff	OOC patients referred to clinic-based retention services: Located Located, maintained in clinic: 525 (50.6) Located, new clinic or relocated: 187 (18.0)	N (%)	712 (68.6)

Interventions with HIV care status (e.g., deceased, incarcerated, relocated, etc.)

Author; Year	Study Design	Data Source	Total Sample size	Sample population description	Outcome Measurement	Effect Size Type	Effect Size
Goldman; 2019 [35] Abstract	Quantitative descriptive study: incidence or prevalence without a comparison group	WSUPG ID clinic records	95	Identified as OOC	Unreachable	N (%)	38 (40.0)
			95	Identified as OOC	Relocated, incarcerated, deceased, in-care at time of call	N (%)	16 (16.8)
			95	Identified as OOC	Reachable	N (%)	41 (43.2)
Hague; 2019 [36]	Quantitative descriptive study: incidence or prevalence without a comparison group	Electronic laboratory reports from MHASP (HIV surveillance data)	1,137	MHASP presumed OOC	Had recent labs	N (%)	273 (24)
			1,137	MHASP presumed OOC	Upcoming appt	N (%)	91 (8)
			1,137	MHASP presumed OOC	Discharged or moved	N (%)	114 (10)
			1,137	MHASP presumed OOC	Other reason not OOC	N (%)	239 (21)
			1,137	MHASP presumed OOC	Confirmed OOC	N (%)	421 (37)
Hart-Malloy; 2019[a] [38] **Related Citations:** Hart-Malloy A; 2018 [37] and Tesoriero; 2017[a] [9]	Quantitative descriptive study: incidence or prevalence without a comparison group	NY HIV surveillance system (state)	4124	Completed ExPS field investigations	Exclude from analysis, HIV labs received after case assignment, no longer meeting definition for ExPS	N (%)	486 (11.8)
			4124	Completed ExPS field investigations	Current to care	N (%)	534 (12.9)
			4124	Completed ExPS field investigations	Living out of jurisdiction (including NYC)	N (%)	1359 (33.0)
			4124	Completed ExPS field investigations	New HIV labs reported before investigation	N (%)	103 (2.5)
			4124	Completed ExPS field investigations	Unable to locate	N (%)	357 (8.7)
			4124	Completed ExPS field investigations	Deceased	N (%)	432 (10.5)
			4124	Completed ExPS field investigations	Other dispositions (clinical trial, medically unable to respond, duplicate case assignment)	N (%)	98 (2.4)

Interventions with HIV care status (e.g., deceased, incarcerated, relocated, etc.)

Author; Year	Study Design	Data Source	Total Sample size	Sample population description	Outcome Measurement	Effect Size Type	Effect Size
			4124	Completed ExPS field investigations	NIC	N (%)	755 (18.3)
Hart-Malloy; 2018 A [37] **Related Citations:** Hart-Malloy; 2019[a] [38] and Tesoriero; 2017[a] [9]	Quantitative descriptive study: incidence or prevalence without a comparison group	State HIV surveillance database	1,735	Sent to field staff for investigation	Unable to locate	N (%)	210 (12.1)
			1,735	Sent to field staff for investigation	Still under investigation	N (%)	173 (10.0)
			1,735	Sent to field staff for investigation	Current to care	N (%)	351 (20.2)
			1,735	Sent to field staff for investigation	Deceased	N (%)	220 (12.7)
			1,735	Sent to field staff for investigation	Out of Jurisdiction	N (%)	406 (23.4)
			1,735	Sent to field staff for investigation	Other (i.e., duplicate, not HIV(+), medically unable to respond)	N (%)	27 (1.6)
			1,735	Sent to field staff for investigation	Confirmed OOC	N (%)	348 (20.1)
Hart-Malloy B; 2018 [37]	Quantitative descriptive study: incidence or prevalence without a comparison group	CHC medical records	261	Provider presumed OOC	Not assigned as OOC (i.e., deceased, out of state, duplicate, not HIV+, or current to care)	N (%)	188 (72.0)
			261	Provider presumed OOC	Unable to locate	N (%)	12 (4.6)
			261	Provider presumed OOC	Still under investigation	N (%)	10 (3.8)
			261	Provider presumed OOC	Current to care	N (%)	23 (8.8)
			261	Provider presumed OOC	Deceased	N (%)	3 (1.1)
			261	Provider presumed OOC	Out of jurisdiction	N (%)	6 (2.3)
			261	Provider presumed OOC	Other (i.e., duplicate, HIV-, medically unable to respond)	N (%)	27 (10.3)
			261	Provider presumed OOC	Confirmed OOC	N (%)	19 (7.3)
Hewitt; 2019 [39]	Quantitative non-randomized study: Cohort	HIV surveillance registry	1,429	Target OOC population	Had no VL values	N (%)	19 (1.3)

Author; Year	Study Design	Data Source	Total Sample size	Sample population description	Outcome Measurement	Effect Size Type	Effect Size
Interventions with HIV care status (e.g., deceased, incarcerated, relocated, etc.)							
			1,429	Target OOC population	Had ≥1 VL values, but not within 90 days before or after program initiation	N (%)	910 (63.7)
			1,429	Target OOC population	Was initially VS at baseline	N (%)	184 (12.9)
			1,429	Target OOC population	Had an initial unsuppressed VL value	N (%)	316 (22.1)
Kunzweiler; 2019 [40]	Quantitative non-randomized study: Cohort	MDPH surveillance data; CHC clinic data	1,418	Identified as OOC and discussed during case reconciliation conferences	Engaged/current to care (recent clinical visit, recent CD4 count, or VL test)	N (%)	764 (53.9)
			1,418	Identified as OOC and discussed during case reconciliation conferences	Other (Site requested additional time to FU on patient)	N (%)	277 (19.5)
			1,418	Identified as OOC and discussed during case reconciliation conferences	Upcoming visit scheduled	N (%)	172 (12.1)
			1,418	Identified as OOC and discussed during case reconciliation conferences	No longer considered patients	N (%)	85 (6.0)
			1,418	Identified as OOC and discussed during case reconciliation conferences	Deceased	N (%)	9 (0.6)
			1,418	Identified as OOC and discussed during case reconciliation conferences	Health center contact unavailable for call	N (%)	28 (2.0)
			1,418	Identified as OOC and discussed during case reconciliation conferences	Identified as OOC post discussion	N (%)	83 (5.9)
Magnus; 2012 [41]	Quantitative non-randomized study	LaPHIE. which statewide public health surveillance data and LSU HCSD EMR data	549 EMR alerts	EMR alerts for 419 unduplicated HIV-infected individuals who had not received HIV specialty care, as evidenced by no CD4 count or VL >1 year	EMR alerts acted on by clinician	N (%)	406 (73.9)
			549 EMR alerts	EMR alerts for 419 unduplicated HIV-infected individuals who had not received HIV specialty care, as evidenced by no CD4 count or VL >1 year (549–409=143 EMR alerts not acted upon, 56% of 143 addressed [56x0.56])	EMR alerts already addressed by a previous healthcare provider at same visit	N (%)	80 (14.6)
			549 EMR alerts	EMR alerts for 419 unduplicated HIV-infected individuals who had not received HIV specialty care, as evidenced by no CD4 count or VL >1 year (549–409=143 EMR alerts not acted upon, 143–80=63 EMR alerts not acted upon)	EMR alerts not acted upon	N (%)	63 (11.5)

Interventions with HIV care status (e.g., deceased, incarcerated, relocated, etc.)

Author; Year	Study Design	Data Source	Total Sample size	Sample population description	Outcome Measurement	Effect Size Type	Effect Size
			406 EMR alerts	EMR alerts acted on by clinician	Referral of patients for treatment or scheduling an appt	N (%)	173 (42.7)
			406 EMR alerts	EMR alerts for 419 unduplicated HIV-infected individuals who had not received HIV specialty care, as evidenced by no CD4 count or VL >1 year (143/549 (26.0%) EMR alerts not acted upon)	Discussed the importance of treatment with the patient	N (%)	131 (32.2)
			406 EMR alerts	EMR alerts for 419 unduplicated HIV-infected individuals who had not received HIV specialty care, as evidenced by no CD4 count or VL >1 year (143/549 (26.0%) EMR alerts not acted upon)	Assessed patient's health and disease stage	N (%)	59 (14.5)
			406 EMR alerts	EMR alerts for 419 unduplicated HIV-infected individuals who had not received HIV specialty care, as evidenced by no CD4 count or VL >1 year (143/549 (26.0%) EMR alerts not acted upon)	Provider reported patient was either in care at another healthcare facility or did not wish to receive treatment at that time	N (%)	34 (8.3)
Mulatu; 2018 [42] **Related Citations:** Sweeney; 2018 [6] and Anderson; 2020 [23]	Quantitative descriptive study: incidence or prevalence without a comparison group	HIV Surveillance Data	18,806	Presumed NIC PWH	Not forwarded for public health investigation (e.g., deceased, out of jurisdiction, not in CAPUS implementation area, in care per other systems)	N (%)	6,554 (34.9)
			18,806	Presumed NIC PWH	Forwarded for investigation follow-up	N (%)	12,252 (65.1)
			12,252	Presumed NIC PWH, forwarded for investigation	Forwarded for investigation, follow-up completed, but not contacted	N (%)	3,332 (27.2)
			12,252	Presumed NIC PWH, forwarded for investigation	Forwarded for investigation, contacted, but follow-up in progress	N (%)	3,968 (32.4)
			12,252	Presumed NIC PWH, forwarded for investigation	Forwarded for investigation, contacted, care status not confirmed	N (%)	101 (0.8)
			12,252	Presumed NIC PWH, forwarded for investigation	Forwarded for investigation, contacted, already in care	N (%)	3,040 (24.8)

Interventions with HIV care status (e.g., deceased, incarcerated, relocated, etc.)							
Author; Year	**Study Design**	**Data Source**	**Total Sample size**	**Sample population description**	**Outcome Measurement**	**Effect Size Type**	**Effect Size**
			12,252	Presumed NIC PWH, forwarded for investigation	Forwarded for investigation, contacted, confirmed not in care	N (%)	1,811 (14.8)
			1,811	Forwarded for investigation, contacted, confirmed not in care	Linkage service offered and offer declined	N (%)	548 (30.3)
Ridgway; 2019 [43]	Quantitative descriptive study: incidence or prevalence without a comparison group	ED and hospitalized EMR; Chicago Department of Public Health electronic HIV surveillance database; eHARS (national)	420	PLWH who received medical care in the ED or inpatient setting identified by electronic algorithm	Linked to care through a separate initiative	N (%)	17 (4.0)
			420	PLWH who received medical care in the ED or inpatient setting identified by electronic algorithm	Deceased	N (%)	8 (1.9)
			420	PLWH who received medical care in the ED or inpatient setting identified by electronic algorithm	Incarcerated	N (%)	2 (0.5)
			420	PLWH who received medical care in the ED or inpatient setting identified by electronic algorithm	Actively engaged in care	N (%)	337 (80.2)
			420	PLWH who received medical care in the ED or inpatient setting identified by electronic algorithm	OOC, and eligible for re-engagement	N (%)	56 (13.3)
Saafir-Callaway; 2020 [44]	Quantitative descriptive study: incidence or prevalence without a comparison group	OOC list by providers, Ryan White CARE Act, HIV surveillance (city), ADAP data	686	Identified as OOC	No contact attempted by providers	N (%)	117 (17.1)
			686	Identified as OOC and attempted contact by providers	Found to be in care at another provider	N (%)	120 (17.5)
			686	Identified as OOC and attempted contact by providers	Relocated to another jurisdiction	N (%)	61 (8.9)
			686	Identified as OOC and attempted contact by providers	Deceased	N (%)	19 (2.8)
			686	Identified as OOC and attempted contact by providers	Unable to locate	N (%)	215 (31.3)

Interventions with HIV care status (e.g., deceased, incarcerated, relocated, etc.)

Author; Year	Study Design	Data Source	Total Sample size	Sample population description	Outcome Measurement	Effect Size Type	Effect Size
			686	Identified as OOC and attempted contact by providers	Other disposition (e.g., incarcerated, not HIV+, not eligible for recapture)	N (%)	51 (7.4)
			686	Identified as OOC and attempted contact by providers	Attempted contact by providers	N (%)	103 (15.0)
Sachdev; 2020 [45]	Quantitative non-randomized study: Cohort	Providers; eHARS, the state HIV surveillance system	954	Referred to LINCS by providers and HIV surveillance	Ineligible	N (%)	260 (27.3)
			954	Referred to LINCS by providers and HIV surveillance	Not located	N (%)	201 (21.1)
			954	Referred to LINCS by providers and HIV surveillance	Already in care	N (%)	146 (15.3)
			954	Referred to LINCS by providers and HIV surveillance	Refused	N (%)	113 (11.8)
			954	Referred to LINCS by providers and HIV surveillance	Enrolled in LINCS	N (%)	233 (24.4)
Sharp; 2019 [47]	Quantitative non-randomized study: Cohort	GDPH database, GHS database, Georgia HIV Surveillance database	166	Generated an HIE alert for OOC	In care elsewhere	N (%)	18 (10.8)
			166	Generated an HIE alert for OOC	HIV negative (erroneous alert)	N (%)	1 (0.6)
			166	Generated an HIE alert for OOC	Admitted to the hospital (excluded from analysis)	N (%)	49 (29.5)
			166	Generated an HIE alert for OOC	OOC and not contacted by social worker	N (%)	78 (47.0)
			166	Generated an HIE alert for OOC	OOC and contacted by social worker	N (%)	20 (12.0)
Sitapati; 2012 [48]	Quantitative descriptive study: incidence or prevalence without a comparison group	EMR	716	Poorly retained patients	Returned to care on own	N (%)	205 (28.6)
			716	Poorly retained patients	Lost or unable to contact	N (%)	88 (12.3)
			716	Poorly retained patients	In care elsewhere	N (%)	98 (13.7)

Interventions with HIV care status (e.g., deceased, incarcerated, relocated, etc.)

Author; Year	Study Design	Data Source	Total Sample size	Sample population description	Outcome Measurement	Effect Size Type	Effect Size
			716	Poorly retained patients	Still clinic patient, but no return visit	N (%)	26 (3/6)
			716	Poorly retained patients	Future return visit scheduled	N (%)	8 (1.1)
			716	Poorly retained patients	Deceased	N (%)	41 (5.7)
			716	Poorly retained patients	Moved out of area	N (%)	101 (14.1)
			716	Poorly retained patients	Incarcerated	N (%)	28 (3.9)
			716	Poorly retained patients	No longer clinic patient or unknown if in care	N (%)	4 (0.6)
			716	Poorly retained patients	Dismissed from clinic or status unknown	N (%)	1 (0.1)
			716	Poorly retained patients	Returned to care	N (%)	116 (16.2)
Sweeney A; 2018 [6] [**All 4 state HDs**] **Related Citations:** Mulatu; 2018^{a} [42] and Anderson; 2020 [23]	Quantitative descriptive study: incidence or prevalence without a comparison group	eHARS (IL, LA, TN); HIV laboratory registry and PRISM (LA); Care Markers Database (combines data from multiple sources) (VA)	16,391	Initially presumed NIC by 4 state HDs	Served under other grants or not prioritized for CAPUS follow-up	N (%)	2,593 (15.8)
			13,798	Included in CAPUS investigation: verified data and prioritized	Further exclusions after matching to other data sources (already in care)	N (%)	2,892 (21.0)
			13,798	Included in CAPUS investigation: verified data and prioritized	Further exclusions after matching to other data sources (i.e., deceased or out of jurisdiction)	N (%)	1,054 (7.6)
			9,852	PWH selected for contact or outreach by project/program staff members	Deceased	N (%)	336 (3.4)
			9,852	PWH selected for contact or outreach by project/program staff members	Out of jurisdiction (n=904) and out of CAPUS area (n=186)	N (%)	1,090 (11.1)
			9,852	PWH selected for contact or outreach by project/program staff members	Incarcerated	N (%)	122 (1.2)
			9,852	PWH selected for contact or outreach by project/program staff members	Other reasons (e.g., unable to contact)	N (%)	1,605 (16.3)
			9,852	PWH selected for contact or outreach by project/program staff members	Contact in progress	N (%)	2,535 (25.7)

Interventions with HIV care status (e.g., deceased, incarcerated, relocated, etc.)							
Author; Year	**Study Design**	**Data Source**	**Total Sample size**	**Sample population description**	**Outcome Measurement**	**Effect Size Type**	**Effect Size**
			9,852	PWH selected for contact or outreach by project/program staff members	Contacted by project/program staff members: In Care	N (%)	2,586 (26.2)
			9,852	PWH selected for contact or outreach by project/program staff members	Contacted by project/program staff members: Care status not yet determined	N (%)	99 (1.0)
			9,852	PWH selected for contact or outreach by project/program staff members	Contacted by project/program staff members: Confirmed NIC and offered linkage or re-engagement services	N (%)	1,479 (15.0)
			1,479	Contacted by project/program staff members: Confirmed NIC and offered linkage or re-engagement services	Services offered, but declined	N (%)	547 (37.0)
			1,479	Contacted by project/program staff members: Confirmed NIC and offered linkage or re-engagement services	Services not offered yet or pending	N (%)	138 (9.3)
			1,479	Contacted by project/program staff members: Confirmed NIC and offered linkage or re-engagement services	Services provided	N (%)	794 (53.7)
Sweeney B; 2018 [6] [**LA state HD**] **Related Citations:** Mulatu; 2018[a] [42] and Anderson; 2020 [23]	Quantitative descriptive study: incidence or prevalence without a comparison group	eHARS (IL, LA, TN); HIV laboratory registry and PRISM (LA)	1,559	PWH in care with virologic failure	Served under other grants or not prioritized for CAPUS follow-up	N (%)	597 (38.3)
			962	Prioritized for follow-up	No longer having virologic failure, had VL taken <90 days before previous VL measure, deceased, out of jurisdiction	N (%)	198 (20.6)
			764	Selected for outreach and attempted to contact	Not contacted: Deceased	N (%)	28 (3.7)
			764	Selected for outreach and attempted to contact	Not contacted: Out of jurisdiction and out of CAPUS project area	N (%)	20 (2.6)
			764	Selected for outreach and attempted to contact	Not contacted: Incarcerated	N (%)	16 (2.1)
			764	Selected for outreach and attempted to contact	Not contacted: Other reason	N (%)	27 (3.5)

Interventions with HIV care status (e.g., deceased, incarcerated, relocated, etc.)

Author; Year	Study Design	Data Source	Total Sample size	Sample population description	Outcome Measurement	Effect Size Type	Effect Size
			764	Selected for outreach and attempted to contact	Not contacted: Contact pending	N (%)	239 (31.3)
			764	Selected for outreach and attempted to contact	Contacted: Adherent to treatment or working on issue with provider	N (%)	165 (21.6)
			764	Selected for outreach and attempted to contact	Contacted: Adherence status pending	N (%)	0 (0)
			764	Selected for outreach and attempted to contact	Contacted: Confirmed to have treatment adherence issues	N (%)	269 (35.2)
			269	Contacted: Confirmed to have treatment adherence issues	Services offered, but declined	N (%)	116 (43.1)
			269	Contacted: Confirmed to have treatment adherence issues	Services not offered yet or pending	N (%)	0 (0)
			269	Contacted: Confirmed to have treatment adherence issues	Services provided	N (%)	153 (56.9)
Tesoriero; 2017[a] [9] **Related Citations:** Hart-Malloy; 2019[a] [38] and Hart Malloy A; 2018 [37]	Quantitative non-randomized study	HIV surveillance databased	1155	Presumed OOC	Not located	N (%)	170 (14.7)
			1155	Presumed OOC	Current to care	N (%)	222 (19.2)
			1155	Presumed OOC	Deceased	N (%)	133 (11.5)
			1155	Presumed OOC	Out of jurisdiction	N (%)	386 (33.4)
			1155	Presumed OOC	Other reason	N (%)	11 (1.0)
			1155	Presumed OOC	Confirmed OOC	N (%)	233 (20.2)
Udeagu; 2019[a] [50] **Related Citations:** Udeagu; 2018[a] [51] and Udeagu; 2013 [52]	Quantitative non-randomized study: Cohort	NYC HIV surveillance data; DOHMH program and public social service and subscriptions databases; HIV clinic medical records	187	Presumed-OOC	Unable to locate	N (%)	37 (19.8)
			187	Presumed-OOC	Current to care	N (%)	3 (1.6)

Interventions with HIV care status (e.g., deceased, incarcerated, relocated, etc.)

Author; Year	Study Design	Data Source	Total Sample size	Sample population description	Outcome Measurement	Effect Size Type	Effect Size
			187	Presumed-OOC	Incarcerated	N (%)	1 (0.5)
			187	Presumed-OOC	HIV-uninfected	N (%)	3 (1.6)
			187	Presumed-OOC	Moved out of NYC	N (%)	76 (40.6)
			187	Presumed-OOC	Deceased	N (%)	5 (2.7)
			187	Presumed-OOC	Confirmed OOC	N (%)	62 (33.2)
Udeagu; 2013 [52] **Related Citations:** Udeagu; 2019[a] [50] and Udeagu; 2018[a] [51]	Quantitative descriptive study: incidence or prevalence without a comparison group	NYC HIV surveillance registry (Registry) (city); Registry matched with Local Vital Records, National Death Index, and Social Security Death Master File	797	Presumed-LTFU	Could not be located	N (%)	113 (14.2)
			797	Presumed-LTFU	Located and current to care	N (%)	229 (28.7)
			797	Presumed-LTFU	Moved out of NYC	N (%)	28 (3.5)
			797	Presumed-LTFU	Incarcerated out of NYC	N (%)	2 (0.3)
			797	Presumed-LTFU	Died	N (%)	16 (2.0)
			797	Presumed-LTFU	Confirmed-LTFU	N (%)	409 (51)
Wohl; 2016 [53]	Quantitative non-randomized study: Cohort	Ryan White medical outpatient program data (clinic)	1139	Identified as OOC (OOC or intermittent care) clinic patients	In care elsewhere	N (%)	410 (36.0)
			1139	Identified as OOC	Navigator unable to locate	N (%)	330 (29.0)
			1139	Identified as OOC	Returned to clinic independently	N (%)	91 (8.0)
			1139	Identified as OOC	No longer LAC resident	N (%)	80 (7.0)
			1139	Identified as OOC	Deceased	N (%)	68 (6.0)
			1139	Identified as OOC	Institutionalized (jail/prison/ mental health facility)	N (%)	34 (3.0)
			1139	Identified as OOC	Declined enrollment	N (%)	46 (4.0)
			1139	Identified as OOC	Enrolled in program	N (%)	78 (6.8)

[a] Primary study

Abbreviations for common terms used within Table 3: Enterprise Data Warehouse (EDW); US national HIV/AIDS reporting system (HARS); Greater San Francisco Bay Area (GBA); Social Worker (SW); Out-of-Care (OOC); Not in Care (NIC); Linkage Integration Navigation Comprehensive Services (LINCS); San Francisco Department of Public Health (SFDPH) linkage and navigation program; Georgia Health System (GHS); Louisiana State University Health Care Services Division (LSU HCSD); Louisiana Public Health Information Exchange (LaPHIE); Los Angeles County (LAC); Massachusetts Integrated HIV/AIDS Surveillance Program (MHASP); Georgia Department of Public Health (GDPH);Massachusetts Department of Public Health (MDPH);Mississippi Department of Health (MSDH); Patient Reporting Investigation Surveillance Manager (PRISM); Wayne State University Physician Group (WSUP (ID)); AIDS Drug Assistance Program (ADAP); Viral Load (VL); People Living with HIV/People with HIV (PLWH/PWH); Health Departments (HD); Disease Intervention Specialists (DIS); Electronic Medical Record (EMR); Enhanced HIV/AIDS Reporting System (eHARS); Emergency Department (ED); Public Health Seattle and King County (PHSKC); Community Health Clinics/Centers (CHC); Electronic Health Records (EHR); Lost to Follow-up (LTFU); Department of Health and Mental Hygiene (DOHMH); Modified Intent to Treat (mITT); Care and Antiretroviral Promotion Program (CAPP)

Table 6:

Data Quality Outcomes

Interventions with *quantitative* evidence of improving surveillance data quality

Author; Year	**Study Design**	**Intervention vs. Control/ Comparison Group**	**Data Source**	**Intervention or Post-Test Sample Size**	**Comparison or Pre-Test Same Size**	**Outcome Measure**	**Measurement Time Points**	**Effect Size Type**	**Effect Size**
Arey; 2019 [24]	Quantitative descriptive study: incidence or prevalence without a comparison group	People living: Post test (final case conference: Dec 2017) vs Pretest (initial case conference: Aug-Sept 2016)	eHARS (state), PRISM, and EHR	834	668	Engaged in care	Post test	N (%)	768 (92.1) vs. 615 (92.1)
				834	669	VS	Post test	N (%)	555 (66.5) vs 415 (62.1)

Interventions with *qualitative* evidence of improving surveillance data quality

Author; Year	**Study Design**	**Data Source**	**Qualitative Description**
Arey; 2019 [24]	Quantitative descriptive study: incidence or prevalence without a comparison group	eHARS (state), PRISM, and EHR	The quality of surveillance data was improved because of the increased concordance between eHARS data and combined data (health center data and HIV surveillance data[eHARS]). This improvement allowed for expansion of D2C efficiency. Supplementing surveillance with clinical data could help to fill in missing data and could also help resolve lags in surveillance reporting.
Beltrami; 2018 [27]	Quantitative descriptive study: incidence or prevalence without a comparison group	HIV surveillance data	The quality of surveillance data was improved because HIV prevention program or medical staff members interviewed patients or reviewed their medical records and then, as part of the project, gave the surveillance staff members information that was not previously in the HIV surveillance database (e.g., current location, HIV risk factors)
Bove; 2015 [29]	Quantitative non-randomized study: Cohort	Madison Clinic’s database which collates EHR, intake forms, and case management records	We found that the primary benefit of our relinkage intervention clinic may have been an improved clinic registry (i.e., combining clinic and HD data) containing accurate information regarding status of the patient population
Donovan; 2018 [34]	Quantitative descriptive study: incidence or prevalence without a comparison group	Clinical EMR; NC CAREWare (Ryan White Service data system); (clinic data only	Surveillance data initially was limited and did not require reporting of undetectable HIV RNA or CD4 over 200c/ml, but data improved over the course of the intervention as the state implemented required CD4 and VL reporting from all labs beginning in July 2013; statewide clinical data-sharing allowed each site to look across the state for evidence of care
Hague; 2019 [36]	Quantitative descriptive study: incidence or prevalence without a comparison group	Electronic laboratory reports from MHASP (HIV surveillance data)	Establishing a single point of contact (e.g. data managers or nurses) at each facility responsible for following up on the presumed OOC line lists; this element ensured that the presumed OOC line lists were processed in a timely and accurate manner and reported to MHASP
Kunzweiler; 2019 [40]	Quantitative non-randomized study: Cohort	MDPH surveillance data; CHC clinic data	HIV follow-up based on laboratory surveillance and clinic data was a new activity for participating CHCs; previously, field epidemiologist follow-up was initiated only upon provider request, for individuals with concurrent infectious syphilis, or for acute HIV infection; The collaboration between CHCs and MDPH leveraged new sources of data, enabled data and resource sharing, improved service delivery, and facilitated continuity of care

Interventions with *qualitative* evidence of improving surveillance data quality

Author; Year	**Study Design**	**Data Source**	**Qualitative Description**
Magnus; 2012 [41]	Quantitative non-randomized study	LaPHIE. which statewide public health surveillance data and LSU HCSD EMR data	The real-time exchange of data between healthcare delivery providers and the state's public health agency enabled us to overcome a previously intractable problem of identifying patients not receiving care for HIV and acting immediately while the patient is still in the facility; a real-time, bi-directional electronic information exchange is an effective method
Mulatu; 2018[a] [42] **Related Citations:** Sweeney; 2018 [6] and Anderson; 2020 [23]	Quantitative descriptive study: incidence or prevalence without a comparison group	HIV Surveillance Data	Key activities to improve the use of surveillance and other data systems included (1) upgrading laboratory and program data reporting systems (e.g., changing from paper to electronic reporting); (2) integrating surveillance, care, and prevention data; (3) developing clinical alerts or data-sharing systems to facilitate linkage to care; and (4) implementing policies and procedures to promote the use of surveillance data for program follow-up. Surveillance and other program records for 2913 PWH were updated with newly acquired information (e.g., current linkage status) during the Data to Care process; CAPUS grantees were able to strengthen their surveillance and other data systems once they identified the gaps in their data (e.g., incomplete demographic, locating, or care information) and were able to integrate updated information collected during follow-up investigations.
Sharp; 2019 [47]	Quantitative non-randomized study: Cohort	GDPH database, GHS database, Georgia HIV Surveillance database	The GPHIE is a bidirectional health information–sharing platform between the GDPH and the GHS that utilizes data traditionally collected for surveillance in the delivery of patient care; By sharing information traditionally collected for surveillance with health care providers, the HIE intervention successfully targets a population that may be overlooked by traditional linkage or re-linkage interventions.
Sitapati; 2012 [48]	Quantitative descriptive study: incidence or prevalence without a comparison group	EMR	Chart analysis was used to identify misclassification and improved accuracy of the registry.
Sweeney A; 2018 [6] **Related Citations:** Mulatu; 2018[a] [42] and Anderson; 2020 [23]	Quantitative descriptive study: incidence or prevalence without a comparison group	eHARS (IL, LA, TN); HIV laboratory registry and PRISM (LA); Care Markers Database (combines data from multiple sources) (VA)	2,852/9,852 (28.9) surveillance case records modified or updated because of D2C activities
Sweeney B; 2018 [6] **Related Citations:** Mulatu; 2018[a] [42] and Anderson; 2020 [23]	Quantitative descriptive study: incidence or prevalence without a comparison group	eHARS (IL, LA, TN); HIV laboratory registry and PRISM (LA)	67/764 (8.8) surveillance case records updated with new information
Udeagu 2019[a] [50] **Related Citations:** Udeagu; 2018[a] [51] and Udeagu; 2013 [52]	Quantitative non-randomized study: Cohort	NYC HIV surveillance data; HIV clinic medical records	The collaboration for eD2C was enabled by a 2014 amendment to the New York State HIV-related law permitting the sharing of patient-specific data from the HIV registry with a patient's treating provider for the purposes of linkage and retention in care; Leveraging combined data sources and coordinated efforts resulted in more robust classification of HIV status, less time spent looking for persons who were otherwise current with HIV care or had moved out of NYC
Wohl; 2016 [53]	Quantitative non-randomized study: Cohort	Ryan White medical outpatient program data (clinic)	If there was evidence of sustained HIV care per VL or CD4 reports in the HIV surveillance database over the previous 6 months at another LAC HIV clinic, the information was documented in the patient's record and the Navigator notified the home HIV clinic and closed the case.

[a] Primary study

Abbreviations for common terms used within Table 3: Out-of-Care (OOC); Georgia Health System (GHS); Louisiana State University Health Care Services Division (LSU HCSD); Georgia Public Health Information Exchange (GPHIE); Louisiana Public Health Information Exchange (LaPHIE); Los Angeles County (LAC); Massachusetts Integrated HIV/AIDS Surveillance Program (MHASP); Georgia Department of Public Health (GDPH);Massachusetts Department of Public Health (MDPH); Patient Reporting Investigation Surveillance Manager (PRISM); Viral Load (VL); People Living with HIV/People with HIV (PLWH/PWH); Health Departments (HD); Injection Drug Use (IDU); Electronic Medical Record (EMR); Enhanced HIV/AIDS Reporting System (eHARS); Community Health Clinics/Centers (CHC); Electronic Health Records (EHR)

Table 7:

Demographic Stratification Outcomes

Interventions with comparison evidence stratified by demographics data			
Author; Year	**Study Design**	**Data Source**	**Quantitative or Qualitative Description**
Anderson; 2020 [23] **Related Citations:** Mulatu; 2018[a] [42] and Sweeney; 2018 [6]	Quantitative non-randomized study: Cohort	LA OPH SHP surveillance database	We adjusted for sex in our analyses and did not find differences in program impact based on participant sex.
Braunstein; 2019 [30]	Quantitative non-randomized study: Cohort	NYC HIV surveillance registry, NYC Vital Statistics Registry, National Death Index and Social Security Death Master File (national death data)	No adjustments made for VL based on demographic characteristics.
Dombrowski; 2018[a] [33] **Related Citations:** Chang; 2019 [32]	Quantitative non-randomized study: Cohort	eHARS (county)	The outcome did not differ significantly between patient subgroups
Sachdev; 2020 [45]	Quantitative non-randomized study: Cohort	eHARS, the state HIV surveillance system	Notably, there were no differences [retention and VS] in relative improvements by [age], race, [sex], [IDU in past 12 months].

[a] Primary study

Abbreviations for common terms used within Table 3: Louisiana Office of Public Health STD/HIV Program (LA OPH SHP); Injection Drug Use (IDU); New York city (NYC); Viral Load (VL); Enhanced HIV/AIDS Reporting System (eHARS); Viral Load Suppression or Virally Suppressed (VLS)

Table 8:

Mixed Methods Appraisal Tool (MMAT) Results

Two screening questions regarding clarity of research questions and availability of data to address questions are followed by questions specific for each study design (e.g., are groups comparable, are measurements appropriate, are outcome assessors blinded, do outcomes have complete data) (Hong 2018).

A: Quality assessment of the included quantitative RCT studies								
				Quantitative RCTs				
		Appropriate randomization	Groups comparable at baseline	Completed outcome data	Outcome blinded to intervention	Intervention adhered to by participants	Total Points	Score
Author (Year)	Study Design							
Shamasunder (2020) [46]	RCT	0	1	0	0	0	1	0.20
B: Quality assessment of the included quantitative nRCT studies								
				Quantitative nRCTs				
		Participants representative of target population	Appropriate measurements for outcome & intervention	Outcome data complete	Confounders accounted for	Intervention delivered as intended	Total Points	Score
Author (Year)	Study Design							
Anderson (2020) [23]	Cohort	1	1	1	1	1	5	1.00
Avoundjian (2020) [25]	Cohort	1	1	1	0	1	4	0.80
Bove (2015) [29]	Cohort	1	1	1	1	1	5	1.00
Braunstein (2019) [30]	Cohort	1	1	1	0	1	4	0.80
Dombrowski (2018) [33]	Cohort	0	1	1	0	0	2	0.20
Hewitt (2019) [39]	Cohort	0	1	1	0	0	2	0.20
Kunzweiler (2019) [40]	Cohort	1	1	1	1	0	4	0.80
Magnus (2012) [41]	nRCT	1	1	1	1	1	5	1.00
Sachdev (2020) [45]	Cohort	1	1	1	1	1	5	1.00
Sohail (2019) [49]	nRCT	1	1	1	0	0	3	0.60
Sharp (2019) [47]	Cohort	1	1	1	1	1	5	1.00
Tesoriero (2017) [9]	nRCT	1	1	1	0	1	4	0.80
Udeagu (2019) [50]	Cohort	1	1	1	1	1	5	1.00
Wohl (2016) [53]	Cohort	1	1	1	0	1	4	0.80
C: Quality assessment of the included quantitative descriptive studies								

				Quantitative Descriptive				
		Relevant sampling strategy to research question	Sample representative of target population	Appropriate measurements	Low risk of nonresponse bias	Appropriate statistical analysis for research question	Total Points	Score
Author (Year)	Study Design							
Arey (2019) [24]	Quantitative Descriptive	1	1	1	0	1	4	0.80
Avoundjian (2018) [26]	Quantitative Descriptive	1	1	1	1	1	5	1.00
Beltrami (2018) [27]	Quantitative Descriptive	1	1	1	1	1	5	1.00
Bertolli (2013) [28]	Quantitative Descriptive	0	1	0	1	1	3	0.60
Buchacz (2015) [7]	Quantitative Descriptive	1	1	1	1	1	5	1.00
Buskin (2014) [31]	Quantitative Descriptive	1	1	1	0	1	4	0.80
Chang (2019) [32]	Quantitative Descriptive	1	1	1	1	1	5	1.00
Donovan (2018) [34]	Quantitative Descriptive	1	1	1	0	1	4	0.80
Goldman (2019) [35]	Quantitative Descriptive	0	1	0	1	1	4	0.80
Hague (2019) [36]	Quantitative Descriptive	1	1	1	1	1	5	1.00
Hart-Malloy (2019) [38]	Quantitative Descriptive	1	1	1	0	1	4	0.80
Hart-Malloy (2018) (A) [37]	Quantitative Descriptive	1	1	1	0	1	4	0.80
Hart-Malloy (2018) (B) [38]	Quantitative Descriptive	1	1	1	1	1	5	1.00
Mulatu (2018) [42]	Quantitative Descriptive	1	1	1	0	1	4	0.80
Ridgway (2019) [43]	Quantitative Descriptive	1	0	1	0	1	3	0.60
Saafir-Callaway (2020) [44]	Quantitative Descriptive	1	1	1	1	1	5	1.00

Sitapati (2012) [48]	Quantitative Descriptive	1	1	1	0	1	4	0.80
Sweeney (2018) [6]	Quantitative Descriptive	0	1	1	0	1	3	0.60
Udeagu (2013) [52]	Quantitative Descriptive	1	1	1	1	1	5	1.00
Udeagu (2018) [51]	Quantitative Descriptive	1	1	1	1	1	5	1.00

RCTs: Randomized Controlled Trials

nRCTs: Non-Randomized Controlled Trials