The HIV Care Cascade Before, During, and After Incarceration: A Systematic Review and Data Synthesis

Princess A. Iroh, MS, Helen Mayo, MLS, and Ank E. Nijhawan, MD, MPH

We conducted a systematic literature review of the data on HIV testing, engagement in care, and treatment in incarcerated persons, and estimated the care cascade in this group.

We identified 2706 titles in MEDLINE, EBSCO, and Cochrane Library databases for studies indexed to January 13, 2015, and included 92 for analysis. We summarized HIV testing results by type (blinded, opt-out, voluntary); reviewed studies on HIV care engagement, treatment, and virological suppression; and synthesized these results into an HIV care cascade before, during, and after incarceration.

The HIV care cascade following diagnosis increased during incarceration and declined substantially after release, often to levels lower than before incarceration. Incarceration provides an opportunity to address HIV care in hard-to-reach individuals, though new interventions are needed to improve post-release care continuity. (*Am J Public Health.* 2015;105: e5–e16. doi:10.2105/AJPH.2015.302635)

THE 2010 NATIONAL HIV/AIDS Strategy outlines 3 interdependent goals: (1) reducing HIV incidence, (2) increasing access to care and improving health outcomes for persons living with HIV, and (3) reducing HIV-related disparities and health inequities.[1] To meet these goals, it is essential to measure and improve performance at every stage in the HIV care continuum (also known as the HIV treatment cascade) as supported by a 2013 executive order by President Obama[2]: diagnosis, linkage to care, retention in care, receipt of antiretroviral therapy (ART), and virological suppression.[3]

Evaluation of this cascade in the general US population according to 2008 data determined that only 80% of HIV-infected individuals were aware of their diagnosis, 62% were linked to care, 41% were retained in routine HIV care, 36% were receiving ART, and 28% had an undetectable viral load.[4] Although more recent measures based on surveillance data indicate somewhat higher proportions achieving success in the steps in the cascade,[5] significant gaps in the HIV care continuum remain, particularly in vulnerable subgroups. For example, African Americans and younger individuals (aged 25–34 years) are less likely than their counterparts to be aware of their diagnosis, engaged in care, receiving ART, or to have a suppressed viral load.[6] These health disparities highlight the need for new approaches to HIV testing, linkage to care, and treatment, especially in hard-to-reach populations.

Because 1 in 7 HIV-infected individuals passes through correctional facilities every year,[7] and most inmates come from minority and medically underserved communities, including many people younger than 35 years, jails and prisons are critical settings to address the HIV care continuum and health disparities.[8,9] Among African American men aged 18 years or older, 1 in 15 is incarcerated, whereas this statistic is 1 in 36 for Hispanic men and 1 in 106 for White men.[9] Incarceration provides a unique opportunity to offer HIV testing, linkage to HIV care, and antiretroviral treatment to individuals who may not be accessing medical services in the community. In addition to affecting individual outcomes by identifying and treating HIV, interventions in the correctional setting have the potential to affect community health by reducing HIV transmission to others through reduction of an HIV patient's viral load, known as treatment as prevention.[10]

Although there have been multiple, well-conducted studies of HIV testing, linkage to care, and treatment in incarcerated individuals, there has been less focus on the HIV care continuum as a whole in this group or on how this cascade changes as an individual passes through the correctional system and back to the community. An improved understanding of the course of HIV identification, care, and treatment in this population will allow us to better direct resources to major gaps in the care continuum and to come closer to achieving the goals of the national HIV/AIDS strategy.

Therefore, we sought to perform a systematic literature review to (1) summarize HIV testing, treatment, and linkage to care efforts in the incarcerated and recently released population; (2) determine the estimates in the cascade of care for HIV-infected individuals before, during, and after incarceration; and (3) identify research gaps and targets for future interventions to improve outcomes in the HIV-infected population involved in the criminal justice system.

METHODS

We conducted a literature search with the Ovid MEDLINE database for English-language studies indexed up to January 13, 2015. We used the following medical subject heading (MeSH) terms: "prisoners," "prisons," "criminals," and text words for "incarcerated within 3 words of men, women, male*, female*, patient*, youth, teen*, individual*, person*"; and "exoffender*, ex-offender*, releasee*, jail, criminal justice, correctional facility*, prison*, criminal*, inmate*," combined with MeSH terms "HIV" (term exploded for comprehensive search), "HIV infections" (exploded), "HIV seroprevalence," and title words for "HIV, AIDS, human immunodeficiency." With text words and subject headings or keywords from the original search, on January 13, 2015, we also searched Ovid MEDLINE

InProcess, EBSCO Academic Search Complete, the EBSCO Legal Collection, and 3 Cochrane Library databases: Cochrane Database of Systematic Reviews, Database of Abstracts of Reviews of Effect, and Cochrane Central Register of Controlled Trials. We developed all search strings with the assistance of a qualified librarian.

Study Selection

The 2 reviewing authors (P. A. I. and A. E. N.) independently assessed abstracts and titles from all database-generated articles for eligibility on the basis of the following criteria: (1) relevance to HIV and incarceration and (2) specifically addressing outcomes related to HIV testing, linkage to HIV care, retention in HIV care, HIV treatment, and virological suppression in inmates (jail or prison) or recently released individuals. We excluded studies that were not performed in the United States or Canada and limited our evaluation to studies involving adults aged 18 years and older. We excluded additional studies if they had an anonymous author, if they were classified as a nonexperimental study (e.g., opinion, review articles, non–peer-reviewed articles, case reports, legal cases), or if the study did not provide original quantitative data.

We reviewed full-text articles for all studies meeting these criteria. For 7 articles, only an abstract was available, which was used only if it contained all the data fields needed for data extraction. Primary authors were contacted for clarification on several articles. After full-text review, we excluded additional studies for a variety of reasons including unclear study design, study outcomes were not the outcomes of interest, the study population represented a selective group and not the general incarcerated population, or a study did not sufficiently differentiate between subgroups (e.g., HIV prevalence results combined for adults and juveniles).

We hand-searched additional studies from the cited references of those studies selected for full review, and identified supplemental references. We elected to include the *Bureau of Justice Statistics Bulletin,* which is published regularly and includes multiple years of testing results. For these bulletins, we decided a priori to look at 3 time periods, published in 1999, 2006, and 2009, each covering 3 to 5 years preceding publication, to obtain estimates from different time frames without overlapping data.

Data Extraction

We generated separate tables for the following categories: HIV testing (Table 1), engagement in HIV care (Table 2), and HIV treatment and virological outcomes (Table 3). We then subdivided the engagement and treatment tables into 3 different sections for studies measuring the outcome before, during, and after incarceration. We extracted the following data from each study for inclusion in all 3 tables: author(s), year of publication, correctional setting, geographical location by state or country, and proportion of individuals achieving the outcome of interest. For all tables, we noted missing data with a dash.

For Table 1, we included number of individuals tested overall, number of positive tests, and number of new positives. We calculated the positivity rate and newly diagnosed positivity rate based on these values. We recorded method of testing (routine or rapid) and grouped studies by how testing was offered (blinded, mandatory, opt-out, opt-in, voluntary). We defined blinded testing in the study methods as using available discarded or excess sera from routine phlebotomy performed on incoming inmates. Blinded testing is anonymized and performed for the purposes of epidemiological study, not for clinical care of inmates. Mandatory testing refers to programs in which all inmates are tested per protocol. In opt-out testing, an inmate is informed that an HIV test will be performed unless he or she declines the test, whereas opt-in testing is when an HIV test is offered routinely and those desiring testing need to actively give permission to be tested. Lastly, voluntary testing refers to testing for HIV that is made available to inmates, not necessarily through a direct offer of testing (may be advertised through posters or signs), and includes testing on patient request. Several studies initially offered voluntary testing and then completed blinded testing on all inmates who declined voluntary testing; these results were combined and included under the blinded category.[13,18,26] For studies that allowed inmates known to be HIV-infected to opt out of testing, only new positives were recorded.[36,38,39]

The included studies in the engagement-in-care table defined engagement as having at least 1 medical visit during the timeframe indicated. Studies are grouped by year of publication. For the HIV treatment table, we defined treatment as receipt of antiretrovirals during the timeframe listed for each study. Undetectable viral load was defined differently in some studies; the majority defined this as less than 400, less than 50, or less than 20, although one study used less than 500.[66] Therefore, for the purpose of this review, we considered a viral load less than 500 copies per milliliter undetectable.

Data Synthesis

To generate the different steps in the HIV treatment cascade for the 3 time periods—before, during, and after incarceration—we included data from all studies relevant to each respective step in the calculations by using weighted means. To estimate the proportion of HIV-infected individuals entering corrections who were known to be HIV-positive at the time of incarceration, we compiled the data from all HIV testing studies that performed blinded testing and reported the number of new diagnoses.[12,14,26] The included studies defined an individual as previously undiagnosed with HIV if the inmate's self-report or medical records indicated a previous negative HIV test or lack of awareness of HIV infection. There was no published literature on blinded testing for HIV during or after incarceration. For the proportion of new HIV diagnoses made during incarceration, we assumed that these diagnoses would be in addition to those already known at entry and, because most facilities only provide testing upon request after entry, would identify relatively few new HIV diagnoses. We extrapolated a 1% increase in known HIV infection based on HIV testing data from inmates tested during incarceration at the Dallas County Jail (written communication, E. Porsa, MD, MPH, CCHP, Parkland Jail Health, July 15, 2014). The proportion of new HIV diagnoses made after release from incarceration were also estimated to be few (<1%) based on 2 studies involving individuals on probation or parole.[51,61]

For engagement in HIV care, we defined linkage to care upon entry to jail or prison as having received any HIV care before incarceration.[66–69] For retention in care upon entry to jail or prison we

TABLE 1—Summary of HIV Testing in Incarcerated and Recently Released Individuals by Testing Type: Systematic Review and Data Synthesis of the HIV Care Cascade Before, During, and After Incarceration Synthesis Indexed up to January 13, 2015, United States and Canada

Author	Year	Setting	Location	No. Tested	No. Positive	Newly Diagnosed	Positivity Rate, %	Newly Diagnosed Positivity Rate, %	Type of testing	Method	Gender
Altice et al.[11]	1998	Prison	CT	975	59	–	6.1	–	Blinded	Routine	Men
Altice et al.[12]	2005	Prison	CT	3 315	250	93	7.54	2.81	Blinded	Routine	Women
Andrus et al.[13]	1989	Prison	OR	977	12	–	1.23	–	Blinded	Routine	Both
Begier et al.[14]	2010	Jail	NY	6 411	389	104	6.07	1.62	Blinded	Routine	Both
Behrendt et al.[15]	1994	Prison	MD	2 842	242	–	8.52	–	Blinded	Routine	Both
Calzavara et al.[16]	1995	Jail	Canada	12 048	123	–	1.02	–	Blinded	Routine	Both
Hammett et al.[17]	1995	Both	Multiple sites[a]	72 399	2 491	–	3.44	–	Blinded	Routine	Both
Hoxie et al.[18]	1990	Prison	WI	3 458	18	–	0.52	–	Blinded	Routine	Men
Hoxie et al.[19]	1998	Prison	WI	3 681	26	–	0.71	–	Blinded	Routine	Men
Macalino et al.[20]	2004	Prison	RI	3 932	70	–	1.78	–	Blinded	Routine	Men
Singleton et al.[21]	1990	Prison	CA	6 179	160	–	2.59	–	Blinded	Routine	Both
Smith et al.[22]	1991	Prison	NY	480	90	–	18.75	–	Blinded	Routine	Women
Solomon et al.[23]	2004	Prison	MD	3 914	251	–	6.41	–	Blinded	Routine	Both
Vlahov et al.[24]	1990	Prison	MD	5 262	415	–	7.89	–	Blinded	Routine	Men
Weisfuse et al.[25]	1991	Prison	NY	2 236	413		18.47		Blinded	Routine	Both
Wohl et al.[26]	2013	Prison	NC	23 200	356	20	1.53	0.09	Blinded	Routine	Both
Wu et al.[27]	2001	SAFPs, Jail, Prison	TX	4 388	109	–	2.48	–	Blinded	Routine	Both
Hammett et al.[17]	1995	Prison	Multiple sites[b]	498 795	5 550	–	1.11	–	Mandatory	Routine	Both
Maruschak[28]	1999	Prison	Multiple sites[c]	217 449	2 608	–	1.20	–	Mandatory	Routine	Both
Maruschak[29]	2006	Prison	Multiple sites[d]	304 735	4 127	–	1.35	–	Mandatory	Routine	Both
Maruschak[30]	2009	Prison	Multiple sites[e]	550 681	6 271	–	1.14	–	Mandatory	Routine	Both
Rich et al.[31]	1999	Prison	RI	3 146	105	–	3.34	–	Mandatory	Routine	Women
Beckwith et al.[32]	2010	Jail	RI	264	2	1	0.76	0.38	Opt-out	Routine and rapid	Men
Beckwith et al.[33]	2011	Jail	RI	1 343	12	1	0.89	0.07	Opt-out	Rapid	Both
Beckwith et al.[34]	2012	Jail	PA	27 000	156	75	0.58	0.28	Opt-out	Rapid	Both
Beckwith et al.[34]	2012	Jail	DC	12 546	106	60	0.84	0.48	Opt-out	Rapid	Both
Beckwith et al.[34]	2012	Jail	MD	2 066	42	7	2.03	0.34	Opt-out	Rapid	Both
CDC[35]	2010	Jail	RI	102 229	1 259	169	1.23	0.17	Opt-out	Routine	Both
CDC[36]	2011	Prison	WA	4 651	–	6	–	0.13	Opt-out	Routine	Men
CDC[37]	2013	Jail	GA	12 141	120	52	0.99	0.43	Opt-out	Rapid	Both
Kavasery et al.[38]	2009	Jail	CT	149	–	0	–	0.00	Opt-out	Rapid	Women
Kavasery et al.[39]	2009	Jail	CT	130	–	1	–	0.77	Opt-out	Rapid	Men
Spaulding et al.[40]	2014	Jail	GA	17 129	243	99	1.42	0.58	Opt-out	Rapid	Both
VanHandel et al.[41]	2012	Both	United States	106 122	1 006	755	0.95	0.71	Opt-out	Routine	Both
CDC[36]	2011	Prison	WA	12 174	–	13	–	0.11	Opt-in	Routine	Both
Cocoros et al.[42]	2014	Both	MA	667	5	–	0.75	–	Opt-in	Routine	Both
Bauserman et al.[43]	2001	JD or Jail	MD	1 314	14	–	1.07	–	Voluntary	Routine	Both
Beckwith et al.[44]	2007	Jail	RI	95	0	–	0.00	–	Voluntary	Rapid	Men
Calzavara et al.[45]	2007	Jail	Canada	1 578	25	–	1.58	–	Voluntary	Routine	Both
Carpenter et al.[46]	1999	Jail	CA	2 169	71	–	3.27	–	Voluntary	Routine	Both
CDC[36]	2011	Prison	WA	604	–	3	–	0.50	Voluntary	Routine	Men
de Voux et al.[47]	2012	Jail	Multiple sites[f]	210 267	1 312	822	0.62	0.39	Voluntary	Routine	Both
Dufour et al.[48]	1996	Prison	Canada	618	20	–	3.24	–	Voluntary	Routine	Both
Ford et al.[49]	1995	Prison	Canada	113	1	–	0.88	–	Voluntary	Routine	Women
Gellert et al.[50]	1993	Jail	CA	3 015	82	–	2.72	–	Voluntary	Routine	Women

Continued

TABLE 1—*Continued*

Gordon et al.[51]	2013	Pro/Par	Multiple sites[g]	364	–	2	–	0.55	Voluntary	Rapid	Both
Hankins et al.[52]	1994	Prison	Canada	394	27	–	6.85	–	Voluntary	Rapid	Women
Harawa et al.[53]	2009	Jail	CA	1 322	–	23	–	1.74	Voluntary	Routine	Both
Kassira et al.[54]	2001	Prison	MD	7 159	405	236	5.66	3.30	Voluntary	Routine	Both
Kendrick et al.[55]	2004	Jail	IL	988	–	9	–	0.91	Voluntary	Rapid	Women
Klein et al.[56]	2002	Prison	NY	9 468	95	–	1.00	–	Voluntary	Routine	Both
Liddicoat et al.[57]	2006	Prison	MA	734	–	2	–	0.27	Voluntary	Routine	Both
Lyons et al.[58]	2006	Jail	IL	110	0	–	0.00	–	Voluntary	Routine	Both
Macgowan et al.[59]	2009	Jail	Multiple sites[h]	33 211	409	269	1.23	0.81	Voluntary	Rapid	Both
McCusker et al.[60]	1996	Prison	MA	1 408	144	–	10.23	–	Voluntary	Routine	Both
Oser et al.[61]	2006	Pro/Par	KY	800	0	–	0.00	–	Voluntary	Rapid	Both
Poulin et al.[62]	2007	Prison	Canada	1 607	54	11	3.36	0.68	Voluntary	Rapid	Both
Rosen et al.[63]	2009	Prison	NC	21 419	718	115	3.35	0.54	Voluntary	Routine	Both
Sabin et al.[64]	2001	Both	Multiple sites[i]	494 029	16 797	8 855	3.40	1.79	Voluntary	Routine	Both
Tartaro and Levy[65]	2013	Jail	NJ	956	3	1	0.31	0.10	Voluntary	Rapid	Both

Note. CDC = Centers for Disease Control and Prevention; JD = juvenile detention; Pro/Par = probation or parole; SAFPs = substance abuse felony punishment units. Dash indicates missing data.
[a]AR, CA, FL, HI, IL, LA, MA, NC, NJ, NY, OR, SC, TN, TX, VA, WA, Canada.
[b]AL, CO, GA, IA, ID, MI, MO, ND, NE, NH, NV, OK, RI, UT, WY.
[c]AL, AR, CO, GA, IA, ID, MI, MO, MS, ND, NE, NH, NV, OK, SD, VA, UT.
[d]AL, AR, CO, GA, IA, ID, MI, MO, MS, ND, NE, NH, OH, OK, RI, SC, UT, WY.
[e]AL, AR, CO, GA, IA, ID, IN, MI, MN, MS, ND, NE, NH, NV, OH, OK, RI, SC, TX, UT, WA, WY.
[f]CT, GA, IL, MA, NY, OH, PA, SC, RI.
[g]MD, RI.
[h]FL, LA, NY, WI.
[i]48 project areas in United States.

used national data from the general population living with HIV in the United States.[4] For linkage to and retention into care during incarceration, we compiled reports from the Dallas County Jail (written communication, E. Porsa, MD, MPH, CCHP, Parkland Jail Health, July 15, 2014) and 2 published studies.[70,71] For the postrelease population, we defined linkage to care as 1 medical visit within 6 months after release from incarceration, which included both newly diagnosed and known HIV-infected individuals.[67–70,75–78] We considered retention in care to be 2 medical visits over 6 months, an outcome reported in 1 multicenter study.[68]

To estimate the proportion of HIV-infected individuals receiving ART upon entry to jail or prison, we compiled data from multiple studies that assessed treatment before incarceration.[68,69,79] For the proportion receiving ART while incarcerated, we included all studies reporting HIV treatment during incarceration or at the time of release.[66,67,69,72,75,77,78,85,88,89,95] For estimates of released inmates on ART, we summarized data from studies with follow-up within a 6-month period.[72,76,81,95,96] Finally, we estimated the proportion of HIV-infected individuals with an undetectable viral load (< 500 copies/mL) upon entry,[68,69,80,98] during,[66,75,77,80,86,87,91–94,98] and after release from incarceration.[99,100]

RESULTS

The electronic search process for article selection is summarized in Figure 1. The search identified 2706 titles, of which we excluded 2406 for not meeting criteria on the basis of review of the title and abstract. We retrieved the remaining 300 full-text articles for review. Of these, we excluded 201 on the basis of our eligibility criteria and we excluded an additional 19 because of reporting results from selective study populations not representative of the entire incarcerated population, the same study population was examined by different articles reporting on related outcomes of interest, or the HIV treatment timeframe was unclear or insufficient for the outcome measure. For inclusion in the final review, we identified an additional 5 titles from hand-searching references along with 2 conference proceedings, 4 Bureau of Justice Statistics HIV testing bulletins, and a report from the local county jail (written communication, E. Porsa, MD, MPH, CCHP, Parkland Jail Health, July 15, 2014).[17,28–30,40,78,81,89,98–100]

Study Characteristics

Overall, we included 92 unique studies for review, of which 10 were included in more than 1 HIV care cascade category.[66–69,72,75,76,78,99] Eleven studies reported HIV outcome data obtained from multiple geographic sites.[41,47,51,59,64,67,68,72,82,86,99] Fifty-five percent of the studies reviewed were surveillance studies of HIV testing upon entry into the correctional setting. Twenty-one were retrospective cohort studies of HIV-infected inmates[66,69,75,78,83,84,86,88,90,92,101] or releasees.[69–71,73,75,78] Three studies used a longitudinal design, assessing HIV outcomes in this population at multiple time points.[67,72,76] Other study designs included descriptive studies,[74,85,87,89] multisite prospective demonstration projects,[68,81,82,99]

TABLE 2—Summary of Engagement Into HIV Care Before, During, and After Release From Incarceration: Systematic Review and Data Synthesis Indexed up to January 13, 2015, United States and Canada

Author	Year	Setting	Location	Intervention	No. Positive	No. Engaged Into Care	Proportion Engaged Into Care, %	Timeframe Relative to Incarceration
Upon entry or before incarceration								
White et al.[66]	2001	Jail	CA	NA	77	32	42	Any time before
Harzke et al.[67]	2006	Prison	Southwestern United States	NA	51	31	61	1 y before
Althoff et al.[68]	2013	Jail	Multiple sites[a]	NA	867	641	74	30 d before
Khawcharoenporn et al.[69]	2013	Jail	IL	NA	172	134	78	Any time before
During incarceration								
Farley et al.[70]	2000	Prison	RI	Yes	172	110	64	During
Zaller et al.[71]	2008	Prison	RI	Yes	59	54	92	During
After incarceration								
Warren et al.[72]	1994	Jail	NY	No	40	15	38	≤ 95 d after
Farley et al.[70]	2000	Prison	RI	Yes	41	34	83	6 mo after
Rich et al.[73]	2001	Prison	RI	Yes	67	64	95	12 mo after
Harzke et al.[67]	2006	Prison	Southwestern United States	No	30	18	60	21 d after
Fontana and Beckerman[74]	2007	Jail	FL	No	105	77	73	12 mo after
Zaller et al.[71]	2008	Prison	RI	Yes	59	56	96	12 mo after
Baillargeon et al.[75]	2010	Prison	TX	No	1750	490	28	≤ 90 d after
Westergaard et al.[76]	2011	Both	MD	No	182	109	60	6 mo after
Wohl et al.[77]	2011	Prison	NC	Both	104	82	79	24 wk after
Althoff et al.[68]	2013	Jail	Multiple sites[a]	Yes	867	572	66	6 mo after
Khawcharoenporn et al.[69]	2013	Jail	IL	No	95	66	69	6 mo after
Beckwith et al.[78]	2014	Jail	RI	No	64	37	58	6 mo after

Note. NA = not applicable.
[a]CT, GA, IL, MA, NY, OH, PA, SC, RI.

nonrandomized trials,[32,38,39,91] and randomized trials.[51,77,94,95]

Of the 50 studies, and 1 conference proceeding[40] that addressed HIV testing, 21 were in the jail setting, 24 in the prison setting, 4 in combined settings, and 2 at probation or parole offices. The Bureau of Justice Statistics HIV testing bulletins predominately reported results from the prison setting.[17,28–30] The majority of testing was implemented upon entry to a correctional facility; however, a few compared testing at different time points during incarceration.[57–59] We identified 13 studies addressing engagement in HIV care. Lastly, we reviewed 31 studies and 1 conference proceeding[100] on HIV treatment and virological suppression in prisoners.

HIV Testing, Engagement in Care, and Treatment

We summarized HIV testing by testing type (Table 1). Eighteen studies, and 4 summary reports indicated testing of inmates in a blinded or mandatory fashion upon entry into the correctional facilities. All but 2 were performed in a prison setting. In general, incarcerated women had higher rates of HIV than incarcerated men, though most studies reported combined results for men and women. The average HIV positivity rate among blinded and mandatory studies combined was 1.39% (range = 0.52%–18.75%), and average newly diagnosed positivity rate (only reported in 3 studies) was 0.66% (range = 0.09%–2.81%).

The majority of opt-out testing was implemented in jails with rapid testing methods. The proportion of positive tests averaged 1.05% (range = 0.58%–2.03%), and all studies reported the proportion newly diagnosed, averaging 0.43% (range = 0%–0.77%).

Opt-in HIV screening was reported by only 2 studies; 1 compared its results to the later adoption of an opt-out screening program,[36] and the other integrated an HCV-screening initiative into an existing HIV-screening program.[42] Twenty-four studies conducted voluntary HIV screening. When we combined the opt-in and voluntary testing efforts, the average HIV-positivity rate was 2.55% (range = 0%–10.23%) and the newly diagnosed positivity rate was 1.32% (range = 0.10%–3.30%).

Engagement in HIV care was summarized in 15 different studies, which ranged from observational descriptive studies to randomized controlled interventions (Table 2). At the time of incarceration, an average of 72% (42%–78%) of inmates who were HIV-positive were reported to have visited an HIV care provider before entering jail or prison. There were 2 studies that specifically reported on engagement in care during incarceration.[70,71] Twelve studies followed up with inmates after release from incarceration and had varying

TABLE 3—Summary of HIV Treatment Before, During, and After Release From Incarceration: Systematic Review and Data Synthesis Indexed up to January 13, 2015, United States and Canada

Author	Year	Setting	Location	Intervention	No. HIV Positive	No. Treated	Proportion on Treatment, %	Undetectable VL, %	Treatment Timeframe Relative to Incarceration
Upon entry or before Incarceration									
Althoff et al.[68]	2013	Jail	Multiple sites[a]	NA	867	449	52	31	7 d before
Clements-Nolle et al.[79]	2008	Jail	CA	NA	108	44	41	–	1 mo before
Springer et al.[80]	2004	Prison	CT	NA	–	292	–	1	3 mo before
Khawcharoenporn et al.[69]	2013	Jail	IL	NA	172	125	73	35	Any time before
Meyer et al.[81]	2014	Both	CT	NA	882	–	–	30	Any time before
During incarceration									
Arriola et al.[82]	2001	Jail	FL, NJ, NY	Yes	171	83	49	–	During
Baillargeon et al.[83]	2000	Prison	TX	No	2360	1621	69	–	During
Baillargeon et al.[75]	2010	Prison	TX	No	1750	827	47	37	During
Beckwith et al.[78]	2014	Jail	RI	No	64	6	9	–	During
Menezes et al.[84]	2013	Prison	NC	No	1911	1445	76	–	During
Mostashari et al.[85]	1998	Prison	CT	No	102	76	75	–	During
Warren et al.[72]	1994	Jail	NY	No	170	136	80	–	During
Khawcharoenporn et al.[69]	2013	Jail	IL	No	172	132	77	–	During (> 39 d)
White et al.[66]	2001	Jail	CA	No	77	45	58	25	During (> 85 d)
Bingham[86]	2012	Federal BOP	United States	No	1445	858	59	46	During (> 3 mo)
Wohl et al.[87]	2003	Prison	NC	No		31		45	During (> 3 mo)
Pai et al.[88]	2009	Jail	CA	No	512	467	91	32	During (> 104 d)
Altice et al.[89]	2001	Prison	CT	No	205	164	80	–	During (6 mo)
Griffin et al.[90]	1996	Jail	TX	No	225	78	35	–	During (> 6 mo)
Kirkland et al.[91]	2002	Prison	United States	Yes	–	108	–	68	During (> 6 mo)
Springer et al.[80]	2004	Prison	CT	No	–	1866	–	59	During (> 6 mo)
Stephenson et al.[92]	2005	Prison	NC	No	–	30	–	50	During (> 9 mo)
Meyer et al.[93]	2012	Prison	CT	Yes	–	151	–	80	Before release (> 90 d)
Springer et al.[94]	2010	Prison	CT	Yes	–	23	–	63	Before release (> 90 d)
Wohl et al.[77]	2011	Prison	NC	Both	89	62	70	58	Before release (> 3 mo)
Harzke et al.[67]	2006	Prison	Southwestern United States	No	30	14	47	–	At release
Meyer et al.[81]	2014	Both	CT	No	–	882	–	70	At release
Reznick et al.[95]	2013	Both	CA	Yes	151	89	59	–	At release
After incarceration									
Warren et al.[72]	1994	Jail	NY	No	30	8	27	–	Immediately after
Springer et al.[94]	2010	Prison	CT	Yes	–	23	–	61	12 wk
Baillargeon et al.[96]	2009	Prison	TX	No	2115	634	30	–	60 d after
Devereux et al.[97]	2002	Prison	NV	Yes	35	22	63	–	3 mo after
Reznick et al.[95]	2013	Both	CA	Yes	139	63	45	–	4 mo after
Meyer et al.[98]	2014	Jail	Multiple sites[a]	Yes	867	450	52	–	6 mo after
Spaulding et al.[99]	2013	Jail	Multiple sites[a]	Yes	1082	–	–	26	6 mo after
Westergaard et al.[76]	2011	Both	MD	No	182	67	37	–	~7.6 mo after

Note. BOP = Bureau of Prisons; NA = not applicable; VL = viral load. Dash indicates missing data.
[a]CT, GA, IL, MA, NY, OH, PA, SC, RI.

timeframes for engagement in HIV care, ranging from 21 days to a year. Engagement in care, defined as a single medical visit after release, was lower in observational studies, 28% by 3 months, 58% to 59% by 6 months, and 73% by 12 months compared with studies that conducted directed interviews or employed an intervention, 38% to 60% at 3 months, 66% to 85% at 6 months, and 95% to 96% at 12 months.

Receipt of antiretrovirals before, during, and after incarceration is

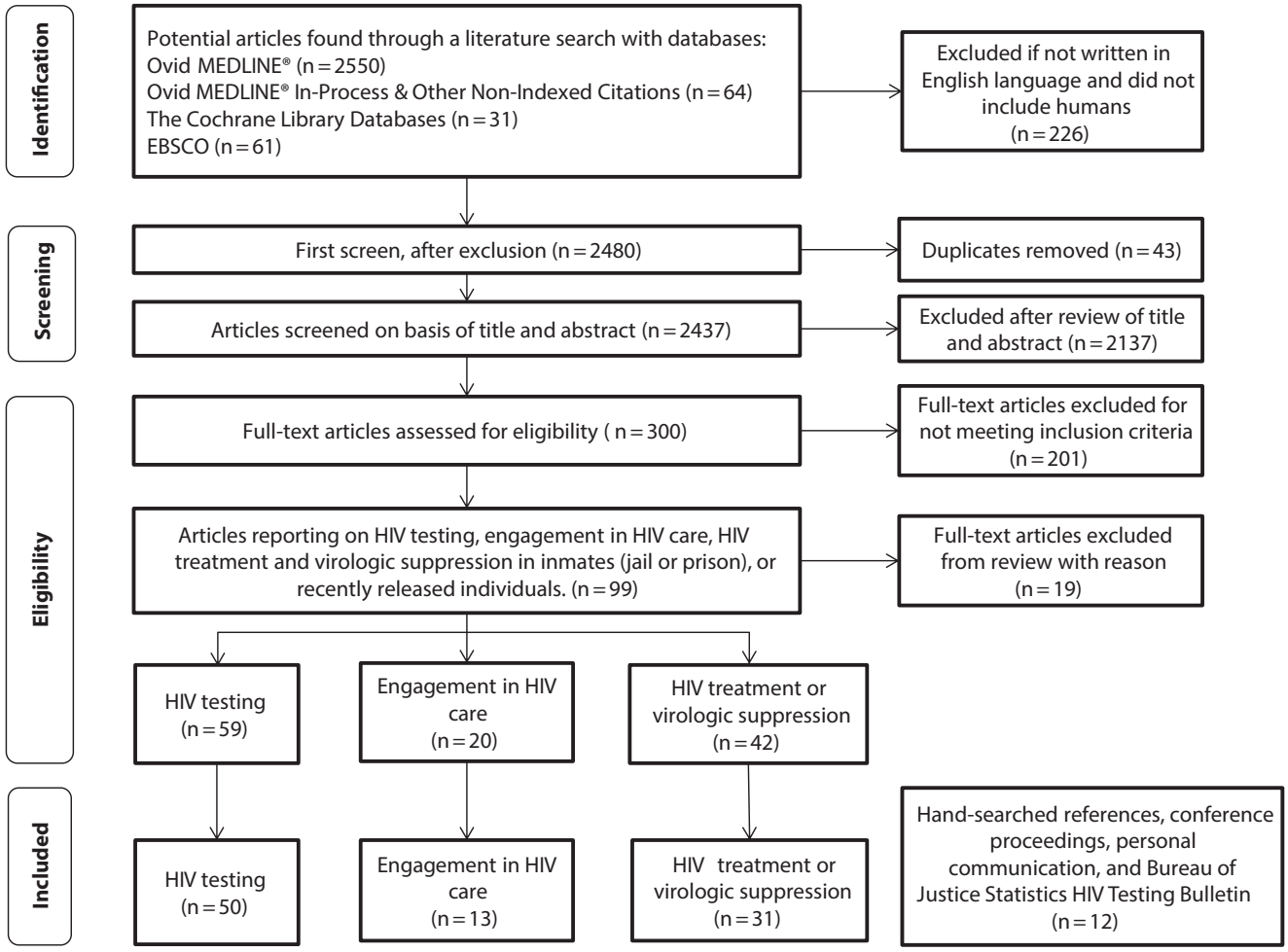


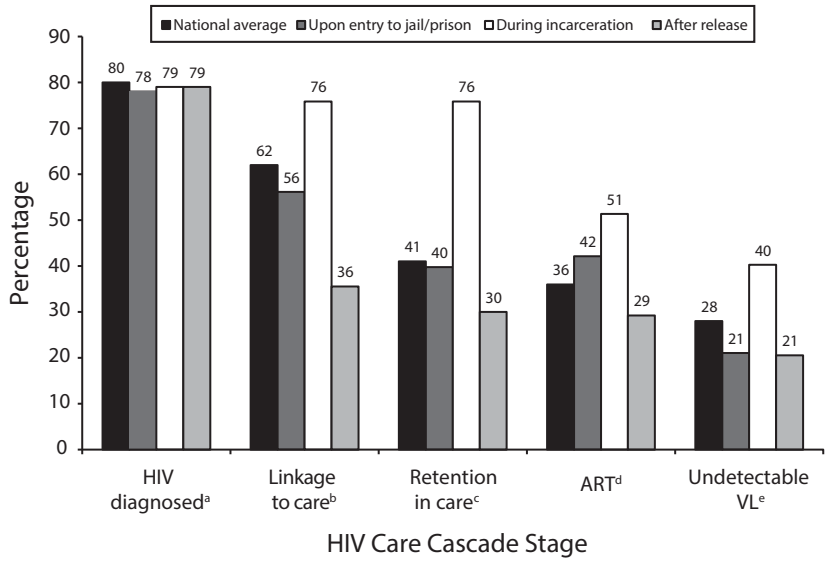
FIGURE 1—Flow diagram of study selection in a systematic review and data synthesis indexed up to January 13, 2015, of the HIV care cascade before, during, and after incarceration: United States and Canada.

summarized in Table 3. Approximately 54% (41%–73%) of HIV-positive patients were receiving ART before incarceration. On average, 65% (9%–91%) received ART during incarceration and 37% (27%–63%) received ART after release. Rates of virological suppression varied at entry to a correctional facility, 27% (1%–35%), then on average up to 51% (25%–80%) during incarceration, and 26% at 6 months postrelease (based on a multicenter demonstration project).[99] Several studies assessed adherence to ART, defined as missing no more than 1 dose per week or taking at least 80% of prescribed medications. We assessed adherence only in those prescribed ART and it was measured by directly observed therapy, through electronic monitoring caps, by pill counts, or by self-reported adherence questionnaire. Before incarceration, adherence was estimated at 34% (33%–48%)[68,79]; during incarceration, adherence was 58% (30%–94%)[85,87,89,91,99]; and after release, adherence was 40% (39%–49%).[81,95]

Cascade

Figure 2 depicts the HIV care cascade before, during, and after release from incarceration. Overall, all steps of the cascade improved substantially during incarceration, often to rates higher than the national average, but dropped to below those rates for each step of the cascade after release from jail or prison, to levels that were equal to or lower than before incarceration. The largest declines were in postincarceration engagement in care, with a drop from 76% to 36% for linkage to care and from 76% to 30% for retention in care. Receipt of ART dropped from 51% to 29% after release, and virological suppression dropped from 40% to 21% after release.

Specific gaps identified in the literature, where only limited or no data were available, include testing after release from corrections (and the potential for



Note. ART = antiretroviral therapy; VL = viral load.
[a]References 4, 14, 69–71, and 76.
[b]References 4, 67, 75, 77–79, 82, 83, 86, 89, and 90.
[c]References 4 and 77.
[d]References 4, 65, 67, 72, 75, 77, 78, 80–86, 88, 90–96, and 98.
[e]References 4, 17, 28–30, 38, 40, 67, 72, 75, 77, 78, 80, 83, 87, 90, 99, and 100.

FIGURE 2—HIV care cascade—before, during, and after release from incarceration: systematic review and data synthesis indexed up to January 13, 2015, United States and Canada.

identifying new positives in the recently released population), rates of linkage to and retention in care before incarceration, and virological outcomes in the released population.

DISCUSSION

Through a systematic review of the literature, we have demonstrated that the HIV care cascade in incarcerated and recently released individuals reflects low rates of HIV awareness, engagement in care, retention in care, and virological suppression in this population. Specifically, upon entry to jail and prison, many individuals who are HIV-infected are not aware of their diagnosis, reinforcing the importance of offering routine, opt-out testing at the time of intake. Of those who are aware of their HIV, many are not engaged in routine care and not taking ART, and few are virologically suppressed. Rates of all of these steps in the cascade increase considerably during incarceration, highlighting the important public health opportunity jails and prisons have to make an impact on this underserved population. However, not only are these gains lost after release, but outcomes for the cascade are also generally worse after incarceration than before, underscoring the urgent need for stronger re-entry and linkage-to-care programs as inmates transition to the community.

We found that the results of HIV testing in jails and prisons varied widely among studies. Because of the heterogeneity of HIV-testing studies and the wide time frame in which they were conducted, it is difficult to draw conclusions about which testing techniques may result in the greatest number of HIV-positive individuals identified. Among the blinded studies, there were several outliers[15,22,24,25] that had been conducted in New York and Maryland in the early 1990s that identified very high rates of infection (7.89%–18.75%). Subsequent blinded studies still identified relatively high rates in these states (6.07%–6.41%),[14,23] though they were much reduced over previous, which may be related to high mortality early in the AIDS epidemic, changes in the epidemiology of injection drug use, prevention efforts, and the introduction of ART. The blinded results provide the best estimate of HIV prevalence in these settings, though this is not a practical approach to offering HIV testing. Eight of the published voluntary testing studies also found high positivity rates greater than 3%[46,48,54,60,62–64,70]; however, it is unknown how many infections were missed among those who did not volunteer for testing. In general, the results among voluntary tests vary widely in part because of variability in how this testing is offered and accepted across sites. Opt-out testing found comparatively lower rates of positive results, though results were relatively consistent across sites and represent testing of a large proportion of the incarcerated population in each setting, including high- and low-risk individuals.

With regard to new HIV diagnoses, certain settings, such as the North Carolina and Rhode Island prison systems,[26,33] or low-prevalence areas such as Wisconsin or Washington state,[18,36] had low rates of newly diagnosed individuals, whereas in other settings,[14,40,52,54,59,64] many more previously undiagnosed individuals were identified. This may reflect the previous success of longstanding testing efforts in correctional systems, which have already identified a large proportion of HIV in those involved in the criminal justice system compared with new testing efforts in places, such as jails and high-prevalence areas in the southern United States, where there has historically been less HIV testing.[40,59,64,102] The Centers for Disease Control and Prevention recommends offering routine, opt-out testing in correctional medical clinics,[103] as this may reduce the stigma of testing, identify new infections, identify infections earlier, and improve access to treatment and prevention services.[47,103] However, per a recent survey, only 19% of prison

systems and 35% of jails provide opt-out HIV testing.[104] Although routine HIV testing in the correctional setting may be cost-effective from a societal perspective,[105] the cost of treatment of HIV-positive inmates is expensive,[106] and could deter correctional facilities from providing testing. Future partnerships between state departments of corrections and departments of health are needed to expand testing in jails and prisons to reduce the estimated 22% of HIV-infected individuals entering corrections who are unaware of their HIV infection (Figure 2).

For incoming inmates, overall rates of linkage to care were 6 percentage points lower than the general population, (Figure 2; 56% vs 62%).[107] This underscores the role of correctional institutions in improving rates of engagement (and re-engagement) in care for this population. During incarceration, the majority of HIV-infected inmates has access to HIV care and ART and surpasses the general population in this step of the cascade. However, after release from incarceration, rates of linkage to care and retention in care drop dramatically resulting in a decline in treatment and virological suppression rates. Multiple factors have been identified that contribute to linkage to HIV care after release from jail or prison. Facilitators of linkage include HIV education during incarceration, discharge planning, transportation, and stable housing[68,108] and barriers include drug use,[109] mental illness, stigma, lack of social support, and unemployment.[110] Accordingly, successful interventions have addressed many of these issues, including opiate replacement therapy,[94,111] enhanced case management,[73,112,113] patient navigation,[114] or combinations thereof.[68] However, results of some interventions have been mixed and a randomized controlled trial of intensive case management versus standard of care did not show a significant difference in rates of linkage to care,[77] though overall rates of linkage to HIV care in this study were quite high.

Nonetheless, nationwide, there is room for improvement in linkage to HIV care after release from incarceration. Fewer than 20% of prisons and jails provide discharge planning services for inmates transitioning to the community per Centers for Disease Control and Prevention guidelines, including making an appointment with a community health care provider, assisting with enrollment in an entitlement program, and providing a copy of the medical record and a supply of HIV medication.[104] Under the Affordable Care Act, states that are expanding Medicaid will have new opportunities to link individuals to community health care after release from jail.[115]

With regard to virological suppression, among individuals known to be HIV-infected, nearly 50% had received treatment before incarceration, though only 27% of them had an undetectable viral load upon entry to jail or prison. However, the majority of inmates do achieve virological suppression during incarceration (52% of total, 65% of those on ART), and suppression rates are higher with longer duration of incarceration.[76,116] Compared with the general population, and with the proportion of those on therapy with undetectable viral load as a proxy for adherence, inmates' average adherence during incarceration, 58% (30%–94%), is not as high as adherence among the general population (78%–87%),[117,118] suggesting a need for education and adherence counseling. This may be especially true in the reincarcerated population, who have lower rates of virological suppression overall,[80,98,119] consistent with a dose–response effect of incarceration on nonadherence.[120] Lastly, we found that the largest gap in the literature on HIV in the criminal justice system is clinical outcomes among released inmates, with only 2 published studies reporting HIV viral loads after release.[94,99] Of these, the Enhancelink study, a multicenter demonstration project, found that 26% had an undetectable viral load 6 months after release by using a missing equals failure analysis. Further study is needed in this area, and a series of ongoing projects on "seek, test, treat, and retain" may provide additional data and insight to this outcome.[121] With the increase in sexual and drug use risk behavior after release from incarceration,[122–125] increasing virological suppression in these individuals has direct implications for secondary HIV prevention.

Along the continuum in the incarcerated and recently released, racial disparities persist. For example, Blacks were less likely to have an HIV provider 30 days before jail entry and more likely to have advanced HIV disease.[126] In addition, Hispanics and Blacks were less likely to fill an initial prescription for ART within 10 and 30 days after release, compared with non-Hispanic Whites.[96] To reduce such health disparities, additional efforts need to be directed at incarcerated individuals and those returning to the community, including specific interventions tailored to minority patients.

Limitations

There are several limitations inherent to our systematic review. Using what is available in the published literature likely biases toward jails and prisons that have extra efforts aimed at identifying HIV, engaging HIV patients in care, and providing treatment. In addition, our systematic review is limited by varied definitions of each care cascade step by different studies. We included observational studies as well as those that implemented interventions to present all of the available published data. Therefore, our cascade may overestimate some of these outcomes because of publication bias, indicating that the disparities in outcomes between this population and the general HIV-infected population may be even greater than our estimates.

The heterogeneity of studies made it challenging to summarize some of the outcomes; however, this was accounted for whenever possible. For example, for testing studies that excluded known HIV-infected individuals, we reported these as new infections only. For engagement in care studies in which missing data (e.g., individuals who do not follow-up after release) was not considered failure, we used the original study group as the denominator. For treatment, guidelines have changed over time with regard to when to initiate therapy, and, therefore, the number eligible for treatment was based on what was provided by each study, following time period–appropriate guidelines.

Conclusions

Overall, this is the first systematic review to our knowledge to address the HIV care cascade in the incarcerated and recently released population. We have summarized HIV testing, engagement in care, and treatment at 3 stages—before, during, and after incarceration—and have found that the care cascade is dynamic, with

large increases during and even larger declines after incarceration. This net negative effect on HIV outcomes is consistent with previous studies, which identified incarceration as disruptive to HIV treatment[117] and virological suppression, though our 3-stage model provides more detail about where and when the gaps in care are most pronounced. Specifically, new efforts are needed to (1) increase opt-out HIV testing for inmates and recently released individuals because of the high rates of unidentified HIV-positive individuals in the criminal justice system; (2) improve continuity of care after release from corrections, because of the sharp decline in HIV medical visits and treatment during this interval, a time period characterized by high-risk sexual and drug-use behaviors leading to HIV transmission and death; and (3) measure and increase virological suppression after release, so that HIV-infected released inmates realize the same benefits of ART as others with HIV.

These targets are directly aligned with the goals of the national HIV/AIDS strategy to decrease HIV incidence, improve health outcomes, and reduce HIV-related health disparities and will require significant shifts in current local and national policies. Specific actions include reducing incarceration overall, reassessing discriminatory sentencing laws, increasing diversion to substance abuse and mental health treatment programs, expanding access to medical care through Medicaid and other benefit programs, incentivizing collaborations between public health and corrections agencies, and disseminating best practices. ■

About the Authors

Princess A. Iroh and Ank E. Nijhawan are with Department of Internal Medicine, Division of Infectious Diseases, University of Texas Southwestern Medical Center, Dallas. Helen Mayo is with Health Sciences Digital Library and Learning Center, University of Texas Southwestern Medical Center.

Correspondence should be sent to Ank E. Nijhawan, MD, MPH, 5323 Harry Hines Blvd, Dallas, TX 75390-9169 (e-mail: ank.nijhawan@utsouthwestern.edu). Reprints can be ordered at http://www.ajph.org by clicking the "Reprints" link.

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Contributors

A. E. Nijhawan and P. A. Iroh originated the idea for the article, reviewed all titles and selected articles for inclusion, completed data extraction, and compiled the data. H. Mayo assisted in executing the search for articles. All authors contributed to the article.

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Human Participant Protection

Institutional review board approval was not needed, as our research did not involve human participant interactions or identifiable private information.

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