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Rural and urban trends in HIV diagnoses and care outcomes among persons with HIV attributed to injection drug use in the U.S., 2016–2022

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Abstract

Purpose: An increase in injection drug use (IDU) has placed new populations at risk for HIV. Understanding the spatial and temporal patterns of HIV diagnoses and care outcomes is crucial to identify gaps in care for people who inject drugs (PWID).

Methods: We analyzed CDC's National HIV Surveillance System (NHSS) data from 2016 to 2022 to examine regional trends and rural-urban differences in linkage to HIV care within one month and viral suppression within six months of diagnosis among individuals aged 13 and older with HIV attributed to IDU. Rural-urban populations were defined using US Department of Agriculture-Economic Research Service (USDA-ERS) Rural-Urban Continuum Codes (RUCC), and trends were assessed using estimated annual percentage change (EAPC).

Results: From 2016 to 2022, HIV diagnoses attributed to IDU increased in large rural counties and small to medium urban counties but linkage to care and viral suppression remained unchanged in these areas. Conversely, diagnoses in large urban counties declined while linkage to care and viral suppression increased.

Conclusions: These findings highlight disparities in HIV diagnoses, linkage to care, and viral suppression across rural and urban areas, emphasizing the need to address these gaps to improve care for PWID and inform public health policies.

Keywords

HIV; HIV Diagnosis; HIV Care Outcomes; Linkage to HIV Medical Care; Viral Suppression; Injection Drug Use; People Who Inject Drugs

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Disclaimer: The findings and conclusions in this report are those of the authors and do not necessarily represent the official position of the Centers for Disease Control and Prevention. This activity was reviewed by CDC and was conducted consistent with applicable federal law and CDC policy.

Introduction

Injection drug use (IDU) puts people at risk for acquiring and transmitting HIV infection. An increase in IDU, attributed to the opioid epidemic, has placed new populations at risk for HIV. Analysis of geographic differences in HIV diagnoses, linkage to care, and viral suppression is important to identify gaps in HIV care for people who inject drugs (PWID).

Lyss et al. (2021) described differences in U.S. rural-urban trends in HIV infection among PWID between 2010 to 2014 and 2014 to 2018 [1]. Between 2010 and 2014, there was a significant overall decline in HIV diagnoses among PWID across all categories of metropolitan counties and micropolitan areas [1]. However, from 2014 to 2018, there was an increase in HIV diagnoses among PWID, particularly in small metro counties [1]. These recent changes across the rural-urban continuum have reshaped historical patterns, resulting in an increase in the proportion of HIV diagnoses among PWID that occurred outside large central metro counties. Exploring these trends is vital for targeting public health interventions more effectively and improving HIV prevention and treatment for PWID.

We describe regional and rural-urban trends in HIV diagnoses attributed to IDU and HIV care outcomes for PWID with HIV diagnosed from 2016 to 2022, using CDC's National HIV Surveillance System (NHSS) data. Findings from this analysis will enhance our understanding of geographic trends in HIV diagnoses and HIV care outcomes among PWID and will help inform efforts to improve HIV care delivery for PWID.

Methods

Data reported to NHSS through December 2023 were used to determine rural-urban differences and regional trends in diagnoses and care outcomes among adults and adolescents (aged 13 years or older) with infection attributed to IDU from 2016 to 2022. Diagnoses, linkage to care within one month of diagnosis, and viral suppression within six months after diagnosis were examined in 40 jurisdictions with complete reporting of CD4 and viral load test results from 2016 to 2022 (Figure 1). To examine regional trends, data were categorized by U.S. Census Divisions as follows: the Northeast, covering New England (CT, MA, ME, NH, RI) and the Mid Atlantic (NY); the Midwest, including East North Central (IL, IN, MI, WI) and West North Central (IA, MN, MO, NE, ND, SD); the South, comprising South Atlantic (DC, DE, FL, GA, MD, NC, SC, VA, WV), East South Central (AL, MS, TN), and West South Central (LA, TX); and the West, encompassing the Mountain (CO, MT, NM, UT, WY) and Pacific (AK, CA, HI, OR, WA) regions.

Linkage to HIV care within one month of diagnosis was defined as having at least one CD4 or viral load test result with a specimen collection date within one month after HIV diagnosis. Viral suppression within six months of diagnosis was defined as having a viral load result <200 copies/mL with a specimen collection date within six months after diagnosis. Statistical adjustment using multiple imputation techniques were applied to account for cases with missing transmission category [2].

Findings were stratified by rural or urban residence at diagnosis. US Department of Agriculture Economic Research Service Rural-Urban Continuum Codes (RUCC) were used

to define rural or urban residence at the county level [3]. RUCC defines metropolitan counties by the population size of their metro area, and nonmetropolitan counties by their degree of urbanization and adjacency to a metropolitan area. In this analysis, metro counties (RUCC 1 to 3) were referred to as “urban” and nonmetro counties (RUCC 4 to 9) as “rural”.

Urban and rural counties were further categorized based on the population size of the metro area within them. Large urban counties contained metropolitan areas with more than 1 million people (RUCC = 1). Medium urban counties had metropolitan areas with populations ranging from 250,000 to 1 million (RUCC = 2). Small urban counties included metropolitan areas with less than 250,000 people (RUCC = 3). Large rural counties had small urban centers with populations of 20,000 or more (RUCC = 4 and 5), medium rural counties had populations ranging from 2,500 to 19,999 (RUCC = 6 and 7), and small rural counties had populations with fewer than 2,500 people (RUCC = 8 and 9)(Figure 1).

Trends in diagnoses, linkage to HIV care, and viral suppression from 2016 to 2022 were assessed by calculating the estimated annual percentage change (EAPC). EAPCs and their 95% confidence intervals (CIs) were determined using Poisson regression. An EAPC was considered statistically significant if its 95% CI did not include zero. The year 2020 was excluded from the EAPC analysis due to the impact of the COVID-19 pandemic on HIV testing, care, and potential disruptions in reporting processes [4].

Results

In large rural counties, HIV diagnoses attributed to IDU among adolescents and adults increased from 98 in 2016 to 126 in 2022 (EAPC: 4.86%, 95% CI: 0.92, 8.96) and remained stable in small and medium rural counties during the same period. HIV diagnoses attributed to IDU also increased from 193 to 265 (EAPC: 5.67%, 95% CI: 2.62, 8.81) in small urban counties and from 593 to 756 (EAPC: 4.95%, 95% CI: 3.19, 6.75) in medium urban counties (Table 1). In contrast, diagnoses declined in large urban counties, from 2,084 in 2016 to 1,797 in 2022 (EAPC: -2.46%, 95% CI: -3.48, -1.43).

Linkage to HIV care within one month of diagnosis remained stable in all rural counties and in small and medium urban counties from 2016 to 2022 but increased in large urban counties, from 72.8% to 79.3% (EAPC: 1.21%, 95% CI: 0.66, 1.76) (Table 1). Viral suppression within six months also remained stable in all rural counties, small urban counties, and medium urban counties, while increasing in large urban counties from 50.4% to 58.4% (EAPC: 2.00%, 95% CI: 1.17, 2.84) (Table 1).

Regionally, HIV diagnoses attributed to IDU increased in rural counties of the West North Central division in the Midwest and the East South Central division in the South, from 23 to 39 (EAPC: 8.21%, 95% CI 0.50, 16.51) and from 16 to 46 (EAPC: 16.15%, 95% CI 7.12, 25.94), respectively (Table 2). Urban counties in these divisions also saw an increase in IDU-related diagnoses, from 100 to 127 (EAPC: 5.50%, 95% CI: 1.79, 9.35) in West North Central and from 88 to 177 (EAPC: 12.28%, 95% CI: 8.11, 16.60) in East South Central (Table 2). In contrast, urban counties in the New England, Mid Atlantic, and Mountain divisions experienced a decline in HIV diagnoses attributed to IDU, decreasing from 179 to

121 (EAPC: -6.70%, 95% CI: -9.50, -3.81), 278 to 203 (EAPC: -4.64%, 95% CI: -4.64, -1.61), and 130 to 70 (EAPC: -6.31%, 95% CI: -9.95, -2.52), respectively (Table 2).

From 2016 to 2022, linkage to HIV care within one month of diagnosis increased in urban counties in the West South Central and Pacific divisions, from 70.0% to 79.2% (EAPC: 1.50%, 95% CI: 0.24, 2.77) and from 73.5% to 80.5% (EAPC: 1.63%, 95% CI: 0.74, 2.53), respectively (Table 2). Viral suppression within six months of diagnosis increased in urban counties in the New England, East North Central, and South Atlantic divisions, from 57.6% to 66.0% (EAPC: 2.96%, 95% CI: 0.59, 5.38), 47.7% to 61.6% (EAPC: 3.44%, 95% CI: 0.91, 3.42), and 46.0% to 54.8% (EAPC: 1.94%, 95% CI: 0.48, 3.42), respectively (Table 2). In contrast, linkage to care and viral suppression in rural counties across nearly all U.S. census divisions did not experience a significant annual percent change and remained stable, except in the West South Central division, where viral suppression increased from 39.3% to 61.6% (EAPC: 5.69%, 95% CI: 0.09, 11.61) (Table 2).

Discussion

This analysis highlights significant trends in HIV diagnoses attributed to IDU across the United States from 2016 to 2022. There was an increase in IDU-related HIV diagnoses in large rural, small urban, and medium urban counties, and a decline in large urban counties. Regionally, the West North Central and East South Central divisions saw significant increases in rural and urban areas, while there was a decline in diagnoses in urban areas of the New England, Mid Atlantic, and Mountain divisions.

Various factors could contribute to the increase in HIV diagnoses attributed to IDU in rural areas, including a lack of infrastructure and resources to prevent and treat HIV, as well as HIV- and substance use-related stigma (4). The current opioid epidemic experienced in the United States has significantly increased opioid-related overdose deaths and the number of individuals injecting opioids, especially in rural areas [5]. Innovative strategies are needed to reach individuals in rural areas, especially those experiencing multiple layers of stigma due to their HIV status and drug use. The decrease in diagnoses in large urban areas could be an indicator of reduced transmission or it could be driven by continued low testing rates after the pandemic in these areas.

While linkage to care and viral suppression increased in large urban areas, no significant improvements were observed in rural and small and medium urban jurisdictions. Regionally, some divisions saw urban improvements, but largely no improvements in rural areas. Rural county residents experience higher rates of poverty, less access to healthcare and transportation, and are less likely to have health insurance [6]. These factors pose major barriers for those seeking care after receiving a HIV diagnosis. Many rural counties lack harm reduction services and drug treatment providers, including access to medications for opioid use disorder, which are critical for engaging people who use drugs to prevent the spread of infectious diseases and educate them on the impacts and consequences of drug use [7]. Additionally, many rural communities lack healthcare providers specializing in HIV care or substance use disorders [7]. Due to the low availability and lack of funding for these services, individuals in need of care are forced to travel long distances for HIV-related

care, including prevention services or treatment following diagnosis, leading to increases in diagnoses and decreases in linkage to care and viral suppression. Therefore, lack of transportation is a major barrier to obtaining preventative care and treatment services [5]. Due to these access barriers, PWID in rural areas experience a higher risk of HIV infection and other drug-use associated consequences [5].

Individuals with diagnosed HIV attributed to IDU experience multifaceted impacts of stigma. They are at higher risk of encountering both internalized and perceived stigma from their HIV status and drug use, and some may also face additional stigma related to factors such as race/ethnicity or sex [8]. Those with multiple stigmatizing characteristics often suffer more frequent negative encounters, which are associated with poorer health outcomes [8]. PWID residing in rural counties often experience stigma in healthcare settings, affecting their healthcare choices. Limited healthcare options in these areas can make it difficult to find non-stigmatizing care, which may reduce their willingness to discuss risky behaviors or seek treatment [8, 9].

Limitations of this analysis included that data were restricted to 40 jurisdictions with complete reporting of HIV-related laboratory data to CDC during the period analyzed; excluded jurisdictions consisted of 643 counties, 65.9% of which would be classified as rural [3]. Additionally, the rural-urban classification was at the county level, the smallest geographic unit available in NHSS data during the analysis period. County-level definitions of rural-urban may mask variations within counties, especially in areas on the fringe of metropolitan regions. Census tract-level rural-urban definitions should be considered in future analysis to enhance accuracy. The absence of comprehensive data on the total population of PWID prevented adjustments in the EAPC for population growth among PWID, thus limiting our ability to standardize trend data by PWID population size. Lastly, data from 2020 were excluded from the EAPC calculations due to significant disruptions in HIV testing services during the COVID-19 pandemic, which likely resulted in the underreporting of diagnoses to NHSS.

These findings highlight the importance of implementing and expanding innovative methods to reach and prioritize PWID in rural and small to medium urban areas for HIV prevention and treatment services, particularly in the East South Central and West North Central divisions. This could include the implementation of telemedicine services for HIV prevention and care provided by a culturally competent and trained healthcare workforce. Expanding telemedicine to provide services like pre-exposure prophylaxis (PrEP), post-exposure prophylaxis (PEP), and linkage to care will positively impact rural residents by addressing transportation barriers, enabling HIV-related care from home, and minimizing access challenges by building the medical workforce's capacity to deliver and promote PrEP adherence [10]. A review of multiple telemedicine applications in rural populations showed increased acceptability, satisfaction, and convenience, lower direct and indirect costs, and improved access to care [11]. Overall, removing barriers to linkage to care and viral suppression among all persons with diagnosed HIV attributed to IDU, with a particular focus on barriers experienced by those residing in rural or smaller urban communities, could improve outcomes.

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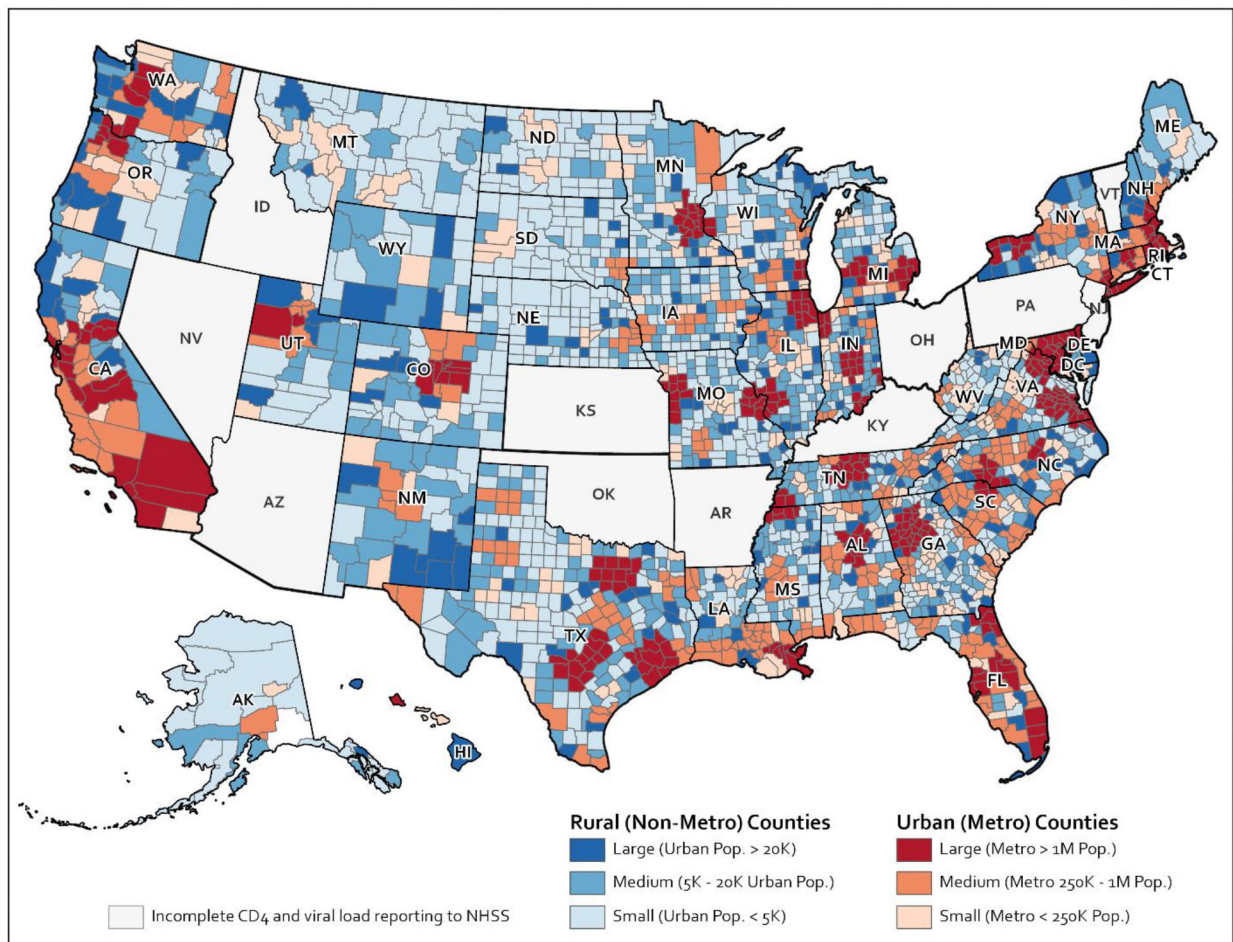


Figure 1.

Rural and urban counties in states with complete CD4 and viral load test results reporting to the National HIV Surveillance System, 2016 to 2022.

Table 1.

HIV diagnoses, linkage to care and viral suppression among adolescents and adults (≥ 13 years old) who inject drugs, by rural or urban county, 2016 to 2022.

HIV Diagnoses													
	2016	2017	2018	2019	2020	2021	2022	EAPC (95% CI)					
County of residence ^a	No.	No.	No.	No.	No.	No.	No.						
Large urban	2,084	2,054	2,090	2,050	1,625	1,872	1,797	-2.46 (-3.48, -1.43)					
Medium urban	593	574	615	725	601	741	756	4.95 (3.19, 6.75)					
Small urban	193	195	239	214	205	264	265	5.67 (2.62, 8.81)					
Large rural	98	102	100	111	81	126	126	4.86 (0.92, 8.96)					
Medium rural	110	100	111	102	96	97	122	0.99 (-2.76, 4.89)					
Small rural	50	70	58	75	41	60	61	1.05 (-4.27, 6.66)					

Linkage to care with 1 month of diagnosis ^b															
	2016	2017	2018	2019	2020	2021	2022	EAPC							
County of residence ^a	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	%		
Large urban	1,517	72.8	1,530	74.5	1,600	76.6	1,572	76.6	1,262	77.6	1,446	77.2	1,426	79.3	1.21 (0.66, 1.76)
Medium urban	431	72.6	420	73.2	470	76.5	538	74.1	478	79.5	556	75.1	559	74.0	0.24 (-0.65, 1.14)
Small urban	146	75.3	144	73.9	188	78.9	153	71.5	144	70.4	192	72.9	208	78.6	0.22 (-1.33, 1.79)
Large rural	76	77.8	80	78.4	71	70.6	85	76.1	65	80.7	101	79.6	87	69.1	-0.92 (-3.07, 1.29)
Medium rural	78	71.0	80	79.5	93	84.2	82	80.4	71	74.1	78	80.6	95	77.9	0.72 (-1.14, 2.61)
Small rural	39	78.6	53	76.5	47	81.0	58	77.1	26	62.4	39	66.2	47	76.6	-1.48 (-4.44, 1.58)

Viral suppression within 6 months of diagnosis ^c															
	2016	2017	2018	2019	2020	2021	2022	EAPC							
County of residence ^a	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	%		
Large urban	1,051	50.4	1,071	52.1	1,202	57.5	1,213	59.2	908	55.9	1,048	56.0	1,050	58.4	2.00 (1.17, 2.84)
Medium urban	291	49.1	319	55.5	361	58.7	415	57.2	329	54.8	424	57.3	415	54.9	1.03 (-0.35, 2.43)
Small urban	110	56.8	105	53.7	130	54.5	119	55.7	105	51.4	131	49.5	150	56.9	-0.54 (-2.91, 1.88)

HIV Diagnoses															
	2016	2017	2018	2019	2020	2021	2022	EAPC (95% CI)							
County of residence ^d	No.	No.	No.	No.	No.	No.	No.								
Large rural	58	59.5	60	58.9	52	51.5	71	63.6	43	52.7	75	59.4	69	55.2	-0.39 (-3.50, 2.83)
Medium rural	56	50.8	64	63.9	70	62.8	68	66.5	54	56.8	57	58.6	74	60.0	0.89 (-2.29, 4.16)
Small rural	26	51.0	38	54.0	39	66.6	47	62.5	25	61.7	33	55.5	38	61.7	1.57 (-2.83, 6.16)

EAPC, Estimated Annual Percentage Change. 2020 was excluded from EAPC calculations. Use caution when interpreting 2020 results, which coincided with the COVID-19 pandemic.

^aDefined using the USDA-ERS Rural-Urban Continuum Codes (RUCC) county-level definitions for rural and urban communities. Large rural counties had small urban centers with populations of 20,000 or more, medium rural counties had populations ranging from 2,500 to 19,999, and small rural counties had populations of 2,500 or fewer. Large urban counties contained metropolitan areas with 1 million people or more. Medium urban counties had metropolitan areas with populations ranging from 250,000 to 1 million, while small urban counties included metropolitan areas with less than 250,000 people.

^bLinkage to HIV medical care was measured by documentation of ≥ 1 CD4 or viral load test ≤ 1 month after HIV diagnosis.

^cViral suppression was measured by documentation of a viral load test < 200 copies/mL within 6 months of diagnosis.

Table 2. Linkage to care, and viral suppression among adolescents and adults (≥ 13 years old) who inject drugs, by residence in a rural or urban
Division from 2016 to 2022.

Diagnoses (No.)																
Urban																
Rural																
Ann Epidemiol. Author manuscript; available in PMC 2026 April 29.																
2017	2018	2019	2020	2021	2022	EAPC (95%CI)	N	2017	2018	2019	2020	2021	2022	EAPC (95%CI)	N	N
15	13	11	11	17	9	-3.88 (-14.85, 8.50)	457	469	459	393	354	383	324	-5.50 (-7.59, -3.36)	324	
6	8	5	4	7	3	-6.11 (-21.71, 12.59)	179	228	190	150	151	167	121	-6.70 (-9.50, -3.81)	121	
9	4	7	6	11	6	-2.22 (-16.27, 14.18)	278	241	269	242	202	215	203	-4.64 (-7.57, -1.61)	203	
65	58	53	40	75	71	2.91 (-2.07, 8.13)	352	319	361	355	290	366	370	1.47 (-0.81, 3.79)	370	
39	32	32	18	45	32	-0.98 (-7.51, 6.01)	252	220	260	225	191	230	243	-0.46 (-3.18, 2.35)	243	
26	26	22	23	30	39	8.21 (0.50, 16.51)	100	100	101	130	99	136	127	5.50 (1.79, 9.35)	127	
156	156	179	140	159	194	4.41 (1.03, 7.90)	1,296	1,262	1,299	1,455	1,125	1,352	1,366	1.20 (-0.10, 2.52)	1,366	
79	75	100	73	84	95	4.13 (-1.04, 9.57)	746	709	752	828	650	730	710	-0.37 (-1.94, 1.23)	710	
22	28	34	34	37	46	16.15 (7.12, 25.94)	88	104	100	144	94	159	177	12.28 (8.11, 16.60)	177	

Diagnoses (No.)																
Rural							Urban									
2016	2017	2018	2019	2020	2021	2022	EAPC (95%CI)	2016	2017	2018	2019	2020	2021	2022	EAPC (95%CI)	
N	N	N	N	N	N	N		N	N	N	N	N	N	N		
9	55	53	45	34	39	52	-1.86 (-7.97, 4.64)	461	449	448	483	381	463	479	0.80 (-1.32, 2.96)	
5	36	43	45	27	31	36	-3.61 (-9.77, 2.97)	766	772	824	787	663	776	758	-0.28 (-1.78, 1.23)	
0	18	23	27	14	16	14	-4.78 (-13.38, 4.66)	130	107	106	128	96	105	70	-6.31 (-9.95, -2.52)	
4	17	19	19	12	15	22	-2.45 (-11.21, 7.18)	636	665	718	659	566	671	689	0.69 (-0.88, 2.30)	
8	271	269	289	218	283	309	2.52 (0.07, 5.03)	2,871	2,823	2,944	2,990	2,432	2,877	2,818	-0.14 (-0.98, 0.71)	
Linkage to care with 1 month of diagnosis ^c																
Rural							Urban									
2016	2017	2018	2019	2020	2021	2022	EAPC	2016	2017	2018	2019	2020	2021	2022	EAPC	
%	N	%	N	%	N	%		%	N	%	N	%	N	%		
73.3	14	90.1	8	71.9	10	89.6	1.54 (-4.50, 7.95)	349	371	362	319	289	81.5	314	82.0	0.64 (-0.45, 1.75)
56.4	5	79.7	4	79.2	4	100.0	4.05 (-6.62, 15.93)	144	181	147	127	84.6	124	85.6	95	0.70 (-0.85, 2.28)

Diagnoses (No.)

Rural														Urban														
2017	2018	2019	2020	2021	2022	EAPC (95%CI)	N	2016	2017	2018	2019	2020	2021	2022	EAPC (95%CI)													
83.2	9	96.7	4	84.1	4	66.7	5	82.5	9	81.5	6	96.5	-0.46 (-6.92, 6.45)	205	73.7	191	79.1	215	80.0	192	79.3	164	81.2	171	79.2	159	78.2	0.63 (-0.76, 2.04)
70.3	49	76.4	6	78.8	46	87.0	31	76.0	58	77.8	57	80.2	1.34 (-1.22, 3.96)	266	75.5	243	76.2	280	77.4	263	74.1	223	77.0	294	80.3	300	81.2	1.27 (0.11, 2.45)
61.7	30	77.6	6	80.5	27	86.0	12	70.3	37	82.9	23	71.7	1.81 (-1.49, 5.22)	185	73.5	164	74.6	197	75.7	164	72.9	140	73.3	184	80.2	190	78.2	1.27 (-0.22, 2.78)
85.6	19	74.5	0	76.6	19	88.4	18	80.3	21	70.3	34	87.2	0.40 (-3.40, 4.34)	81	80.7	79	79.7	83	82.0	99	76.2	83	84.1	110	80.4	110	87.0	1.05 (-0.89, 3.03)
75.4	119	76.6	9	76.0	134	75.1	99	70.9	122	76.3	137	70.5	-0.87 (-2.78, 1.08)	902	69.6	902	71.5	970	74.6	1,070	73.6	851	75.6	963	71.3	1,027	75.2	0.71 (0.04, 1.39)
75.1	62	78.5	7	76.4	78	78.5	51	70.6	66	78.6	67	70.8	-0.70 (-3.25, 1.91)	524	70.3	508	71.7	577	76.7	618	74.7	506	77.8	525	71.9	531	74.8	0.51 (-0.43, 1.47)
67.5	17	77.3	9	66.5	23	66.8	22	65.6	25	67.8	30	64.4	-1.55 (-7.08, 4.31)	55	62.1	64	61.0	69	69.5	98	68.2	71	74.9	98	61.8	117	65.9	0.29 (-2.74, 3.41)
78.3	40	73.4	43	80.3	33	73.8	26	76.8	31	79.3	39	75.2	-0.09 (-3.54, 3.48)	323	70.0	330	73.6	324	72.3	354	73.2	274	72.0	341	73.6	380	79.2	1.50 (0.24, 2.77)
81.6	30	84.6	37	87.1	36	79.7	22	83.8	25	79.8	27	76.0	-1.30 (-4.30, 1.80)	577	75.3	578	74.8	647	78.6	610	77.5	522	78.8	623	80.3	613	80.8	1.27 (0.44, 2.11)
80.1	17	91.8	21	88.8	22	83.6	13	93.0	13	80.6	10	73.9	-2.31 (-7.68, 3.38)	109	84.1	90	83.7	91	85.2	100	78.5	74	76.4	84	80.5	58	83.5	-0.67 (-2.60, 1.30)
82.8	13	77.0	16	85.0	14	74.1	9	73.0	12	78.9	17	77.3	-1.00 (-5.49, 3.70)	468	73.5	488	73.4	557	77.6	509	77.3	448	79.2	539	80.3	554	80.5	1.63 (0.74, 2.53)

Diagnoses (No.)																								
Rural							Urban																	
2017	2018	2019	2020	2021	2022	EAPC (95%CI)	2016	2017	2018	2019	2020	2021	2022	EAPC (95%CI)										
N	N	N	N	N	N		N	N	N	N	N	N	N											
75.1	213	78.3	162	74.3	218	77.1	229	74.1	-0.36 (-1.67, 0.97)	2,094	72.9	2,094	74.2	2,259	76.7	2,262	75.7	1,885	77.5	2,194	76.3	2,193	77.8	0.86 (0.39, 1.34)
Viral suppression within 6 months of diagnosis ^d																								
Rural							Urban																	
2017	2018	2019	2020	2021	2022	EAPC	2016	2017	2018	2019	2020	2021	2022	EAPC										
No.	%	No.	%	No.	%	(95%CI)	No.	%	No.	%	No.	%	No.	%										
52.7	15	96.7	7	68.9	13	74.7	8	96.5	3.36 (-5.73, 13.32)	260	56.9	284	60.5	287	62.5	264	67.2	232	65.5	248	64.8	213	65.7	2.14 (0.65, 3.66)
54.5	6	96.6	3	58.3	4	95.3	3	96.4	0.76 (-8.00, 10.36)	103	57.6	136	59.4	112	59.2	100	66.8	102	67.5	115	68.7	80	66.0	2.96 (0.59, 5.38)
51.6	9	96.7	3	47.0	3	50.8	6	96.5	5.32 (-7.58, 20.01)	157	56.4	148	61.5	175	64.9	163	67.5	130	64.0	133	61.8	133	65.5	1.60 (-0.36, 3.60)
59.0	37	57.5	33	57.7	40	75.5	46	64.9	1.72 (-1.91, 5.48)	180	51.1	182	57.0	213	58.8	218	61.4	168	58.0	234	64.0	236	63.8	3.23 (1.25, 5.25)
54.5	18	45.9	17	51.9	25	77.8	19	59.5	3.84 (-1.40, 9.35)	120	47.7	115	52.4	149	57.4	132	58.5	106	55.2	134	58.3	149	61.6	3.44 (0.91, 6.03)
66.8	19	74.9	17	64.8	16	72.2	27	69.4	-1.31 (-6.19, 3.82)	60	59.5	67	67.3	63	62.6	86	66.4	63	63.2	100	73.5	86	67.9	2.29 (-0.36, 5.00)

Diagnoses (No.)																											
Rural										Urban																	
2017	2018	2019	2020	2021	2022	EAPC (95%CI)	N	2017	2018	2019	2020	2021	2022	N	EAPC (95%CI)												
53.2	56.2	59	57.2	112	62.4	80	57.1	88	54.9	108	55.6	0.14 (-2.62, 2.97)	595	45.9	619	49.1	692	53.3	802	55.1	584	51.9	670	49.5	736	53.9	1.59 (0.45, 2.75)
57.4	47	59.1	60.3	67	67.5	42	58.5	47	55.6	52	54.5	-1.15 (-4.85, 2.70)	344	46.0	334	47.1	414	55.1	462	55.8	344	52.8	362	49.5	389	54.8	1.94 (0.48, 3.42)
77.1	14	62.7	51.2	21	60.9	19	56.7	18	49.2	24	51.1	-5.54 (-11.77, 1.13)	35	39.3	45	42.8	52	51.8	82	56.8	55	58.0	72	45.0	82	46.0	0.71 (-3.23, 4.81)
39.3	27	49.3	55.9	24	52.1	19	54.4	23	58.8	32	61.6	5.69 (0.09, 11.61)	216	46.9	240	53.6	227	50.6	258	53.4	186	48.9	236	51.1	265	55.3	1.55 (-0.44, 3.59)
50.8	22	61.8	64.9	28	62.0	14	54.0	18	57.7	18	51.4	-0.50 (-5.60, 4.88)	417	54.5	410	53.0	501	60.8	464	58.9	359	54.2	451	58.1	432	56.9	0.86 (-0.37, 2.11)
42.3	14	76.9	50.4	18	67.9	8	53.1	10	59.4	6	43.0	-0.62 (-8.25, 7.64)	73	56.4	68	63.5	72	67.5	88	68.6	55	57.0	71	67.9	42	60.0	1.47 (-1.42, 4.44)
57.8	8	46.0	82.4	10	53.5	7	54.9	9	55.9	12	56.9	-0.41 (-7.14, 6.81)	344	54.1	341	51.3	430	59.9	376	57.0	304	53.7	380	56.6	390	56.6	0.90 (-0.46, 2.27)
54.2	161	59.5	59.4	186	64.3	122	56.2	165	58.3	181	58.4	0.52 (-1.40, 2.48)	1,452	50.6	1,494	52.9	1,693	57.5	1,747	58.4	1,343	55.2	1,603	55.7	1,616	57.4	1.56 (0.87, 2.25)

Annual Percentage Change. 2020 was excluded from EAPC calculations. Use caution when interpreting 2020 results, which coincided with the COVID-19 pandemic.

RDA-ERS Rural-Urban Continuum Codes (RUCC) county-level definitions for rural and urban communities.

Analysis grouped by U.S. Census Division: New England (CT, MA, ME, NH, RI), Mid Atlantic (NY), East North Central (IL, IN, MI, WI), West North Central (IA, MN, MO, NE, SD, ND, DE, FL, GA, MD, NC, SC, VA, WV), East South Central (AL, MS, TN), West South Central (LA, TX), Mountain (CO, MT, NM, UT, WY), and Pacific (AK, CA, HI, OR, AZ).

CD4 count was measured by documentation of ≥1 CD4 or viral load test ≤1 month after HIV diagnosis.

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d_{Viral} Viral suppression was measured by documentation of a viral load test <200 copies/mL within 6 months of diagnosis.
EAPC, Estimated Annual Percentage Change