

# ***State-Level Estimates of HIV Incidence, Prevalence, and Undiagnosed Infections: 12.2% Undiagnosed in NYS; 15% US undiagnosed***

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“.....In 2014, the percentage of undiagnosed HIV infections ranged from 9.9% in Pennsylvania to 19.2% in Texas.

.....Five states (California, Georgia, Florida, New York, and Texas) accounted for 51% of undiagnosed infections.”

## **CONCLUSIONS**

- The method using the first CD4 count after HIV diagnosis to measure the progression of HIV disease can be readily applied to surveillance data to produce national and jurisdiction-level estimates of HIV incidence, prevalence, and undiagnosed infection.
- Estimates of and changes in HIV incidence, prevalence, and undiagnosed infection varied by state and region during 2008-2014.
- Increases in HIV prevalence are likely due to improvements in HIV treatment.
- Decreases in percentages of persons with undiagnosed HIV infection are likely due to increases in testing among at risk populations.
- Decreases in HIV incidence may be due to increases in numbers of persons receiving care and treatment and decreases in numbers of persons with undiagnosed infection.
- Public health officials in the south and states with high percentages of undiagnosed infection may consider tailoring HIV prevention and testing initiatives to their unique environments.

## **BACKGROUND**

- The burden of HIV infection and health outcomes for people living with HIV vary widely across the United States.
- New methods allow for estimating HIV incidence, prevalence, and percent of undiagnosed infections using case surveillance data and CD4 test results.
- Estimating HIV outcomes with appropriate models is important to aid in the development and evaluation of HIV care, prevention, and treatment programs and for monitoring progress towards the goals of the National HIV/AIDS Strategy for the United States.

## **OBJECTIVES**

- To assess trends in HIV incidence, prevalence, and undiagnosed infections among adults and adolescents for each state, the District of Columbia, and nationally for 2008–2014.

## METHODS

- Data source: National HIV Surveillance System.
- Study population: Persons aged 13 years and older.
- Statistical analyses:
  - HIV case surveillance data and the first CD4 value after diagnosis were used to estimate the distribution of delay from infection to diagnosis based on a well characterized CD4 depletion model.
  - The distribution of diagnosis delay was used to estimate HIV incidence (includes diagnosed and undiagnosed infections).
  - HIV incidence data, combined with information on cumulative numbers of diagnoses and deaths, were used to estimate HIV prevalence (persons living with diagnosed and undiagnosed infections).
  - Estimated HIV prevalence and the number of persons living with diagnosed HIV infection were used to estimate the number and percentage of undiagnosed infection.
  - Estimated annual percentage changes (EAPCs) were calculated for each outcome and considered significant if the p-value was <0.05.

## RESULTS

- United States:
  - During 2008–2014, the annual number of HIV infections (3.6% per year) and the percentage of persons with undiagnosed infection (3.4% per year) decreased; HIV prevalence increased by 2.4% per year.
  - In 2014, states located in the south accounted for 50% of annual HIV infections, 45% of persons living with HIV, and 50% of undiagnosed HIV infections.
- Among 36 jurisdictions with numerically stable estimates (>100 HIV diagnoses per year):
  - HIV incidence:
    - During 2008–2014, HIV infections decreased in 8 states and the District of Columbia (EAPC range 2%-10%).
    - In 2014, the number of infections ranged from 110 in Delaware to 5,100 in California.
    - Five states (California, Georgia, Florida, New York, and Texas) accounted for 52% of HIV infections.
  - HIV prevalence:
    - During 2008–2014, the annual number of persons living with HIV increased in 23 jurisdictions (EAPC range 1%-4%).
    - In 2014, HIV prevalence ranged from 3,000 persons in Utah to 145,900 in New York.
  - Undiagnosed infection:
    - During 2008–2014, the percentage of undiagnosed HIV infections decreased in 7 states (California, Georgia, Illinois, Louisiana, Maryland, Ohio, Tennessee, and Texas; EAPC range 3%-8%).
    - In 2014, the percentage of undiagnosed HIV infections ranged from 9.9% in Pennsylvania to 19.2% in Texas.
    - Five states (California, Georgia, Florida, New York, and Texas) accounted for 51% of undiagnosed infections.

## Abstract Body:

The burden of HIV infection, the range of testing, and health outcomes for people living with HIV vary widely across the United States. Understanding the current status of HIV prevention and care outcomes in states informs efforts to achieve local HIV prevention and care goals and the goals of National HIV/AIDS Strategy.

Data from the National HIV Surveillance System on HIV diagnoses among persons aged  $\geq 13$  years and their first CD4 test result after diagnosis were used to produce state-level estimates of HIV incidence, prevalence, and percentage of undiagnosed infections during 2008–2014 for each of the 50 states and the District of Columbia. The indicators were derived from estimates of diagnosis delays based on a CD4 depletion model. Estimated annual percentage changes (EAPCs) in incidence, prevalence, and percentage undiagnosed were calculated and considered as significant if p-value is less than 0.05.

During 2008–2014, among 36 jurisdictions with numerically stable estimates ( $>100$  HIV diagnoses per year) there were significant increases (EAPCs 1–4%) in HIV prevalence in 23 jurisdictions and significant decreases (EAPCs 3–8%) in percentages of undiagnosed HIV infection in 7 jurisdictions. Estimated annual numbers of HIV infections decreased (EAPCs 2–10%) in 9 jurisdictions. In 2014, HIV prevalence ranged from an estimated 2,359 persons in Nebraska to 145,916 in New York. The estimated annual number of HIV infections ranged from 68 in Nebraska to 5,082 in California. Estimated percentages of undiagnosed HIV infections ranged from 10% in Pennsylvania to 19% in Texas. Five jurisdictions (California, Georgia, Florida, New York, and Texas) accounted for 52% of HIV infections and 51% of undiagnosed infections in 2014. In 2014, by region, states located in the South accounted for 45% of persons living with HIV, 51% of HIV infections, and 50% of undiagnosed HIV infections.

Estimates of and changes in HIV incidence, prevalence, and undiagnosed HIV infection varied by state and geographic region. Differences in HIV outcomes between states and regions are due to a complex array of social, demographic, economic, and political factors in addition to the capacity of public health, health care systems, and the community to address HIV. Public health officials in the South and states with high percentages of undiagnosed infection should consider tailoring HIV prevention and testing initiatives to their unique environments.

**Table 1. Estimated HIV incidence among persons aged ≥13 years, 2014, United States**

Area of residence	2014		Trend 2008-2014				
	No.	95% Confidence intervals		EAPC	L95	U95	p-value
United States	37,600	35,400	39,800	-3.6	-4.3	-2.9	<0.01
Alabama	560	290	830	-5.7	-11.2	0	0.05
Alaska	40	0	110	—	—	—	—
Arizona	780	460	1,100	-0.5	-6	5.3	0.86
Arkansas	310	110	520	3.5	-5.5	13.4	0.46
California	5,100	4,300	5,900	-1.7	-3.7	0.3	0.09
Colorado	340	140	540	-5.9	-12.8	1.5	0.12
Connecticut	260	80	450	-3.3	-11.1	5.1	0.43
Delaware	110	0	220	-3.2	-15.6	11.1	0.65
District of Columbia	490	240	750	-10	-14.7	-4.9	<0.01
Florida	4,700	3,900	5,500	-1.9	-4	0.2	0.08
Georgia	1,900	1,400	2,400	-6.1	-9	-3.2	<0.01
Hawaii	100	0	210	—	—	—	—
Idaho	10	0	40	—	—	—	—
Illinois	1,200	820	1,600	-4.3	-7.9	-0.5	0.03
Indiana	420	190	650	-2.8	-9.2	3.9	0.4
Iowa	80	0	170	—	—	—	—
Kansas	90	0	190	—	—	—	—
Kentucky	270	100	450	-1.9	-9.6	6.4	0.64
Louisiana	1,100	690	1,400	-1.4	-5.9	3.3	0.54
Maine	80	0	180	—	—	—	—
Maryland	1,200	830	1,700	-7.5	-11.1	-3.7	<0.01
Massachusetts	740	430	1,000	-1.8	-6.8	3.5	0.5
Michigan	800	480	1,100	-0.4	-5.5	5	0.89
Minnesota	280	100	470	-5.6	-12.9	2.3	0.16
Mississippi	360	140	580	-4.4	-11.5	3.2	0.25
Missouri	440	210	680	-5.3	-11.4	1.1	0.1
Montana	30	0	80	—	—	—	—
Nebraska	70	0	160	—	—	—	—
Nevada	400	170	630	-1.9	-8.8	5.5	0.61
New Hampshire	40	0	100	—	—	—	—
New Jersey	1,100	680	1,400	-3.6	-7.9	0.9	0.11
New Mexico	130	0	260	-2	-13.7	11.3	0.76
New York	3,600	2,900	4,200	-5.1	-7.2	-2.9	<0.01
North Carolina	1,200	840	1,600	-4.9	-8.5	-1.2	0.01
North Dakota	20	0	80	—	—	—	—
Ohio	710	410	1,000	-1.9	-6.7	3.2	0.46
Oklahoma	210	50	370	-3.1	-11.6	6.1	0.5
Oregon	190	40	330	-8.2	-16.5	0.9	0.08
Pennsylvania	770	440	1,100	-7.3	-11.4	-3	<0.01
Rhode Island	110	0	240	—	—	—	—
South Carolina	700	390	1,000	-2.5	-7.8	3.1	0.37
South Dakota	20	0	80	—	—	—	—
Tennessee	760	450	1,100	-1.6	-6.4	3.6	0.54
Texas	4,100	3,400	4,900	-2.4	-4.6	-0.2	0.03
Utah	120	10	240	-5	-16.7	8.2	0.44
Vermont	10	0	40	—	—	—	—
Virginia	880	540	1,200	-3.4	-7.9	1.4	0.16
Washington	380	170	600	-4.1	-10	2.2	0.2
West Virginia	90	0	180	—	—	—	—
Wisconsin	200	40	370	-6.5	-14.6	2.3	0.14
Wyoming	0	0	20	—	—	—	—

**Table 2. Estimated HIV prevalence among persons aged  $\geq 13$  years, 2014, United States**

Area of residence	2014			Trend 2008-2014			
	No.	95% Confidence intervals		EAPC	L95	U95	p-value
United States	1,107,700	1,088,500	1,127,000	2.4	2.1	2.6	<0.01
Alabama	14,700	12,500	17,000	2.3	0.1	4.6	0.04
Alaska	780	260	1,300	—	—	—	—
Arizona	17,400	15,000	19,700	2.8	0.9	4.8	0.01
Arkansas	6,100	4,700	7,600	2.5	-0.8	5.9	0.15
California	139,900	133,100	146,700	2.8	2.1	3.6	<0.01
Colorado	12,800	11,000	14,600	2.0	-0.1	4.1	0.07
Connecticut	11,300	9,400	13,200	1.0	-1.4	3.4	0.43
Delaware	3,700	2,600	4,800	1.0	-3.1	5.4	0.63
District of Columbia	18,200	15,700	20,700	2.9	0.8	5.0	0.01
Florida	121,300	114,700	127,800	2.5	1.7	3.3	<0.01
Georgia	55,800	51,400	60,100	2.8	1.7	4.0	<0.01
Hawaii	3,100	2,200	4,000	—	—	—	—
Idaho	1,100	590	1,500	—	—	—	—
Illinois	40,200	36,600	43,800	2.5	1.1	3.8	<0.01
Indiana	12,200	10,200	14,200	2.5	0.1	4.9	0.04
Iowa	2,800	1,900	3,700	—	—	—	—
Kansas	3,400	2,300	4,400	—	—	—	—
Kentucky	7,700	6,100	9,200	2.7	-0.3	5.7	0.08
Louisiana	23,300	20,300	26,200	2.5	0.6	4.4	0.01
Maine	1,700	980	2,400	—	—	—	—
Maryland	37,200	33,600	40,900	2.2	0.8	3.7	<0.01
Massachusetts	22,400	19,800	25,000	2.4	0.7	4.2	0.01
Michigan	18,200	15,600	20,800	2.9	0.8	5.1	0.01
Minnesota	8,900	7,300	10,400	2.8	0.2	5.5	0.04
Mississippi	10,300	8,400	12,100	1.6	-0.9	4.3	0.21
Missouri	13,400	11,400	15,500	2.3	0.1	4.6	0.04
Montana	650	210	1,100	—	—	—	—
Nebraska	2,400	1,500	3,200	—	—	—	—
Nevada	10,200	8,400	12,000	2.8	0.3	5.4	0.03
New Hampshire	1,400	800	2,000	—	—	—	—
New Jersey	39,200	35,500	42,800	0.9	-0.4	2.2	0.19
New Mexico	3,700	2,600	4,800	2.3	-1.9	6.8	0.29
New York	145,900	139,200	152,600	1.4	0.7	2.0	<0.01
North Carolina	34,000	30,600	37,400	3.0	1.5	4.4	<0.01
North Dakota	380	10	760	—	—	—	—
Ohio	22,500	19,800	25,200	2.5	0.8	4.3	<0.01
Oklahoma	6,400	4,900	7,900	2.2	-1.1	5.6	0.2
Oregon	7,300	5,800	8,700	1.7	-1.2	4.6	0.26
Pennsylvania	36,700	33,300	40,100	1.3	0.0	2.7	0.05
Rhode Island	2,700	1,700	3,600	—	—	—	—
South Carolina	19,100	16,600	21,600	2.0	0.2	4.0	0.03
South Dakota	540	130	940	—	—	—	—
Tennessee	19,000	16,400	21,600	2.7	0.8	4.7	0.01
Texas	95,600	89,700	101,600	3.6	2.7	4.5	<0.01
Utah	3,000	2,100	4,000	3.1	-1.4	7.9	0.19
Vermont	700	310	1,100	—	—	—	—
Virginia	25,100	22,300	27,900	2.6	0.9	4.2	<0.01
Washington	14,100	12,100	16,200	2.5	0.4	4.7	0.02
West Virginia	2,100	1,300	2,900	—	—	—	—
Wisconsin	7,100	5,600	8,600	2.5	-0.6	5.6	0.11
Wyoming	320	10	620	—	—	—	—

EAPC, estimated annual percentage change.

Note: Data include persons with a diagnosis of HIV infection regardless of stage of disease at diagnosis. Grey: Jurisdictions with numerically unstable estimates ( $\leq 100$  HIV diagnoses per year).

Orange: Significant decrease in trends from 2008-2014. Blue: Significant increase in trends from 2008-2014.

**Table 3. Estimated percentages of persons aged  $\geq 13$  years living with undiagnosed HIV infection, 2014, United States**

Area of residence	2014			Trend 2008-2014			
	%	95% Confidence intervals		EAPC	L95	U95	p-value
United States	15.0	14.3	15.7	-3.4	-4.1	-2.6	<0.01
Alabama	16.2	9.7	22.8	-4.9	-10.6	1.2	0.11
Alaska	18.3	0.0	47.2	—	—	—	—
Arizona	16.0	10.3	21.8	-2.7	-8.4	3.3	0.37
Arkansas	16.1	6.1	26.1	-2.7	-12.1	7.8	0.6
California	15.0	12.9	17.1	-2.6	-4.9	-0.3	0.03
Colorado	13.1	6.9	19.3	-3.5	-10.7	4.4	0.38
Connecticut	11.2	4.1	18.4	-2.6	-12.5	8.4	0.63
Delaware	14.0	1.3	26.8	-3.1	-16.4	12.2	0.67
District of Columbia	17.2	11.3	23.1	-1.6	-7.4	4.5	0.59
Florida	15.6	13.4	17.9	-1.3	-3.7	1.3	0.33
Georgia	16.6	13.3	19.9	-6.1	-8.9	-3.2	<0.01
Hawaii	12.0	0.0	25.1	—	—	—	—
Idaho	4.4	0.0	24.9	—	—	—	—
Illinois	14.2	10.4	18.0	-5.0	-8.9	-1.0	0.02
Indiana	16.6	9.6	23.7	-4.2	-10.4	2.5	0.22
Iowa	16.3	1.9	30.6	—	—	—	—
Kansas	15.1	1.8	28.4	—	—	—	—
Kentucky	15.6	6.9	24.3	-6.0	-13.6	2.2	0.15
Louisiana	19.1	13.5	24.7	-5.3	-9.4	-1.0	0.02
Maine	14.9	0.0	33.1	—	—	—	—
Maryland	15.3	11.2	19.4	-4.3	-8.4	-0.1	0.05
Massachusetts	15.4	10.3	20.4	-0.5	-6.2	5.5	0.87
Michigan	18.9	12.7	25.1	-2.8	-8.0	2.6	0.31
Minnesota	15.7	8.0	23.5	-3.7	-11.2	4.5	0.37

Mississippi	13.6	6.0	21.2	-7.3	-14.4	0.4	0.06
Missouri	14.4	7.9	20.9	-4.1	-10.8	3.2	0.27
Montana	15.6	0.0	45.1	—	—	—	—
Nebraska	15.9	0.4	31.4	—	—	—	—
Nevada	18.0	10.4	25.6	-3.0	-9.4	3.8	0.38
New Hampshire	13.9	0.0	33.0	—	—	—	—
New Jersey	10.4	6.5	14.3	-4.7	-10.2	1.1	0.11
New Mexico	16.3	3.4	29.1	-2.8	-14.7	10.7	0.67
New York	12.3	10.3	14.3	-1.1	-3.8	1.8	0.46
North Carolina	15.8	11.6	20.0	-1.9	-6.2	2.6	0.4
North Dakota	20.7	0.0	64.0	—	—	—	—
Ohio	12.2	7.2	17.2	-8.0	-13.2	-2.5	0.01
Oklahoma	13.2	3.6	22.9	-6.8	-16.1	3.6	0.19
Oregon	14.0	5.4	22.5	-4.7	-13.4	5.0	0.33
Pennsylvania	9.9	6.0	13.8	-7.9	-12.8	-2.7	<0.01
Rhode Island	15.9	0.5	31.3	—	—	—	—
South Carolina	17.3	11.6	23.0	-3.4	-8.4	1.8	0.2
South Dakota	10.1	0.0	42.4	—	—	—	—
Tennessee	15.7	10.0	21.4	-2.5	-8.2	3.6	0.41
Texas	19.2	16.5	21.8	-3.8	-5.9	-1.6	<0.01
Utah	14.5	1.3	27.6	-3.5	-17.2	12.5	0.65
Vermont	6.6	0.0	31.2	—	—	—	—
Virginia	14.3	9.6	19.1	-3.6	-8.7	1.7	0.18
Washington	15.6	9.4	21.9	-3.2	-9.5	3.5	0.34
West Virginia	12.4	0.0	28.6	—	—	—	—
Wisconsin	16.7	7.7	25.8	-3.1	-11.4	6.0	0.5
Wyoming	15.8	0.0	58.9	—	—	—	—

## References

1. Song R, Hall IH, Green TA et. al. Using CD4 Data to Estimate HIV Incidence, Prevalence, and Percent of Undiagnosed Infections in the United States. *J Acquir Immune Defic Syndr.* 2017 Jan 1;74(1):3-9.