Demographic Trends in US HIV Diagnoses, 2008–2017: Data Movies

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In this editorial, we introduce the data movie as a tool for investigating and communicating changing patterns of disease using the example of HIV in the United States. The Centers for Disease Control and Prevention currently tracks all new HIV diagnoses through the National HIV Surveillance System. Understanding what these data tell us is critical to the goal of ending the HIV epidemic in the United States.[1] However, summarizing trends across multiple population characteristics simultaneously—for example, exploring how the age distribution of new diagnoses varies by geographic region and how that relationship has changed over time—can be difficult. Because data movies allow us to visualize complex relationships more easily than large tables or paneled figures, they can help us take full advantage of our increasingly rich national surveillance data.

DATA DESCRIPTION

The Centers for Disease Control and Prevention provided counts of new diagnoses of HIV infection throughout the 50 states and the District of Columbia over the 10-year period from 2008 to 2017. Counts were stratified by calendar year, quarter, region (Northeast, Midwest, South, West), age group in years (13–14, 15–19, 20–24, 25–29, 30–34, 35–39, 40–44, 45–49, 50–54, 55–59, 60–64, ≥ 65), sex assigned at birth (male, female), and race/ethnicity (American Indian/Alaska Native, Asian, Black/African American, Hispanic/Latino, Native Hawaiian/other Pacific Islander, White, multiple races). Hispanic/Latino individuals may be of any race; all other groups are non-Hispanic. Our data included all diagnoses that occurred between 2008 and 2017 and had been reported to the Centers for Disease Control and Prevention by December 2018.

We converted counts of new diagnoses to rates by dividing the number of diagnoses by the total number of person-years in each stratum; the number of person-years was computed by using population denominators from the US Census Bureau's 2000 to 2010 State Intercensal Datasets (for 2008 and 2009) and Vintage 2018 state population estimates (for 2010–2017). We smoothed counts and rates across the four quarters of each calendar year to improve the interpretability of our data movies (details are provided in the Appendix, available as a supplement to the online version of this article at http://www.ajph.org).

We excluded the 13- to 14-year age group because it accounted for only 345 total diagnoses from 2008 to 2017. We also combined smaller racial/ethnic groups in our presentation of the total number of diagnoses by race/ethnicity but did not combine them when calculating rates to avoid masking differences between groups. Disaggregated counts and rates of diagnoses among American Indian/Alaska Native, Native Hawaiian/other Pacific Islander, and multiracial individuals are presented separately as Supplemental Data Movies. Estimated rates from strata with no diagnoses in a given quarter were excluded from calculations of rate ratios; this exclusion affected Asian females 15 to 19 years of age in quarter 4 (Q4) of 2009, Q4 of 2016, and Q1 of 2017 and Asian females 65 years or older in Q4 of 2008, Q4 of 2012, and Q1 and Q2 of 2013.

Using methods described elsewhere,[2] we produced data movies showing time trends in (1) counts of diagnoses by race/ethnicity, stratified by sex and region; (2) counts of diagnoses by race/ethnicity, stratified by age and sex; (3) diagnosis rates by race/ethnicity, stratified by age and sex; and (4) rate ratios comparing rates of diagnoses among racialized minority groups relative to Whites, stratified by age and sex. Data movies were produced in SAS version 9.4 (SAS Institute, Cary, NC). The computer code is provided in the Appendix.

RESULTS

The data movies and more detailed interpretations are available as a supplement to the online version of this article at http://www.ajph.org. Overall, we found that the rate of HIV diagnosis fell by 25% from 2008 through 2017, decreasing steadily from 19.4 to 14.5 diagnoses per 100 000 people. Although the overall rate of diagnosis decreased, large demographic disparities persisted or increased during this period. By the end of 2017, diagnoses were even more disproportionately concentrated in the southern states, among young males, and among people of color.

Data Movie 1 (available as a supplement to the online version of this article at https://www/ajph.org) illustrates the trend in the relative size of the epidemic across the four regions of the United States. Although the number of diagnoses decreased in all regions from 2008 to 2017, decreases in the South did not keep pace with decreases in the Northeast and Midwest. Data Movie 1 also shows the growing number of diagnoses among Hispanics/Latinos in the West, driving the 1.1% average annual increase in total diagnoses in that region from 2013 to 2017 (Figure 1).

Data Movies 2 and 3 illustrate the shift in the age distribution and the racial and ethnic composition of new diagnoses from 2008 to 2017. Among people with male sex at birth, we observed a dramatic shift in the age distribution of diagnoses from middle-aged to younger males, with nearly three times as many new diagnoses among males in their 20s as among males in their 40s by 2017. We also observed a consistently high burden of diagnoses among Black and Hispanic males relative to White and Asian males. Among people with female sex at birth, Blacks remained the most likely to be diagnosed with HIV, accounting for 60% of all females receiving an HIV diagnosis in 2017. Although the total number of diagnoses decreased over the period for most groups of females, the number of diagnoses increased among Asians and among females 60 years or older (Figures 2 and 3).

Data Movie 4 tracks racial and ethnic differences in diagnosis rates from 2008 to 2017. Throughout the period, racial and ethnic differences remained most pronounced among the oldest female groups and youngest male groups. Overall, the racial gap was greatest for Black versus White females; although differences between age-specific diagnosis rates narrowed over time, Black females still had an overall diagnosis rate 14 times that of White females in 2017 (Figure 4).

DISCUSSION

The first long-term analysis of trends in US HIV diagnoses was conducted in 2014, revealing that the national diagnosis rate had declined by one third from 2002 to 2011.[3] An updated analysis showed that the total number of HIV diagnoses in the United States decreased by 18.7% from 2008 to 2013.[4] Our findings extend these earlier analyses by four years, from 2013 to 2017. We found that the national diagnosis rate has continued to drop, owing to a gradual decrease in the number of new diagnoses paired with steady population growth. After the previously reported average annual decrease of 4% from 2008 to 2013, the total number of diagnoses remained stable from 2013 to 2016 and then declined by 3.3% from 2016 to 2017.

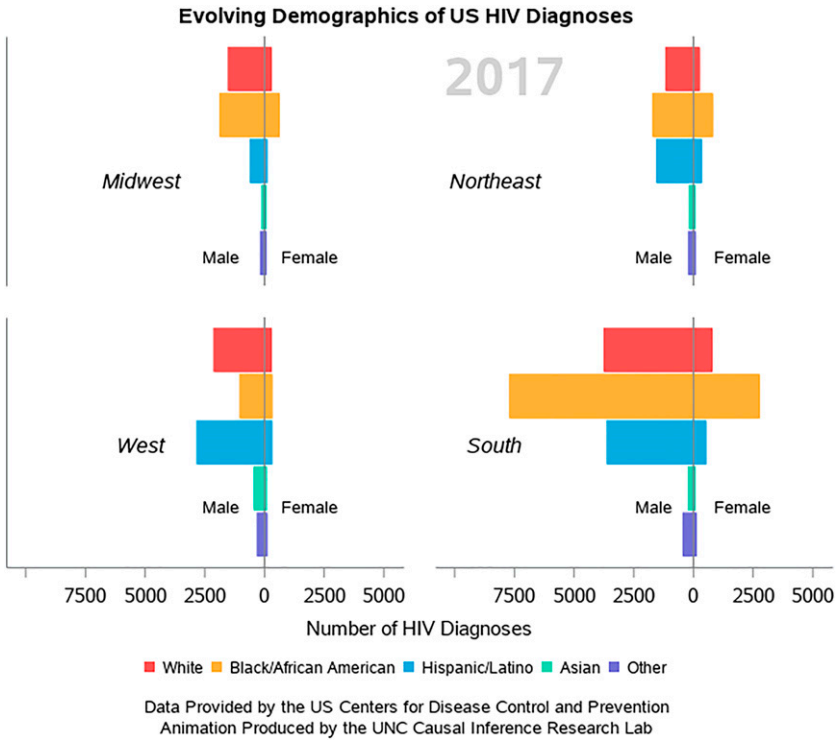

FIGURE 1— Still from Data Movie 1

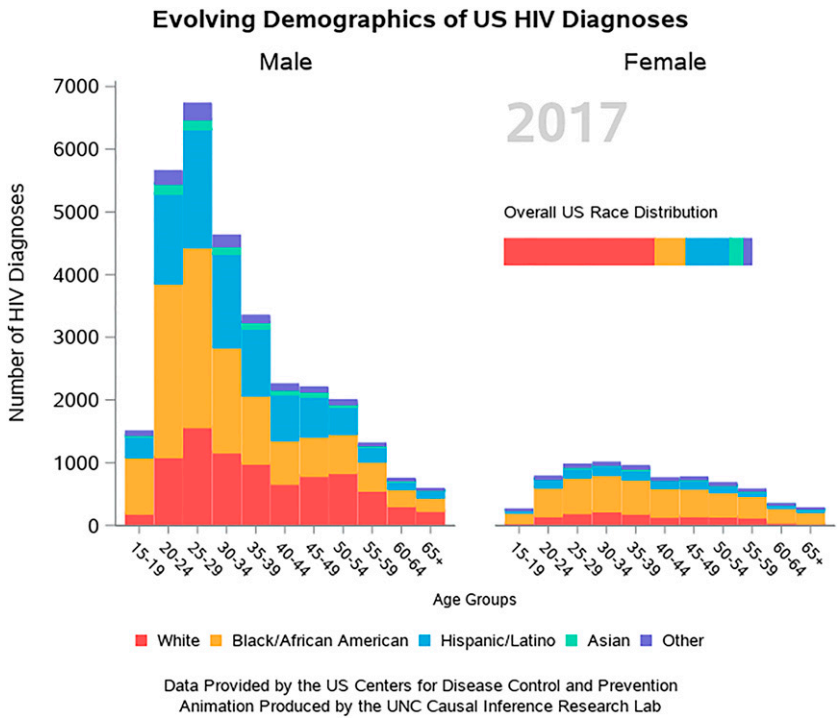

FIGURE 2— Still from Data Movie 2

One of the goals put forth by the Office of National AIDS Policy in 2010 was to reduce the disparity in new HIV diagnoses between people living in the South and the total US population by at least 15% between 2010 and 2020. However, the disparity ratio, rather than decreasing, increased by 12% from 2010 to 2017.[5] Alarming racial and ethnic differences also persisted throughout the period, with Black and Hispanic people receiving HIV diagnoses at much higher rates than White people. Such disparities may be the result of multiple factors, including but not limited to differences in testing access and uptake, differential access to preexposure prophylaxis, and differential access to care and treatment among people with HIV.

We also observed a striking shift in the age distribution of new diagnoses from middle-aged to younger males. Although we did not disaggregate diagnoses by mode of transmission, it is possible that higher rates of transmission among young men who have sex with men are at least partly responsible for the increasing proportion of diagnoses received by males in their 20s. A previous study reported that the overall diagnosis rate among males decreased by 27% from 2002 to 2011, but diagnoses attributed to male-to-male sexual contact among young males 13 to 24 years of age increased each year by an estimated 10.5% (95% confidence interval [CI] = 10.1%, 10.9%).[3] By 2014, owing to sustained decreases in all other transmission categories, more than two thirds of all new diagnoses were attributed to male-to-male sexual contact.[6]

As a result of the lag between time of infection and time of testing, trends in diagnoses may reflect earlier trends in incidence.[3] This lag is known to vary by population group. For example, among people with HIV diagnosed in 2016, median time from infection to diagnosis ranged from 29 months among Whites to 40 months among Blacks and 45 months among Hispanics.[7]

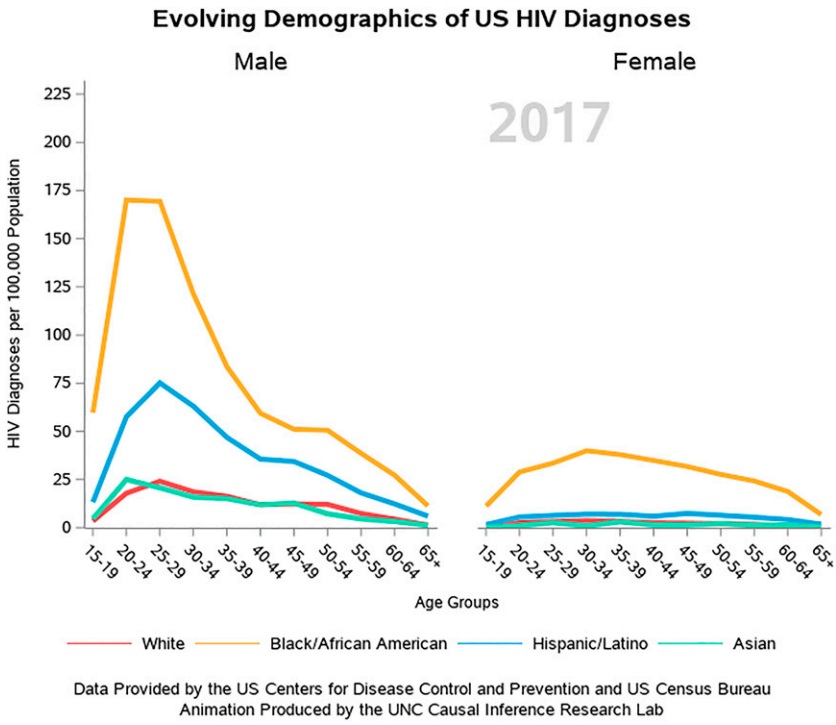

FIGURE 3— Still from Data Movie 3

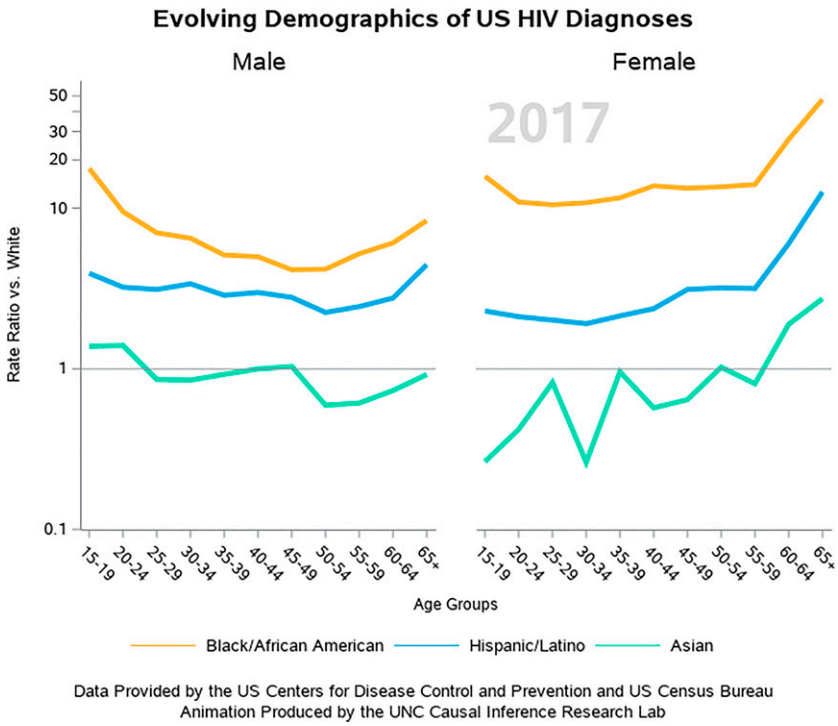

FIGURE 4— Still from Data Movie 4

Moreover, because the lag between infection and testing varies over calendar periods, trends in diagnoses conflate trends in incidence and trends in testing. Similarly, comparisons of rates between population groups (e.g., rate ratios) calculated from diagnosis data will yield conservative estimates of underlying disparities in incidence when the testing rate is higher in the reference group and exaggerated estimates of disparities when the testing rate is higher in the index group.

Despite these limitations, monitoring trends in diagnoses is a crucial step toward improving timely linkage to care, reducing onward transmission, and ultimately reducing HIV incidence and demographic disparities in incidence in the United States.

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PUBLICATION INFORMATION

Full Citation: Zalla LC, Edwards JK, Cole SR, Rudolph JE, Breger TL, Virkud A, Johnson AS, Hall HI. Demographic trends in US HIV diagnoses, 2008–2017: data movies. *Am J Public Health*. 2021;111(4):529–532.

Acceptance Date: December 14, 2020.

DOI: https://doi.org/10.2105/AJPH.2020.306131

CONTRIBUTORS

L. C. Zalla conducted the analysis and drafted the editorial. J. K. Edwards and S. R. Cole conceptualized the study, provided input on the analysis, and revised the editorial. J. E. Rudolph, T. L. Breger, and A. Virkud provided input on the analysis and revised the editorial. A. Satcher Johnson and H. I. Hall provided the data and revised the editorial.

ACKNOWLEDGMENTS

Funding for this study was provided by the National Institutes of Health through the University of North Carolina at Chapel Hill Center for AIDS Research (grant P30 AI50410).

Note. 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.

CONFLICTS OF INTEREST

The authors declare no conflicts of interest.

HUMAN PARTICIPANT PROTECTION

No protocol approval was needed for this research because no human participants were involved.

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