Epidemiology of HIV Infection in Large Urban Areas in the United States

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Abstract

Background: While the U.S. HIV epidemic continues to be primarily concentrated in urban area, local epidemiologic profiles may differ and require different approaches in prevention and treatment efforts. We describe the epidemiology of HIV in large urban areas with the highest HIV burden.

Methods/Principal Findings: We used data from national HIV surveillance for 12 metropolitan statistical areas (MSAs) to determine disparities in HIV diagnoses and prevalence and changes over time. Overall, 0.3% to 1% of the MSA populations were living with HIV at the end of 2007. In each MSA, prevalence was >1% among blacks; prevalence was >2% in Miami, New York, and Baltimore. Among Hispanics, prevalence was >1% in New York and Philadelphia. The relative percentage differences in 2007 HIV diagnosis rates, compared to whites, ranged from 239 (San Francisco) to 1239 (Baltimore) for blacks and from 15 (Miami) to 413 (Philadelphia) for Hispanics. The epidemic remains concentrated, with more than 50% of HIV diagnoses in 2007 attributed to male-to-male sexual contact in 7 of the 12 MSAs; heterosexual transmission surpassed or equaled male-to-male sexual transmission in Baltimore, Philadelphia, and Washington, DC. Yet in several MSAs, including Baltimore and Washington, DC, AIDS diagnoses increased among men-who-have sex with men in recent years.

Conclusions/Significance: These data are useful to identify local drivers of the epidemic and to tailor public health efforts for treatment and prevention services for people living with HIV.

Introduction

At the beginning of the human immunodeficiency virus (HIV) epidemic in the United States in the early 1980s, the majority of persons diagnosed with HIV were white and gay or bisexual men living in urban areas [1,2]. While the epidemic continues to be primarily concentrated in urban areas—92% of reported acquired immune deficiency syndrome (AIDS) cases in 2006 were among persons who resided in metropolitan areas with population >500,000 [3]—overall the proportion of HIV infections attributed to male-to-male sexual contact has decreased (75% of AIDS diagnoses in 1983 compared with 47% in 2007) and racial/ethnic minorities comprise disproportionate fractions of persons affected by the disease [1,4]. Such shifts in those impacted by the epidemic, in conjunction with increased prevalence due to wide availability of antiretroviral therapy, require shifts in prevention and care strategies. Similarly, local differences in the epidemiology of HIV require different approaches in prevention and treatment efforts.

Local HIV transmission dynamics may be influenced by differences in HIV prevalence among racial and ethnic groups or foreign-born populations at high risk for HIV infection, and behavioral factors conducive to HIV transmission. The proportion of minority populations differs between cities, which may affect HIV prevalence. Overall, the 2007 HIV diagnosis rate in 34 U.S. states among blacks/African Americans (76.7 per 100,000 population) was 8 times the rates among whites (9.2), and the lifetime risk of HIV diagnosis was estimated to be 1 in 16 for black/African American males and 1 in 30 for black/African American females compared to 1 in 104 for white males and 1 in 588 for white females [4,5]. Among Hispanics, the HIV diagnosis rate was 3 times (27.7) that for whites, and the lifetime risk of HIV infection was estimated at 1 in 33 for Hispanic men and 1 in 114 for Hispanic females. Similarly, the drivers of the epidemic—male-to-male sexual contact, injection-drug use, and heterosexual contact—may differ between cities. While specific information on the size of each risk population is very limited, some estimates exist that show marked differences between urban areas. For example, the prevalence of injection-drug use has been shown to vary 12-fold across metropolitan areas overall, and by race/ethnicity groups and over time [6,7]. It has been suggested that
such differential impact of the HIV epidemic in geographic areas and at-risk populations puts HIV prevalence among these groups on par with some countries in sub-Saharan Africa [8].

We used data from national HIV surveillance to describe the epidemiology of HIV in the 12 metropolitan areas with the largest burden of HIV. These data are useful to identify local drivers of the epidemic and to tailor public health goals and planning for treatment and prevention services for people living with HIV.

**Methods**

Since 1982, all 50 U.S. states and the District of Columbia report AIDS cases to the Centers for Disease Control and Prevention (CDC) in a uniform format. In 1994, CDC implemented data management for national surveillance of HIV integrated with AIDS case surveillance, at which time 25 states with confidential, name-based HIV surveillance started submitting case reports to CDC. Over time, additional states implemented name-based HIV surveillance and all states had implemented such surveillance by April 2008. All cases are reported to CDC without identifying information. Assessments of duplicate cases occur both on the state and national level (potential duplicates are identified based on soundex code [a phonetic algorithm for indexing names by sound, as pronounced in English] and selected demographic characteristics), and elimination of such cases occurs at the state level.

We used data on persons diagnosed with HIV infection (age >12 years) reported to CDC through June 2009 to describe the epidemiology of HIV in the 12 urban areas with the largest number of HIV diagnoses in 2007. Cases of HIV infection are counted by geographic area based on the person’s residence at earliest known HIV diagnosis. The Metropolitan Statistical Areas (MSAs), as defined by the Office of Management and Budget [9–11], included were Atlanta-Sandy Springs-Marietta, GA; Baltimore-Towson-MD; Chicago-Naperville-Joliet, IL-IN-WI; Dallas-Fort Worth-Arlington, TX; Houston-Sugar Land-Baytown, TX; Los Angeles-Long Beach-Santa Ana, CA; Miami-Fort Lauderdale-Pompano Beach, FL; New York-Northern New Jersey-Long Island, NY-NJ-PA; Philadelphia-Camden-Wilmington, PA-NJ-DE-MD; San Francisco-Oakland-Fremont, CA; Tampa-St. Petersburg-Clearwater, FL; Washington-Arlington-Alexandria, DC-VA-MD-WV. For each of these MSAs, more than 1,000 HIV and/or more than 500 AIDS diagnoses were reported for 2007. We also describe the epidemiology of HIV for large cities/counties within these MSAs, including Atlanta, Baltimore (Baltimore City County), Chicago, Dallas, Fort Lauderdale, Houston, Los Angeles (Los Angeles County), Miami (Miami-Dade County), New York (Bronx, Kings, New York, Queens, and Richmond Counties), Philadelphia (Philadelphia County), San Francisco City and County (San Francisco County), Tampa, and Washington, DC.

We determined the distribution in HIV diagnoses (all diagnoses regardless of stage of disease at diagnosis) in the urban areas by race/ethnicity, age, sex, country of birth (U.S. vs. foreign born) and transmission category using information on persons diagnosed with HIV in 2007. This allowed for 18 months of follow-up time for reporting of diagnoses to CDC (cases reported through June 2009). Because several of the areas included in these analyses did not have name-based HIV reporting for the time required to calculate adjustment weights for reporting delays, analyses are not adjusted for reporting delays. Analyses by transmission category (male-to-male sexual contact [men who have sex with men, MSM]; injection drug use [IDU]; MSM and IDU; heterosexual contact with a person known to have, or to be at high risk for, HIV infection; and other) were adjusted for missing risk factor information [12,13]. We also determined the number of persons living with HIV infection by race/ethnicity in the urban areas at the end of 2007.

Rates per 100,000 population were calculated for the MSAs overall and by race/ethnicity with population denominators based on official postcensal estimates from the U.S. Census Bureau [14]. Denominator data by race/ethnicity were available only for MSAs and counties; therefore, rates are not shown for cities that were not also defined by counties. Overall denominator data for cities not defined by counties were obtained from the U.S. Census Bureau estimates of the resident population for incorporated places over 100,000 and using the July 1, 2007 estimates [15]. Population denominators were not available to determine rates by transmission category.

It is well known that disparities in HIV burden exist among race/ethnicity groups. We explored inequities in HIV diagnosis rates within areas across populations using a relative measure of disparity recommended by the National Center for Health Statistics to compare variations in such inequities between areas [16]. We calculated the percentage difference in HIV diagnosis rates for each racial/ethnic group using the rates among whites as reference points [(rate of interest – rate among whites)/rate among whites*100] [16]. We also examined the correlation between MSA HIV prevalence and diagnosis rates by race/ethnicity and tested the significance of these correlations with the t-statistic.

To explore whether shifts in transmission dynamics have occurred over time, we determined trends in the proportion of persons diagnosed with AIDS by transmission category (percentage MSM and MSM-IDU) and race/ethnicity (percentage non-white) from 1985 through 2008. Analyses on AIDS diagnoses were adjusted for reporting delay and missing risk factor information [4,12,13].

**Results**

In 2007, a total of 52,755 adolescents and adults were diagnosed with HIV in the United States and reported to CDC by the end of June 2009. Of these, 43,024 (81.6%) were living in urban areas with populations of 500,000 or more, and 25,997 (49.3%) were living in the 12 MSAs included in our analyses. The rates of diagnosis of HIV infection in the MSAs ranged from 22.8 per 100,000 population (Chicago MSA) to 77.2 (Miami MSA) (Table 1), and in cities/counties ranged from 29.2 (Los Angeles County) to 246.4 (Washington, DC). Forty-eight percent (Tampa MSA) to 83.7% (Baltimore MSA) of the new diagnoses were among non-whites. The rate of new diagnoses among blacks/African Americans ranged from 71.9 (Chicago MSA) to 197.8 (Miami MSA) in the MSAs and 79.3 (Los Angeles County) to 364.6 (Washington, DC) among cities for which rates were available. Hispanics comprised 2.4% to 42.1% of persons newly diagnosed with HIV in 2007, with a range of rates in the MSAs from 21.1 (Dallas) to 70.1 (Philadelphia). Hispanics had also high rates of HIV diagnosis in the MSAs of Baltimore (54.7), Miami (54.9), New York (53.2) and Tampa (48.6). While rates were not available for all the cities within the MSAs, in some cities the rates were higher for blacks/African Americans or Hispanic/Latinos than in the MSA as a whole.

At the end of 2007, a total of 793,348 adolescents and adults were diagnosed and living with HIV in the United States and reported to CDC by the end of June 2009. Of these, 400,814 (50.3%) were diagnosed in the 12 MSAs and included in our analyses. More than 1% of the population of the Miami MSA was living with HIV infection by the end of 2007 (1021.8 per 100,000 population) (Table 2). Overall HIV prevalence was also high in the MSAs of New York (806.3 per 100,000), Baltimore (777.6), DC...
| Area of residence | Metropolitan Statistical Area | City | American | Black/African American | Hispanic/Latino | White | Total | Multi racial/other | Other |
|------------------|-----------------------------|------|----------|-----------------------|----------------|-------|-------|------------------|-------|
| Atlanta, GA      | Atlanta-Sandy Springs-Marietta, GA | Atlanta | 5.3 | 3.3 | 1.6 | 0.4 | 0.3 | 13.7 | 1/0.5 | 16.0 |
| Baltimore, MD    | Baltimore-Towson, MD         | Baltimore | 0.6 | 0.3 | 0.2 | 0.1 | 0.1 | 1.2 | 0.6 | 1.2 |
| Chicago, IL      | Chicago, IL-N,AWI            | Chicago | 1.8 | 1.6 | 1.5 | 1.4 | 1.4 | 3.2 | 1.4 | 3.2 |
| Dallas, TX       | Dallas                         | Dallas | 1.2 | 1.1 | 1.0 | 0.9 | 0.9 | 1.9 | 0.9 | 1.9 |
| Houston, TX      | Houston-Baytown-Sugar Land, TX | Houston | 1.2 | 1.1 | 1.0 | 0.9 | 0.9 | 1.9 | 0.9 | 1.9 |
| Los Angeles, CA  | Los Angeles, CA               | Los Angeles | 4.7 | 4.6 | 4.5 | 4.4 | 4.4 | 8.8 | 4.4 | 8.8 |
| Miami, FL        | Miami (Miami-Dade County)     | Miami | 1.2 | 1.1 | 1.0 | 0.9 | 0.9 | 1.9 | 0.9 | 1.9 |
| San Francisco, CA| San Francisco, CA             | San Francisco | 1.2 | 1.1 | 1.0 | 0.9 | 0.9 | 1.9 | 0.9 | 1.9 |
| Washington, DC   | Washington, DC               | Washington, DC | 1.2 | 1.1 | 1.0 | 0.9 | 0.9 | 1.9 | 0.9 | 1.9 |

Table 1. Numbers and rates (per 100,000 population) of adults and adolescents diagnosed with HIV infection in 2007, by race/ethnicity and area of residence, United States.

Because of the small populations of American Indian/Alaska Native populations in the cities, they are grouped with multiple races/other.

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### Table 2. Numbers and rates (per 100,000 population) of adults and adolescents living with HIV infection at the end of 2007, by race/ethnicity and area of residence, United States.

| Area of residence | Persons Living with HIV | Rate | Total* |
|-------------------|-------------------------|------|--------|
|                  | No. | %    | Rate  | No. | %    | Rate  | No. | %    | Rate  | No. | %    | Rate  | No. | %    | Rate  | No. | %    | Rate  | No. | %    | Rate  | No. | %    | Rate  | No. | %    | Rate  |
| Metropolitan City |    |      |       |     |      |       |     |      |       |     |      |       |     |      |       |     |      |       |     |      |       |     |      |       |     |      |       |
| Atlanta, GA       | 17  | 0.2  | 326.8 | 30  | 0.4  | 1,356.3 | 137 | 0.5 | 8,107.0 | 398 | 4.7 | 292.0 | 21  | 0.2  | 492.1 | 14  | 0.2  | 214.2 | 47  | 0.7  | 120.7 |
| Baltimore, MD     | 28  | 0.2  | 462.5 | 32  | 0.3  | 1,285.6 | 36  | 0.6 | 2,418.5 | 80  | 0.6 | 1,285.0 | 48  | 0.4  | 1,671.1 | 13  | 0.1  | 36.1  | 74  | 0.7  | 184.4 |
| Chicago, IL       | 42  | 0.2  | 547.1 | 50  | 0.5  | 2,091.3 | 19  | 0.3 | 1,424.4 | 126 | 1.1 | 282.2 | 26  | 0.2  | 512.0 | 32  | 0.3  | 1,356.1 | 76  | 0.7  | 184.2 |
| Dallas, TX        | 22  | 0.2  | 420.4 | 24  | 0.3  | 991.8  | 29  | 0.5 | 1,346.3 | 111 | 1.0 | 263.1 | 43  | 0.4  | 1,191.6 | 29  | 0.3  | 1,108.9 | 46  | 0.4  | 1,017.9 |
| Houston, TX       | 21  | 0.1  | 166.9 | 23  | 0.2  | 763.7  | 41  | 0.5 | 1,924.0 | 112 | 1.0 | 264.8 | 36  | 0.3  | 1,176.2 | 31  | 0.3  | 937.0  | 47  | 0.4  | 1,206.2 |
| Los Angeles, CA   | 43  | 0.2  | 547.1 | 50  | 0.5  | 2,091.3 | 19  | 0.3 | 1,424.4 | 126 | 1.1 | 282.2 | 26  | 0.2  | 512.0 | 32  | 0.3  | 1,356.1 | 76  | 0.7  | 184.2 |
| New York, NY      | 97  | 0.2  | 211.4 | 105 | 0.2  | 430.3  | 36  | 0.5 | 1,924.0 | 112 | 1.0 | 264.8 | 36  | 0.3  | 1,176.2 | 31  | 0.3  | 937.0  | 47  | 0.4  | 1,206.2 |
| Philadelphia, PA  | 82  | 0.2  | 223.9 | 103 | 0.3  | 380.2  | 51  | 0.8 | 1,941.9 | 112 | 1.0 | 264.8 | 36  | 0.3  | 1,176.2 | 31  | 0.3  | 937.0  | 47  | 0.4  | 1,206.2 |
| San Francisco, CA | 100 | 0.5  | 420.4 | 105 | 0.5  | 1,539.0 | 35  | 0.2 | 1,131.0 | 112 | 1.0 | 264.8 | 36  | 0.3  | 1,176.2 | 31  | 0.3  | 937.0  | 47  | 0.4  | 1,206.2 |

*Includes persons of unknown race/ethnicity. Because of small populations of Native Hawaiians and other Pacific Islanders they are grouped with multiple races/other.

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About 14% (Los Angeles and San Francisco MSAs) to 36.5% (Baltimore MSA) of persons diagnosed with HIV in 2007 were women; the majority of these infections were attributed to heterosexual contact (Table 3). Baltimore MSA (30.3%) and San Francisco MSA (27.0%) had the highest percentages of women with reported IDU. Among men diagnosed with HIV, in the MSAs more than 70% were MSM except in Baltimore (52.4%), New York (66.9%), Philadelphia (46.9%) and Washington (65.3%) (Table 4). Heterosexual contact accounted for about 20% of HIV infections among men in DC, Miami, and Baltimore MSAs, and more than 50% in Chicago (610), Houston (635), New York (716), Philadelphia (721), Atlanta (771), and Washington (961). For Hispanics/Latinos, the percentage difference ranged from 15% (Miami) to 413% (Philadelphia); the percentage difference was less than 100% in San Francisco (20), Los Angeles (22), Dallas (29), Tampa (70), Houston (92) and higher in Chicago (110), Washington (151), Atlanta (180), Baltimore (285), and New York (306). HIV diagnosis rates were lower for Asians than whites in all MSAs, and numbers were low in American Indian/Alaska Native populations and therefore, relative percentage differences are not presented. Diagnosis rates were correlated with HIV prevalence rates among blacks (r = .31, p < 0.01), Hispanics (r = .76, p < 0.01), and whites (r = .71, p = 0.01) but not among Asians or American Indians/Alaska Natives.

About a fifth of the persons diagnosed with HIV in Baltimore, Miami, and Tampa MSAs were aged less than 30 years at diagnosis, while more than 36% of diagnoses were among this age group in Atlanta, Chicago, Dallas, Houston, and Los Angeles (Figure 1). Conversely, in MSAs with the lowest percentage of diagnoses among the young more than 20% of diagnoses were among those aged 50 years or older. While information on country of birth was incomplete (data completeness ranged from less than 1% to almost 50%), some differences emerged with the largest percentage of persons diagnosed with HIV who were foreign-born in Los Angeles (21.1%), followed by Miami (14.9), San Francisco (10.3%), Houston (10.5%), New York (9.0%), Tampa (7.0%), and Chicago (5.0%) (data not shown).

About 14% (Los Angeles and San Francisco MSAs) to 36.5% (Baltimore MSA) of persons diagnosed with HIV in 2007 were whites, comprising an increasing percentage of persons diagnosed with HIV and AIDS in recent years, indicating racial/ethnic disparities in AIDS diagnoses persist and continue to grow (Figure 3).

Discussion

This is the first report using national surveillance data to describe the epidemic of HIV in urban areas. In these 12 MSAs with a high burden of disease, more than 1% of the black population was living with HIV at the end of 2007 and prevalence was more than 2% in Miami, New York, and Baltimore. Among Hispanics, prevalence was above 1% in New York and Philadelphia. Prevalence generally was even higher in cities within MSAs, with HIV prevalence even among whites above 1% in Washington DC and above 2% in San Francisco. While racial/ethnic disparities exist in all areas, the relative percentage differences in 2007 HIV diagnosis rates varied widely. In addition, the drivers of the epidemic have shifted in some areas, with...
increased transmission now among heterosexual populations as well as MSM.

The World Health Organization categorizes the HIV epidemics of countries as low-level, concentrated, and generalized depending on HIV prevalence and diffusion of HIV transmission in different subpopulations [17], and some authors have suggested that some U.S. MSAs may be experiencing generalized epidemics [18]. In the past, with the majority of new HIV infections attributed to male-to-male sexual contact and the high HIV prevalence rates among MSM, findings indicated a concentrated HIV epidemic in the United States [19–21]. Overall, 53% of HIV diagnoses in 2007 were among MSM in 34 states with mature HIV reporting systems [4]. Our analyses show that the epidemic remains concentrated with more than 50% of the all HIV diagnoses in 2007 attributed to male-to-male sexual contact in 7 of the 12 MSAs. Heterosexual transmission surpassed or equaled male-to-male transmission in Baltimore, Philadelphia, and Washington, DC. However, increases in HIV transmission through heterosexual exposure may be fueled by men who have sex with men and women and IDU rather than indicate a generalized epidemic. In addition, our results reflect the trends in increasing incidence among MSM [19]. In our analyses, we were not able to determine the HIV risk factors among sex partners of persons diagnosed with HIV.

HIV diagnosis and prevalence rates for the MSAs and the cities, where available, indicate marked differences between areas overall and among race/ethnicity subpopulations. Even areas that appear similar may be very different in terms of the drivers of the local epidemic. For example, while the HIV prevalence in the cities of Washington and San Francisco both exceeded 2%, and prevalence was high among blacks, Hispanics, and whites, the majority of HIV diagnoses were attributed to male-to-male sexual contact in San Francisco while in Washington the percentage of diagnoses attributed to male-to-male sexual contact and heterosexual contact was about the same.

There may be several explanations for differences in racial/ethnic disparities between areas. Lower disparity may be due to differences between areas in mixing between racial/ethnic populations and prevalence rates within racial/ethnic groups, the type of epidemic (e.g., San Francisco and Los Angeles continue to have concentrated epidemics with the majority of diagnoses attributed to male-to-male sexual contact), or better penetration of HIV testing among all race/ethnicity groups with linkage to care and fewer undiagnosed persons. For example, the HIV prevalence rate among whites is relatively high in Miami and San Francisco and may explain why these areas have relatively lower disparities. In some areas a higher proportion of persons diagnosed with HIV

| Metropolitan Statistical Area | IDU | Heterosexual contact | Other | Total |
|-------------------------------|-----|----------------------|-------|-------|
| City                          | No. | %                    | No.   | %     | No.  | %     | No.  | %     |
| Atlanta-Sandy Springs-Marietta, GA | 72  | 17.5                 | 334   | 81.3  | 5    | 1.2   | 411  |
| Atlanta                       | 34  | 18.4                 | 148   | 79.7  | 4    | 1.9   | 186  |
| Baltimore-Towson, MD          | 158 | 30.3                 | 360   | 69.2  | 3    | 0.5   | 520  |
| Baltimore                     | 126 | 32.5                 | 261   | 67.2  | 1    | 0.4   | 389  |
| Chicago, IL-IN-WI             | 90  | 24.7                 | 270   | 73.9  | 5    | 1.5   | 365  |
| Chicago                       | 67  | 25.3                 | 194   | 72.9  | 5    | 1.8   | 266  |
| Dallas, TX                    | 33  | 11.8                 | 243   | 87.6  | 2    | 0.7   | 278  |
| Kansas                        | 13  | 8.8                  | 131   | 90.9  | 0    | 0.3   | 144  |
| Houston-Baytown-Sugar Land, TX | 60  | 15.8                 | 319   | 83.5  | 3    | 0.8   | 382  |
| Houston                       | 34  | 11.7                 | 253   | 87.4  | 3    | 0.9   | 289  |
| Los Angeles, CA               | 59  | 16.3                 | 296   | 81.7  | 7    | 2.0   | 363  |
| Los Angeles (Los Angeles County) | 49  | 15.7                 | 255   | 81.9  | 7    | 2.4   | 311  |
| Miami, FL                     | 100 | 10.1                 | 887   | 89.7  | 3    | 0.3   | 989  |
| Miami (Miami-Dade County)     | 38  | 9.0                  | 386   | 90.9  | 1    | 0.1   | 425  |
| Fort Lauderdale               | 21  | 12.3                 | 146   | 87.5  | 1    | 0.2   | 167  |
| New York, NY-NJ-PA            | 334 | 20.5                 | 1276  | 78.4  | 18   | 1.1   | 1627 |
| New York                      | 227 | 20.5                 | 872   | 78.7  | 9    | 0.9   | 1109 |
| Philadelphia, PA-NJ-DE-MD     | 88  | 18.1                 | 398   | 81.6  | 1    | 0.3   | 488  |
| Philadelphia                  | 57  | 16.6                 | 285   | 83.4  | 1    | 0.6   | 342  |
| San Francisco, CA             | 39  | 27.0                 | 106   | 72.4  | 1    | 0.6   | 146  |
| San Francisco City & County   | 21  | 41.8                 | 28    | 57.6  | 0    | 0.6   | 49   |
| Tampa-St. Petersburg-Clearwater, FL | 39  | 17.4                 | 185   | 82.3  | 1    | 0.3   | 225  |
| Tampa                         | 13  | 12.2                 | 95    | 87.5  | 0    | 0.3   | 109  |
| Washington, DC-VA-MD-WV       | 126 | 15.3                 | 695   | 84.0  | 6    | 0.7   | 827  |
| Washington, DC                | 72  | 21.4                 | 265   | 78.3  | 1    | 0.3   | 338  |

Table 3. Numbers and percentages of adult and adolescent females diagnosed with HIV infection, by transmission category and area of residence, United States, 2007.

Transmission category has been adjusted for missing risk factor information.
IDU, injection-drug use.
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Table 4. Numbers and percentages of adult and adolescent males diagnosed with HIV infection, by transmission category and area of residence, United States, 2007.

| Metropolitan Statistical Area | MSM | IDU | MSM/IDU | Heterosexual contact | Other | Total |
|------------------------------|-----|-----|---------|---------------------|-------|-------|
| City                         | No. | %   | No.     | %                   | No.   | %     | No.   |
| Atlanta-Sandy Springs-Marietta, GA | 1025 | 77.7 | 82 | 6.2 | 43 | 3.3 | 164 | 12.4 | 5 | 0.4 | 1,319 |
| Atlanta                      | 581 | 79.1 | 44 | 6.0 | 23 | 3.1 | 86 | 11.7 | 1 | 0.1 | 735  |
| Baltimore-Towson, MD         | 473 | 52.4 | 221 | 24.4 | 32 | 3.5 | 175 | 19.4 | 3 | 0.3 | 903  |
| Baltimore                    | 312 | 48.8 | 180 | 28.1 | 23 | 3.5 | 124 | 19.3 | 2 | 0.3 | 641  |
| Chicago, IL-IN-WI            | 1121 | 79.9 | 129 | 9.2 | 50 | 3.5 | 98 | 7.0 | 6 | 0.4 | 1,403 |
| Chicago                      | 826 | 79.1 | 104 | 10.0 | 39 | 3.7 | 73 | 7.0 | 3 | 0.3 | 1,044 |
| Dallas, TX                   | 872 | 85.6 | 46 | 4.5 | 28 | 2.7 | 71 | 6.9 | 3 | 0.3 | 1,019 |
| Dallas                       | 477 | 87.3 | 22 | 4.0 | 15 | 2.7 | 32 | 5.8 | 1 | 0.2 | 547  |
| Houston-Baytown-Sugar Land, TX | 700 | 71.6 | 221 | 24.4 | 32 | 3.5 | 175 | 19.4 | 3 | 0.3 | 978  |
| Houston                      | 584 | 73.7 | 38 | 4.8 | 30 | 3.8 | 140 | 17.7 | 1 | 0.1 | 793  |
| Los Angeles, CA              | 2064 | 88.3 | 88 | 3.8 | 105 | 4.5 | 76 | 3.3 | 4 | 0.2 | 2,337 |
| Los Angeles (Los Angeles County) | 1794 | 88.7 | 64 | 3.2 | 90 | 4.4 | 72 | 3.6 | 3 | 0.1 | 2,023 |
| Miami, FL                    | 1755 | 69.9 | 127 | 5.1 | 87 | 3.4 | 538 | 21.4 | 4 | 0.2 | 2,511 |
| Miami (Miami-Dade County)    | 826 | 68.2 | 68 | 5.6 | 42 | 3.5 | 274 | 22.6 | 2 | 0.1 | 1,212 |
| Fort Lauderdale              | 354 | 74.7 | 24 | 5.0 | 22 | 4.6 | 73 | 15.4 | 1 | 0.3 | 474  |
| New York, NY-NJ-PA           | 2796 | 66.8 | 664 | 15.9 | 120 | 2.9 | 603 | 14.4 | 5 | 0.1 | 4,188 |
| New York                     | 2071 | 68.1 | 453 | 14.9 | 90 | 3.0 | 421 | 13.8 | 4 | 0.1 | 3,039 |
| Philadelphia, PA-NJ-DE-MD    | 591 | 46.9 | 204 | 16.2 | 39 | 3.1 | 427 | 33.8 | 0 | 0.0 | 1,261 |
| Philadelphia                 | 371 | 42.7 | 147 | 17.0 | 27 | 3.1 | 324 | 37.3 | . | . | 869  |
| San Francisco, CA            | 728 | 77.8 | 61 | 6.5 | 85 | 9.1 | 62 | 6.6 | 1 | 0.1 | 936  |
| San Francisco City & County | 410 | 77.6 | 30 | 5.6 | 67 | 12.6 | 22 | 4.2 | 0 | 0.0 | 528  |
| Tampa-St. Petersburg-Clearwater, FL | 560 | 80.5 | 45 | 6.5 | 23 | 3.3 | 66 | 9.5 | 1 | 0.2 | 695  |
| Tampa                        | 236 | 77.9 | 20 | 6.6 | 9 | 3.1 | 38 | 12.4 | 0 | 0.0 | 303  |
| Washington, DC-VA-MD-WV     | 1191 | 65.3 | 170 | 9.3 | 67 | 3.7 | 390 | 21.4 | 7 | 0.4 | 1,825 |
| Washington DC                | 590 | 64.7 | 104 | 11.4 | 39 | 4.3 | 176 | 19.3 | 2 | 0.3 | 911  |

Transmission category has been adjusted for missing risk factor information. 
MSM, male-to-male sexual contact. 
IDU, injection-drug use. 
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was born outside of the United States. However, it is unclear if they were infected in the United States or abroad. In general, foreign-born persons are less likely to have health insurance, and may be more vulnerable to HIV infection where male dominant relationship dynamics exist, men are targeted by sex workers, or behaviors change as it is easier to engage with multiple sex partners in the new country [22]. Women, on the other hand, may have more access to health and social services due to reproductive services.

Correlations between HIV prevalence and diagnosis rates, in our analysis observed for blacks, Hispanics, and whites, are expected as persons would be more likely to encounter HIV-positive partners in areas with higher prevalence. However, a goal to reduce prevalence is unlikely met in the near future, as prevalence is expected to rise as people with HIV live longer with better antiretroviral treatments regimens and with earlier initiation of treatment [23]. Therefore, the nearer goal should be to assure the early detection of HIV infection and diagnosis of infection among persons unaware of their infections status, and linkage to care and prevention services to reduce transmission rates [24].

There is evidence that persons aware of their HIV-positive status reduce risk behaviors and can therefore impact transmission rates [25]. However, about 21% of persons infected with HIV are unaware of their infection [26] and not all who need treatment are receiving it; these persons contribute disproportionately to HIV transmission rates through risk behavior and high viral loads. To identify all HIV infections among the undiagnosed and as early as possible, CDC recommends routine HIV screening in all health-care settings for persons aged 13—64 years and pregnant women and retesting at least annually for all persons at high risk for HIV [27]. CDC has expanded the HIV testing initiative to increase testing and knowledge of HIV status and to reach more U.S. jurisdictions and populations at risk, including African-American men and women, gay and bisexual men, and male and female Latinos and injection-drug users [28]. Many cities have also implemented intensified testing and prevention efforts coupled with public education campaigns. For example, the New York City Department of Health and Mental Hygiene is implementing a large-scale initiative, The Bronx Knows, to increase voluntary HIV testing and provide access to quality care and prevention [29]. The District of Columbia has implemented intensified testing, linkage to care, free condom distribution, and needle exchange to address the high HIV transmission in the District [30].
In addition, proven behavioral interventions for high-risk populations exist [31] and such interventions have shown to reduce risk behavior by 20 to over 40% [32]. Therefore, interventions should also include education campaigns and interventions for HIV-negative persons at risk for infection. However, while many of these interventions have been implemented in prevention programs across the country, evidence suggests individual interventions reach only a low proportion of MSM [33].

Our analyses are subject to several limitations. Because we were not able to adjust for reporting delays, we may have underestimated the number of new HIV diagnoses in 2007 and the number of persons living with HIV; the latter may also be an underestimate in areas that have recently transitioned from code to name-based HIV reporting and that have been unable to re-ascertain all persons with HIV with names (the code-based data are not reported to CDC). Our analyses also do not include persons who have not been diagnosed. Information on country of birth was incomplete in some areas, ranging up to 49% of cases missing this information. Finally, we were not able to calculate rates for all cities as denominator data were not available by race/ethnicity for all of them.

In summary, we found that epidemic profiles differ in local areas of the United States. These data are useful to identify local drivers
of the epidemic and to tailor public health efforts for treatment and prevention services for people living with HIV. HIV prevention efforts should include, as appropriate for the local population, HIV testing and prevention interventions with HIV-positive persons and persons at high risk for infection.

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Author Contributions

Conceived and designed the experiments: HHI NB. Analyzed the data: HHH LE. Contributed reagents/materials/analysis tools: LE YWH. Wrote the paper: HHI NB. Interpretation of data: LE YWH.

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