HIV Incidence Surveillance in Arizona

Arizona participates in a Centers for Disease Control and Prevention (CDC) funded initiative that collects information for the purpose of making annual national and state estimates of the number of new HIV infections. Traditionally, this has been estimated by the number of new HIV/AIDS diagnoses that are reported to the Health Department. When HIV diagnoses go up or down, it is not clear whether the change is the result of a success in promoting HIV testing, or of a failure in preventing HIV infection or in changes in surveillance activities. Knowing whether new diagnoses are recent or long term infections provides a more accurate picture of who is currently at increased risk of HIV infection and assists in the evaluation of the effectiveness of HIV prevention programs.

With new laboratory advances recent and long-term infections can be distinguished on a population level. After being infected by HIV the levels of HIV specific Immunoglobulin G (IgG) antibody increase slowly in the body over several months and are maintained throughout the chronic infection. The Serologic Testing Algorithm for Recent HIV Seroconversion (STARHS) method uses a comparison of two HIV enzyme-linked immunosorbent assays (EIA). The first EIA is the test used for routine diagnosis which detects very low levels of HIV specific IgG antibodies. The second EIA measure is less sensitive and is only capable of detecting samples with a higher concentration of antibodies that is associated with a long-standing infection. If the infection has occurred recently, (in the last 162 days with a standard error of 8.5 days) the second assay will be less reactive.

The STARHS method currently uses the Calypte HIV-1 BED Capture EIA, which approved only for surveillance use and cannot be used for diagnostic or clinical purposes. It is performed on leftover serum from the diagnostic, confirmed-positive specimen. The Arizona Department of Health Services (ADHS) coordinates the shipment of the remnant serum to the CDC New York State STARHS Lab for testing. If the original diagnostic specimen is not available, a subsequent serum or plasma specimen obtained within 3 months of diagnosis is acceptable for testing.

The specimens from those who are diagnosed with AIDS within 6 months of HIV diagnosis are classified as longstanding infections. ADHS collects Antiretroviral (ARV) use history as specimens from individuals who took ARV therapy within the 6-month period before the specimen was collected are not eligible for the STARHS test. This would produce false "recent" results.

In addition to the results from the STARHS test, the statistical model for estimating HIV incidence, shown below, requires information on testing history.

$$\text{Number of new HIV infections} = \frac{\text{Number of BED recent specimens}}{\text{Probability of being classified as recent}}$$

The probability of being classified as a recent infection is different for first time testers and repeat testers; therefore, ADHS collects information on the dates and numbers of previous HIV negative tests to classify new and repeat testers. For testers who had previously had an HIV test, the probability of being classified as recent is based on the time from the last negative HIV test to first positive test. For those who were diagnosed as HIV+ at their first test, the probability of being classified as recent is based on the probability of being diagnosed with AIDS at the time of HIV diagnosis.

All of these pieces of information are combined in a statistical model which provides the estimated number of new HIV infections that occur in a given year. This information, along with accompanying confidence intervals is presented in the following section.

2006-2009 National (CDC) HIV Incidence Estimates

On August 3, 2011 the CDC released an incidence estimate for the 2006-2009 years.

- In 2006 there were an estimated 48,600 (95% confidence interval [CI]: 42,400-54,700) new HIV infections in the United States. [1]
- In 2007 there were an estimated 56,000 (95% CI: 49,100-62,900) new HIV infections.[1]
- In 2008 there were an estimated 47,800 (95% CI: 41,800-53,800) new HIV infections.[1]
- In 2009 there were an estimated 48,100 (95% CI: 42,200-54,000) new HIV infections.[1]

The CDC describes the incidence of HIV infection as stable over the 4 year time period, but notes several disparities among racial and age groups. The CDC described, "During this time, there was an estimated 21% increase in HIV incidence for people aged 13-29 years, driven by a 34% increase in young MSM (the only group to experience a significant increase in incidence in this age range). Among MSM aged 13-29, HIV incidence among black/African American MSM increased significantly (48%) from 2006 through 2009 with a statistically significant 12.2% estimated annual percentage increase." [1] The reasons for these disparities remain unclear at this time period.[1]

2006-2009 Arizona HIV Incidence Estimates

The CDC model estimated the HIV incidence for Arizona during the 2006-2009 time period. For this time period, Arizona had 1,978 persons aged 13 years or older with reported HIV (non AIDS) diagnoses. As discussed, this is not a precise way to measure new infections as HIV diagnoses may occur years after initial infection. The CDC model estimated that there were

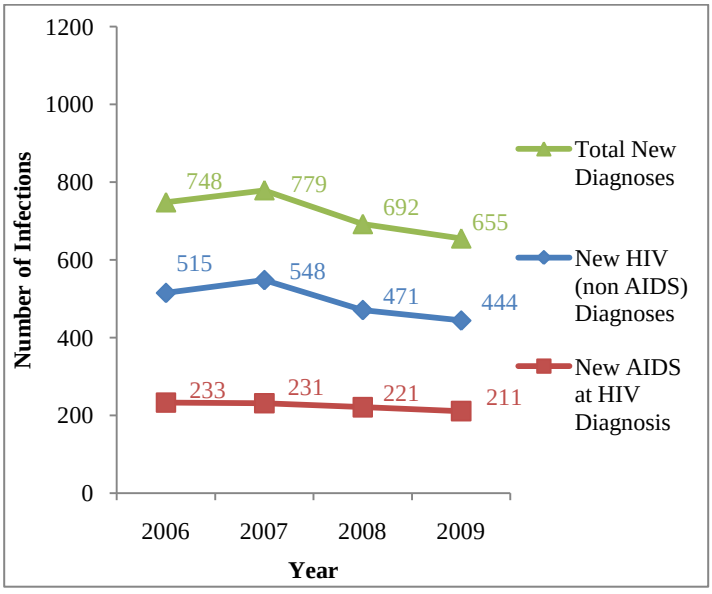
[1]HIV Incidence. Accessed on August 3, 2011. http://www.cdc.gov/hiv/topics/surveillance/incidence.htm
[2]Hall HI et al. *J Acquir Immune Defic Syndr.* 2010 Oct 1;55(2):271-6.
[3]Prejean J, Song R, Hernadez A, Ziebell R, Green T, et al. (2011) Estimated HIV Incidence in the United States, 2006-2009. PLoS ONE 6(8):e17502. Doi:10.1371/journal.pone.0017502
[4] CDC Estimates of New HIV Infection in the United States. Accessed on August 2, 2011. http://www.cdc.gov/hiv/topics/surveillance/resources/factsheets/incidence.htm

2,772 new HIV infections during this time period or about 700 per year. There is an increase in incidence from 2006 to 2007, and a decrease from 2007 to 2008, which mirrors the significant changes in the national estimate. The CDC is still exploring what this increase means, but cannot attribute the increase in 2007 to one factor. Due to Arizona's low number of cases in certain categories, analysis by gender, transmission category, age, and race could not be conducted. Graph 1 shows the new reported diagnoses of HIV/AIDS in Arizona from 2006-2009. Graph 2 shows the trend in estimated new HIV infections. The 95% confidence intervals for the new estimates are included.

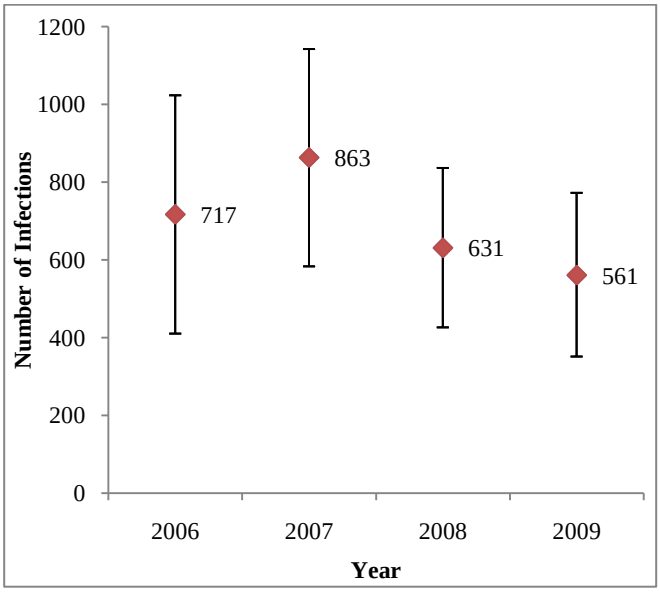
Chart 1: Comparing Arizona Actual and Estimated New HIV Infections, 2006-2009

Year	2006	2007	2008	2009
New HIV (non AIDS) diagnoses	515	548	471	444
New AIDS at HIV Diagnosis	233	231	221	211
Total New Diagnoses	**748**	**779**	**692**	**655**
Estimated New Infections	**717**	**863**	**631**	**561**

Graph 1: AZ 2006-2009 New HIV/AIDS Diagnoses



Graph 2: AZ 2006-2009 HIV Incidence Estimate (95% CI)



[1]HIV Incidence. Accessed on August 3, 2011. http://www.cdc.gov/hiv/topics/surveillance/incidence.htm
[2]Hall HI et al. *J Acquir Immune Defic Syndr.* 2010 Oct 1;55(2):271-6.
[3]Prejean J, Song R, Hernadez A, Ziebell R, Green T, et al. (2011) Estimated HIV Incidence in the United States, 2006-2009. PLoS ONE 6(8):e17502. Doi:10.1371/journal.pone.0017502
[4] CDC Estimates of New HIV Infection in the United States. Accessed on August 2, 2011. http://www.cdc.gov/hiv/topics/surveillance/resources/factsheets/incidence.htm

Implications

With the advances in anti-retroviral medication and care, individuals with HIV/AIDS are living longer lives; therefore, the time possible to transmit the virus increases. Current prevention efforts have helped keep the estimated number of new HIV infections stable; however, studies have shown that if prevention efforts are not intensified this number will increase.[2] The National 2010 HIV/AIDS Strategy necessitates that populations most affected by HIV/AIDS receives prevention program attention. The national incidence estimate and current surveillance data illustrate that African Americans, Hispanic, and young MSM represent special populations that need urgent attention.[3] The CDC estimates "that one-quarter of HIV-infected people are unaware of their HIV infection and that these persons account for more than half of all new infections"; therefore universal testing and prevention efforts must continue to be at the forefront of the fight against HIV/AIDS.[4]

Additional Resources

Centers for Disease Control and Prevention

- www.cdc.gov
- http://www.cdc.gov/hiv/topics/surveillance/index.htm
- http://www.cdc.gov/hiv/topics/surveillance/incidence.htm
- http://www.plosone.org/article/info%3Adoi%2F10.1371%2Fjournal.pone.0017502

National HIV/AIDS Strategy

- http://aids.gov/