Estimates of HIV Incidence Rates in Michigan, 2010-2014

Key Findings

Michigan's total HIV incidence rate was stable overall for 2010-2014. In 2014, Michigan had an estimated 651 new infections or 7.8 new infections per 100,000 people.

Michigan males, black persons, men who have sex with men (MSM) and those under 34 years of age have the highest incidence rates and counts.

An apparent increase in the overall incidence estimate for 2013 noted in our previous report was likely attributable to small sample sizes and the statistical model used to create the estimates, as the estimate returned to a more typical level in 2014.

Young, black MSM continue to be disproportionately impacted by the epidemic.

Introduction

Since 2005, Michigan has participated in a Centers for Disease Control and Prevention (CDC)-funded initiative called STARHS (Serologic Testing Algorithm for Recent HIV Seroconversion). The goal of STARHS is to estimate HIV incidence, or the number of new infections occurring each year, nationally as well as at the state level. HIV incidence data differ from traditionally reported prevalence data and from the number of new diagnoses. Incidence data estimate the total number of diagnosed and undiagnosed new infections in a particular year. Prevalence data measure everyone living with HIV, including newly diagnosed cases that may have been infected at any time.

HIV incidence data have important public health implications because they provide information on where recent infections are occurring. The data assist in evaluating HIV intervention and prevention programs for effectiveness; in targeting prevention efforts associated with ongoing transmission; and in allocating resources to populations in greatest need of prevention efforts.

Michigan has released local incidence estimates in parallel with CDC national estimates since the 2006 estimates that were released in 2008. Presented in this document are Michigan's updated incidence estimates for 2010 through 2014. National estimates, when released, will provide greater context for the Michigan data during this period.

Methods

STARHS uses results of a laboratory test for incidence (either BED assay or avidity assay[1,2]) along with data collected on newly diagnosed cases' testing history and antiretroviral use to estimate HIV incidence for the whole population, including those not yet diagnosed. The incidence test is performed on available leftover serum from diagnostic, confirmed-positive specimens. The remnant serum is sent without name to the New York State STARHS Lab for testing after HIV infection has been confirmed. If the original diagnostic specimen is not available, a subsequent blood specimen obtained within three months of HIV diagnosis is acceptable for testing.

The incidence assays are enzyme immunoassays that classify each HIV infection as recent or long-standing based on the amount of HIV-specific antibody present in each sample (BED) or by the strength of antibody binding (avidity), which tends to increase over time. A recent incidence result indicates HIV infection in approximately the previous six months. Test results are not reliable enough to report on an individual basis, but across a large population they do provide the foundation to estimate the number and rate of new HIV infections occurring each year in the population.

We used a set of statistical programs provided by CDC to estimate HIV incidence at the state level[1,2]. These programs use a stratified extrapolation approach (inference of incidence rates by subgroups) with multiple imputation (statistical technique for analysis of incomplete data). Similar to our previous 2009-2013 incidence report, reporting delay weights were not applied to account for cases diagnosed but not yet reported to the surveillance program by January 2016. Reporting of HIV cases for 2010 through 2014 was largely completed by January 2016 and reporting delay weights are noted to not affect incidence estimates to a significant degree in the past.

Rates per 100,000 population were calculated for all cases greater than 12 years of age at diagnosis using the estimated population for each year found in the "Bridged-Race Population Estimates," calculated by the National Center for Health Statistics and based on the U.S. Census Bureau population estimates[3]. Data are presented in this report for subgroups (such as sex, race, age and risk) where there are a minimum of 200 reported HIV cases, 40 incidence tests (or 20% completeness), and ten recent incidence results. Age groups are based on *age at infection,* which is derived from age at diagnosis and recency result. Risk groups include men who have sex with men (MSM, excluding MSM/IDU), injection drug users (IDU, including MSM/IDU), and heterosexuals. Since reliable denominator data are not available for risk groups, counts are reported instead of rates for those groups. Estimates for select sub-populations are also included, such as counts for men who have sex with men (MSM) by race and age.

Counts and/or rates were considered stable if their confidence intervals (CIs) overlapped. This indicates that the counts and/or rates did not change significantly over time.

Results

Michigan's HIV incidence rates were stable through the five-year period of 2010 to 2014 (Table 1). During that period, Michigan's incidence rates ranged from a low of 7.0 to a high of 10.2 infections per 100,000 people. Michigan males, black persons, and MSM have the highest incidence rates and counts. By age at infection, those under 34 years of age have highest rates and counts.

There were no significant changes overall or in any of the reported subgroups over the five year period. In the figures below, 2013 stands out as an unusual year where the estimated count and rate of new infections were higher overall, and for certain groups, compared to recent years. As noted in the previous 2009-2013 report, this may be because the statistical model provided by CDC to produce these estimates is very sensitive to small changes in testing patterns. Additionally, small sample sizes at the state level may produce unstable estimates. Incidence estimates for all groups returned to levels that are more typical in 2014.

We are unable to report estimated counts or rates for Hispanic/Latino and other racial/ethnic groups due to insufficient data to produce reliable estimates (numbers do not meet 200/40/10 minimum criteria described in methods).

Table 1: Estimated Number and Rate of New HIV Infections in Michigan, 2010 – 2014

Category	2010			2011			2012			2013			2014		
	N	%	Rate†	N	%	Rate†	N	%	Rate†	N	%	Rate†	N	%	Rate†
Sex															
Male	474	82	11.8	483	81	12.0	504	82	12.5	740	87	18.2	561	86	13.8
Female	105	18	2.5	115	19	2.7	110	18	2.6	109	13	2.6	90	14	2.1
Race/ethnicity															
White	219	38	3.4	164	27	2.5	242	39	3.7	328	39	5.1	241	37	3.7
Black	303	52	27.0	381	64	33.9	308	50	27.3	452	53	40.1	345	53	30.6
Age															
13-24	246	42	14.6	243	41	14.5	255	42	15.2	360	42	21.4	270	41	16.1
25-34	179	31	15.4	177	30	15.1	192	31	16.3	240	28	20.2	213	33	17.7
35-44	49	8	3.9	100	17	8.1	99	16	8.1	126	15	10.5	52	8	4.4
45+	105	18	2.5	79	13	1.9	68	11	1.6	122	14	2.9	115	18	2.7
Risk^															
MSM	426	74	N/A	437	73	N/A	466	76	N/A	660	78	N/A	519	80	N/A
IDU	51	9	N/A	45	8	N/A	45	7	N/A	72	8	N/A	N/A**	N/A**	N/A
Hetero-sexual/Other	103	18	N/A	116	19	N/A	103	17	N/A	117	14	N/A	89	14	N/A
Special Populations															
Black MSM	201	35	N/A	252	42	N/A	231	38	N/A	370	44	N/A	264	41	N/A
White MSM	181	31	N/A	141	24	N/A	185	30	N/A	241	28	N/A	198	30	N/A
Young, Black MSM	124	21	N/A	161	27	N/A	139	23	N/A	255	30	N/A	158	24	N/A
Older, Black MSM	77	13	N/A	91	15	N/A	92	15	N/A	115	14	N/A	107	16	N/A
Older, White MSM	120	21	N/A	116	19	N/A	130	21	N/A	195	23	N/A	147	23	N/A
Black Men	227	39	43.3	284	47	54.1	248	40	47.2	408	48	77.6	286	44	54.3
White Men	194	34	6.1	149	25	4.7	203	33	6.4	275	32	8.7	214	33	6.7
Black Women	76	13	12.7	97	16	16.2	61	10	10.2	44	5	7.3	59	9	9.8
TOTAL	579		7.0	598		7.2	614		7.4	849		10.2	651		7.8

† Rate per 100,000 population for ages 13 and older, Vintage 2015 Bridged-Race Postcensal Population Estimates[3].

**Insufficient data to report this group; did not meet minimum 200/40/10 criteria described in Methods

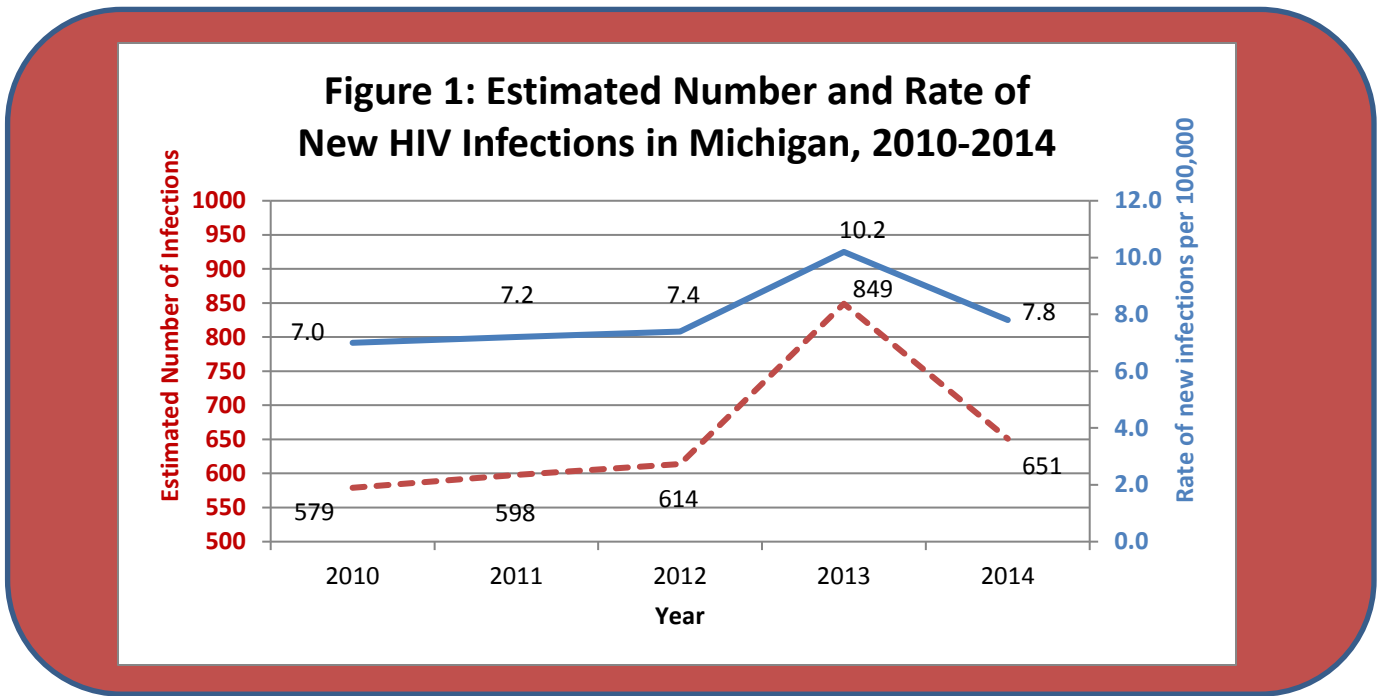^Rates are not reported for risk categories because no reliable denominator data exist for these groups

Figure 1: Estimated Number and Rate of New HIV Infections in Michigan, 2010-2014

Estimated Number of Infections

Rate of new infections per 100,000

7.0   7.2   7.4   10.2   7.8

579   598   614   849   651

Year

2010   2011   2012   2013   2014

Figure 1. No significant changes in estimates of recent infection were detected for 2010-2014 in Michigan. 2013 was an unusual year where the estimated count and rate of new infections was higher than in surrounding years. This rise was not statistically significant and may have been due to the sensitivity of the model to changes in underlying testing patterns and small sample sizes. Counts and estimates returned to more typical levels in 2014.
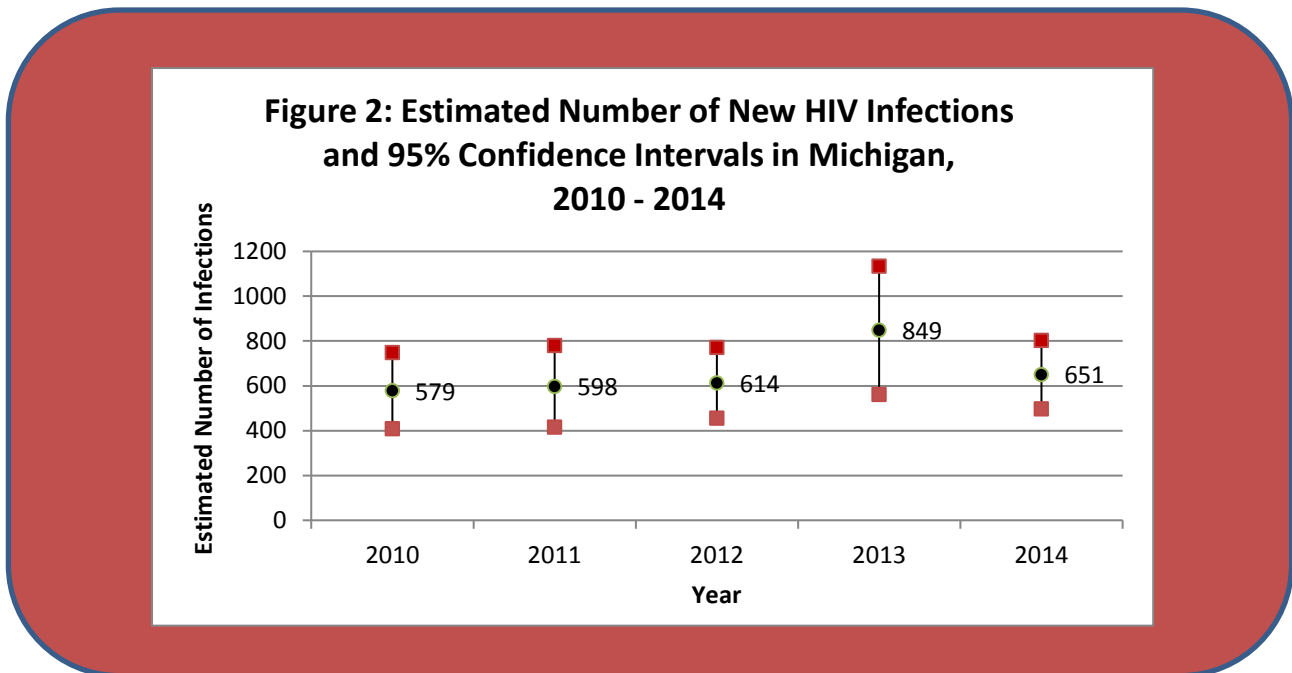
Figure 2: Estimated Number of New HIV Infections and 95% Confidence Intervals in Michigan, 2010 - 2014

Estimated Number of Infections

579   598   614   849   651

Year

2010   2011   2012   2013   2014

Figure 2. One method to demonstrate that the number of new infections in Michigan did not change significantly over time is to show confidence intervals. The 95% confidence intervals (95% certainty that the true number falls between the upper and lower values) for the number of new HIV infections from 2010 to 2014 are shown in Figure 2. Note that the confidence intervals overlap from year to year, indicating there was not a statistically significant change. The range of values is large due to the estimation process and small sample sizes.

Figure 3: Estimated Rate of New HIV Infections in Michigan, by Age at Infection, 2010 - 2014
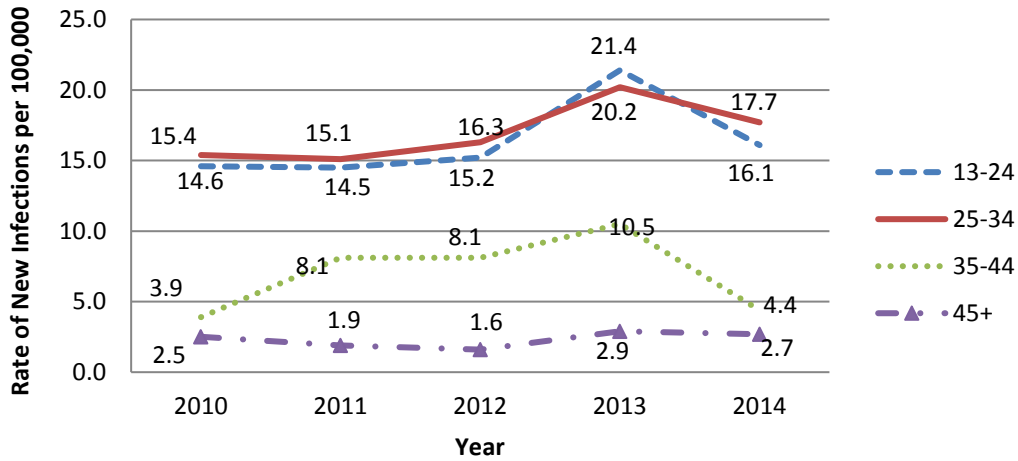
Figure 3. By age at infection, 13-24 year olds and 25-34 year olds alternate with highest rates of HIV infection. There were no significant changes in infection rates for any age group between 2010 and 2014.

Figure 4: Estimated Rate of New HIV Infections in Michigan, by Race and Sex, 2010-2014
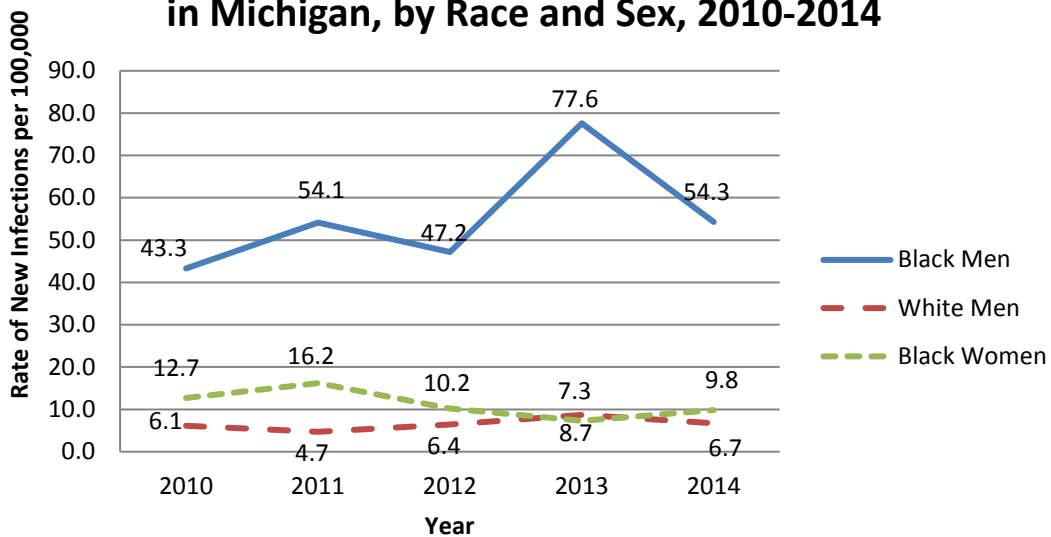
Figure 4. Overall, rates of HIV infection were stable for black males, white males, and black females between 2010 and 2014. White females had too few incident cases to be included in this report. This figure demonstrates the disproportionate impact of HIV on black males in Michigan. In 2014, the rate in black males was 8 times the rate of white males.

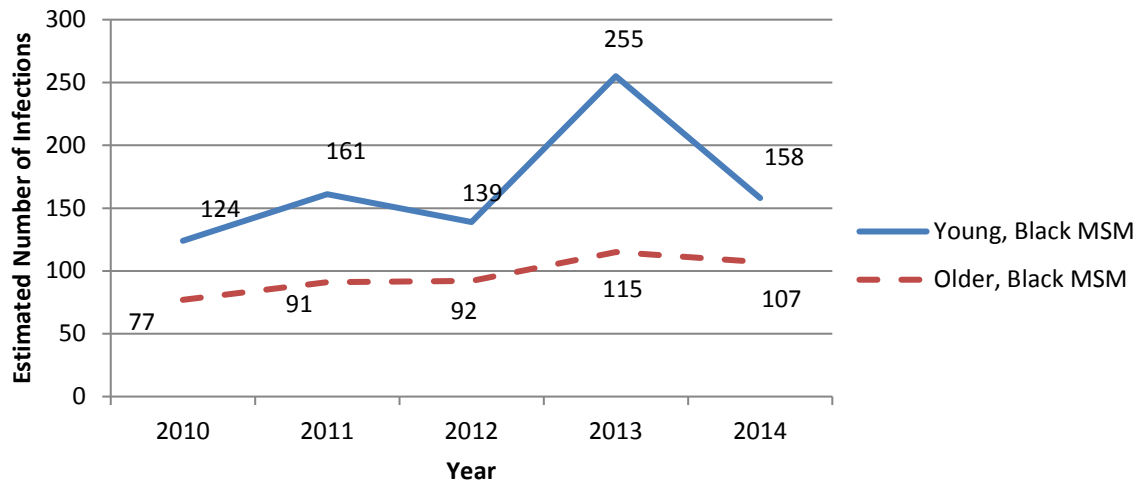## Figure 5: Estimated Number of New Infections in Michigan, by Age, Race, and Risk, 2010-2014

Figure 5. The estimated number of new HIV infections in Black MSM by age at infection are depicted in Figure 5, where "young" refers to 13-24 year olds and "older" refers to those ages 25 and above. In 2014, the estimated number of infections in young, black MSM was nearly 1.5 times the estimate of older, black MSM. This suggests the importance of allocating prevention and testing resources to this group.

<u>**Summary**</u>

This HIV incidence report should be interpreted along with prevalence[4] and trend[5] reports issued by MDHHS. It is yet another descriptive tool to analyze the trajectory of the HIV epidemic over time. Rates and counts were stable between 2010-2014, overall and for each subgroup analyzed. However, large confidence intervals produced by the complex estimation process may mask real changes in progress. Thus, MDHHS monitors new diagnoses on a quarterly basis. Increases noted in some demographic subgroups in 2013 returned to levels that are more typical in 2014.

[1] Hall HI, Song R, Rhodes P, et al; HIV Incidence Surveillance Group. Estimation of HIV Incidence in the United States. JAMA 2008;300:520--9. (http://jama.ama-assn.org/content/300/5/520.full)
[2]Karon JM, Song R, Brookmeyer R, Kaplan EH, Hall HI; Estimating HIV incidence in the United States from HIV/AIDS surveillance data and biomarker HIV test results. [Journal Article, Research Support, N.I.H., Extramural] *Stat Med 2008 Oct 15; 27(23):4617-33.* (https://www.ncbi.nlm.nih.gov/pubmed/18833636)
[3] Vintage 2015 Bridged-Race Postcensal Population Estimates; Division of Vital Statistics National Center for Health Statistics: http://www.cdc.gov/nchs/nvss/bridged_race/data_documentation.htm
[4]July 2016 Michigan Department of Health and Human Services Annual HIV Surveillance Report: http://www.michigan.gov/documents/mdhhs/State_tables_july_2016_531699_7.pdf
[5]Annual Review of HIV Trends in Michigan, 2010-2014: http://www.michigan.gov/documents/mdhhs/MIReport16_525874_7.pdf