STI Ratios among Persons Living Diagnosed with HIV Infection in Ohio, 2000-2010

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INTRODUCTION

The interrelated epidemics of human immunodeficiency virus (HIV) and sexually transmitted infections (STIs) in the U.S. has been observed and studied since the beginning of the HIV epidemic in the early 1980's. Substantial evidence indicates the presence of STIs increases the likelihood of both acquiring and transmitting HIV (1-3). STI increase the risk of HIV transmission approximately 3- to 5-fold and the impact of HIV infection on STIs suggest that, at a community level, HIV infection may increase the prevalence of some STIs (4). The potential for STIs to accelerate HIV progression to acquired immune deficiency syndrome (AIDS) has been studied less and remains unclear (4-6). Knowledge of patterns and trends between HIV and STIs is important for targeting services for persons infected with multiple conditions and for preventing new infections (7). Such data will support the efforts of Ohio in moving toward the Centers for Disease Control and Prevention's (CDC's) Program Collaboration and Service Integration (PCSI) strategic priority to share data by conducting electronic matching of surveillance case registries to create better linkages that address the interrelated epidemics of HIV and STIs (8). Currently, there is no single public health surveillance system or data source at the state or national level that tracks both HIV and STIs jointly on a population level.

Goals and Objectives
The primary goals of this assessment are to 1) retrospectively examine demographic and risk characteristics of persons living diagnosed with HIV infection (PLWH), which includes PLWH only and PLWH ever diagnosed and reported with a STI (PLWH/STI), in Ohio and 2) improve the understanding of the synergistic relationship between HIV and STIs in Ohio.

Objectives include:
1. To identify and describe differences in STI ratios between PLWH only and PLWH/STI in Ohio between 2001 and 2010.
2. To summarize and provide the results of the assessment for use in HIV and STD prevention program planning efforts.

METHODS

In 2011, ODH HIV/AIDS Surveillance Program retrospectively assessed all Ohio reports of syphilis, gonorrhea and HIV infections reported among persons 13 years of age and older during the 10 years between January 1, 2001 and December 31, 2010. A memorandum of understanding was created to ensure the Ohio Department of Health (ODH) data shared between the Sexually Transmitted Disease (STD) Surveillance and the HIV/AIDS Surveillance Programs, both in the Bureau of HIV/AIDS, STD and TB (BHST); was accessed, stored, and analyzed in compliance with ODH BHST's data security and confidentiality policy.

Data Sources
The Enhanced HIV/AIDS Reporting System (eHARS): EHARS maintained by the ODH HIV/AIDS Surveillance Program was the source of the data for PLWH in Ohio. PLWH in Ohio as of June 30, 2011 reported and diagnosed during the 10 years between January 1, 2001 and December 31, 2010 were exported out of eHARS. EHARS cases with perinatal exposure as the mode of transmission, persons aged 12 and under diagnosed and reported with an HIV infection, and cases with incomplete information on age at diagnosed HIV infection were excluded.

The Ohio Disease Reporting System (ODRS): ODRS maintained by ODH STD Surveillance Program was the source of the syphilis (any stage) and gonococcal infections data. All syphilis and gonococcal infections reported in Ohio between January 1, 2001 and December 31, 2010 were exported out of ODRS. ODRS case records missing last name and/or date of birth were excluded from the dataset.

The Matched Dataset: Cases from the eHARS and ODRS datasets were standardized and de-duplicated, and deterministically matched on social security number, first name, last name, date of birth and/or sex to determine which PLWH were ever diagnosed and reported with a STI in Ohio. All PLWH 13 years of age and older and diagnosed and reported during the 10-year assessment period, January 1, 2001 through December 31, 2010, were included in the dataset. Only STI cases reported in Ohio during the assessment period that matched a PLWH case were included in the dataset.

Study Population
The assessment base comprised all 9,105 PLWH in Ohio included in the matched dataset. Demographic characteristics of PLWH in the analysis dataset included 7,199 (79 percent) males and 1,906 (21 percent) females. The majority of PLWH (5,874 persons, 65 percent) were between 13 and 39 years of age. The highest percentage of PLWH were black/African Americans (4,284 persons, 47 percent) followed by white (4,214 persons, 46 percent), and Hispanic/Latino (427 persons, five percent). The highest percentage of risk characteristics were Male-to-male sexual contact (MSM) (4,694 males, 52 percent) followed by other/unknown (2,034 persons, 22 percent) and heterosexual contact (1,835 persons, 20 percent) (Table 1).

Of the 9,105 PLWH in Ohio included in the matched dataset, 7,430 (82 percent) were PLWH only, 1,112 (12 percent) PLWH ever diagnosed with gonorrhea, 414 (4 percent) PLWH ever diagnosed with syphilis and 149 (2 percent) PLWH ever diagnosed with gonorrhea and syphilis.

Table 1. Number and percent of persons living diagnosed with HIV infection, Ohio, 2001-2010

Characteristic	No.	%		No.	%
Sex			**Transmission category**		
Males	7,199	79%	**Male adult or adolescent**		
Females	1,906	21%	Male-to-male sexual contact	4,694	65%
			Injection drug use (IDU)	210	3%
Age as of 12/31/2010			Male-to-male sexual contact and IDU	188	3%
13-14	7	<1%	Heterosexual contact	695	10%
15-19	442	5%	Other/unknown	1,412	20%
20-24	1,304	14%	Subtotal	7,199	100%
25-29	1,276	14%	**Female adult or adolescent**		
30-34	1,331	15%	Injection drug use	144	8%
35-39	1,514	17%	Heterosexual contact	1,140	60%
40-44	1,328	15%	Other/unknown[3]	622	33%
45-49	918	10%	Subtotal	1,906	100%
50-54	576	6%			
55-64	345	4%			
65+	64	1%			
Race/Gender					
White, not Hispanic Males	3,659	40%			
White, not Hispanic Females	556	6%			
Black/African American, not Hispanic Males	3,075	34%			
Black/African American, not Hispanic Females	1,218	13%			
Hispanic/Latino Males	325	4%			
Hispanic/Latina Females	102	1%			
Other Males[2]	47	1%			
Other Females[2]	13	<1%			
Unknown	110	1%			
Total	**9,105**				

Persons Living Diagnosed with HIV Infection[1]

[1]Living with a diagnosis of HIV infection represents all persons 13 years of age and older diagnosed and reported in Ohio from January 1, 2001 through December 31, 2010 who have not been reported as having died as of December 31, 2010.
[2]Includes Asian/Pacific Islanders and American Indian/Alaska Natives
[3]Includes hemophilia, blood transfusion, and risk factor not reported or identified
Source: Ohio Department of Health HIV/AIDS Surveillance Program. Data reported through June 30, 2011.

Statistical Analysis

Crude and adjusted STI ratios and 95 percent confidence intervals (CI) were calculated using Multivariate Poisson regression analysis of age category, race/sex and transmission mode among PLWH. Each poisson regression model controlled for age, race, sex and HIV transmission category. The Proc Genmod procedure in SAS version 9.2 was used to analyze all data.

RESULTS

Results of the multivariate analysis comparing STI ratios of PLWH are presented by sex, age, race/sex and transmission category. The STI ratio is an estimate of the proportional relationship between the number of STIs among PLWH by demographic characteristics and transmission category in Ohio during the assessment period.

STI ratio by sex and age
There was no difference in the number of STIs among males and females in the adjusted model that controlled for sex, age, race and HIV transmission category. PLWH in the 13-14, 15-19, 20-24, and 25-29 age groups had statistically significant more STIs than those in the 30-34 age group (Adjusted STI ratio=3.25, p=0.009; Adjusted STI ratio=1.70, p<0.001; Adjusted STI ratio=1.44, p<0.001; Adjusted STI ratio=1.31, p<0.001, respectively). PLWH 13-34 years of age had 45 percent more STIs than those 35 years of age or older (Adjusted STI ratio=1.45, p<0.001) (not shown). PLWH 35 years of age or older had the same or statistically significant fewer STIs than those 30-34 years of age.

STI ratio by race/sex
Among PLWH, black/African American males had 23 percent more STIs than white males in both the unadjusted and adjusted model that controlled for sex, age, race and HIV transmission category (Adjusted STI ratio=1.23; p<0.001). Black/African American females had 48 percent more STIs than white females (Adjusted STI=1.48; p=0.001). Hispanic/Latino males had 39 percent fewer STIs than white males (Adjusted STI=0.61; p<0.001) and Hispanic/Latina females had 49 percent fewer STIs than white females (Adjusted STI; p=0.07). Both other/unknown males and females had the same number of STIs as white males and females (Table 2).

STI ratio by HIV transmission category
PLWH with MSM as the transmission mode had nearly twice the number of STIs than all other combined transmission categories (Adjusted STI ratio=1.92; p<0.001) (not shown). Among males, Injection drug users (IDU), MSM and IDU, heterosexual contact, and other/unknown transmission modes had statistically significant fewer STIs (Adjusted STI ratio=0.58, p=0.001; Adjusted STI ratio=0.68, p=0.01; Adjusted STI ratio=0.46, p<0.001; Adjusted STI ratio=0.51, p<0.001, respectively). Among females, IDU had 82 percent more STIs than those with heterosexual contact (Adjusted STI ratio=1.83; p<0.001). Females with other/unknown transmission mode had the same number of STIs as females with heterosexual contact (Table 2).

Table 2. Poisson regression analysis comparing STI ratios of persons living diagnosed with HIV infection by selected characteristics and HIV transmission category, Ohio, 2001-2010

Characteristic	PLWHA[1] (N=9,105)		Characteristic		
	STI Ratio (95%CI)	Adjusted STI Ratio[2] (95%CI)		STI Ratio (95%CI)	Adjusted STI Ratio[2] (95%CI)
Sex			**Transmission category**		
Males	1.46 (1.31-1.62)*	0.92 (0.79-1.06)	**Male adult or adolescent**		
Females	Ref.	Ref.	Male-to-male sexual contact	Ref.	Ref.
			Injection drug use (IDU)	0.48 (0.35-0.66)*	0.58 (0.42-0.81)*
Age as of 12/31/2010			Male-to-male sexual contact and IDU	0.66 (0.50-0.89)*	0.68 (0.51-0.92)*
13-14	2.86 (1.18-6.90)*	3.25 (1.34-7.89)*	Heterosexual contact	0.43 (0.36-0.52)*	0.46 (0.38-0.56)*
15-19	1.94 (1.64-2.31)*	1.70 (1.43-2.02)*	Other/unknown[4]	0.48 (0.42-0.55)*	0.51 (0.44-0.58)*
20-24	1.63 (1.42-1.87)*	1.44 (1.25-1.65)*			
25-29	1.37 (1.19-1.58)*	1.31 (1.14-1.52)*	**Female adult or adolescent**		
30-34	Ref.	Ref.	Injection drug use	1.41 (1.02-1.95)	1.83 (1.31-2.56)
35-39	1.05 (0.90-1.21)	1.03 (0.89-1.19)	Heterosexual contact	Ref.	Ref.
40-44	0.93 (0.79-1.08)	0.92 (0.79-1.08)	Other/unknown[4]	0.84 (0.67-1.06)	0.84 (0.67-1.05)
45-49	0.71 (0.59-0.86)*	0.73 (0.60-0.88)*			
50-54	0.83 (0.68-1.03)	0.86 (0.69-1.06)			
55-64	0.64 (0.48-0.85)*	0.68 (0.51-0.90)*			
65+	0.31 (0.13-0.76)*	0.33 (0.14-0.81)*			
Race/Sex					
Male adult or adolescent					
White, not Hispanic Males	Ref.	Ref.			
Black/African American, not Hispanic Males	1.23 (1.13-1.34)*	1.23 (1.12-1.34)*			
Hispanic/Latino Males	0.56 (0.42-0.74)*	0.61 (0.46-0.81)*			
Other/Unknown[3]	0.94 (0.68-1.29)	0.93 (0.68-1.29)			
Female adult or adolescent					
White, not Hispanic Females	Ref.	Ref.			
Black/African American, not Hispanic Females	1.30 (1.04-1.64)*	1.48 (1.18-1.87)*			
Hispanic/Latina Females	0.44 (0.21-0.91)*	0.51 (0.25-1.05)*			
Other/Unknown[3]	1.05 (0.46-2.40)	1.13 (0.49-2.57)			

Note: CI = confidence interval; Ref. = referent group; *p<0.05.

[1] Persons living with a diagnosis of HIV infection represents all persons 13 years of age and older diagnosed and reported in Ohio from January 1, 2001 through December 31, 2010 who have not been reported as having died as of December 31, 2010.

[2] From poisson regression model that controlled for sex, age, race and HIV transmission category.

[3] Includes Asian/Pacific Islanders and American Indian/Alaska Natives

[4] Includes hemophilia, blood transfusion, and risk factor not reported or identified

Source: Ohio Department of Health HIV/AIDS and STD Surveillance Program. HIV/AIDS Surveillance data reported through June 30, 2011.

DISCUSSION

Limitations

Several factors influence the completeness and accuracy of our findings. First, HIV infection surveillance data represents confidential reports of HIV infection and AIDS diagnoses; not all persons with an HIV infection. HIV diagnosis data represent the earliest date of diagnosis reported to the ODH HIV/AIDS Surveillance Program which may not be the earliest date an individual became aware of their HIV infection. HIV infection surveillance data may underestimate the level of recently infected persons because some infected persons do not know they are infected as they have not sought testing or their test results. In addition, incomplete HIV or CD4+ T-cell testing may interfere with the completeness of AIDS reporting.

Second, STD surveillance data may be under reported due to a proportion of individuals with subclinical to mild disease symptoms who are not diagnosed, presumptively treated by private sector providers or do not seek treatment. Although STI risk behaviors result from unsafe sexual behavior, they do not necessarily correlate with HIV risk. For both HIV infection and STD surveillance data, the majority of laboratory reports originate from facilities that do not routinely collect demographic and clinical information required for surveillance reporting.

Third, based on the matching procedures employed small numbers of "false positives" and missed true matches most likely occurred. While these errors are unlikely to have a significant influence on the overall or key results, they may result in minor biases. Furthermore, the assumption that all PLWH did not match to any STI had no STI, and that all persons diagnosed and reported with an STI who did not match to any PLWH were HIV-negative represents a bias in under estimating PLWH/STI.

Fourth, validity of estimates could be affected by the high proportion of those with other/missing transmission modes if they differ significantly between PLWH only and PLWH/STI. The validity of these estimates could also be affected if those with other/missing risk are proportionally different from those with known HIV risk. The magnitude of this bias cannot easily be determined.

Conclusions

Despite possible biases, our results are consistent with and expand upon previous studies' findings on the knowledge of patterns and trends between HIV and STIs. Findings from this assessment indicate that linking HIV/AIDS and STD surveillance data helps to identify persons with HIV who represent increased risk for possible transmission of HIV that are not evident in the separate surveillance registries (e.g. PLWH/STI were more likely to be 30 years of age or younger, black/African American and have MSM as the mode of HIV transmission than PLWH only during the assessment period). Increased collaboration between HIV/AIDS and STD surveillance programs will allow for improved use of existing data by prevention specialists to strengthen public health primary and secondary prevention interventions targeting highly affected populations.

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