

Integrating HIV testing into syphilis partner services in Mississippi to improve HIV case finding

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This work was presented in part as a poster at the Conference on Retroviruses and Opportunistic Infections, March 4-7, 2018, Boston, MA, USA.

Conflicts of Interest and Source of Funding: This work was funded by the Centers for Disease Control and Prevention grant #CDC H25 PS005106. TA received funding from an NIH National Center for Advancing Translational Sciences TL1 Training Grant (#5 TL1 TR002318-02).

Short Summary: An evaluation of syphilis partner services in Mississippi found that integrating HIV testing into partner services was effective for identifying new cases of HIV, especially among young, Black/African American MSM.

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Abstract:

Background: Mississippi (MS) has the 10th highest rate of new HIV infections in the United States. The Mississippi State Department of Health (MSDH) integrated partner HIV testing into syphilis partner services (PS) in 2014, but the effectiveness of this as an HIV case-finding strategy has not been evaluated.

Methods: We identified all early syphilis (primary, secondary, and early latent) case records reported from 7/1/2014-12/31/2016, excluding case records for people concurrently newly diagnosed with HIV. Among sex partners of these people, we identified new diagnoses of early syphilis and HIV. We calculated the number needed to interview (NNTI) as the number of syphilis index case-patients interviewed divided by the number of partners newly diagnosed with early syphilis or HIV.

Results: A total of 1535 of the 1619 early syphilis index case-patients (95%) were interviewed for PS. These case-patients named 2267 partners, of whom 1868 (82%) were contacted by MSDH. Among partners, 1508 (81%) tested for syphilis and 745/1321 (56%) partners not previously diagnosed with HIV were tested for HIV. PS identified 696 new early syphilis case-patients (46%) and 24 new HIV case-patients (3.2%) among partners. Sixty-four index case-patient interviews were needed to identify one new case of HIV, and two interviews were needed to identify one new case of syphilis among partners.

Conclusion: Syphilis PS allowed MSDH to interact with 1592 MSM over a 30-month period and was effective for identifying people newly infected with early syphilis and HIV. Increasing HIV testing among partners of syphilis case-patients could increase HIV case finding in MS.

Key words: HIV, syphilis, STD partner services, public health practice

Introduction

The southeastern United States (US) has the highest rates of new HIV infections and the highest prevalence of HIV in the US. In 2016, eight of the 10 states with the highest rates of HIV infection were located in the South.¹ Mississippi has the 10th highest rate of new HIV infections among adults and adolescents in the US and has experienced an increase in the rate of new HIV infections since 2012, despite national decreases in HIV incidence over the same time period.^{2,3} The HIV epidemic in Mississippi is characterized by high rates of HIV infection among Black/African Americans, especially among young, Black/African American men who have sex with men (MSM).^{4,5} In 2015, 80% of new HIV diagnoses in Mississippi were among Black/African Americans, and nearly half of diagnoses in the Jackson metropolitan area were among Black/African-American MSM.⁴ Improving identification of persons newly infected with HIV and ensuring that they are linked to care is critical for reducing HIV-related morbidity and mortality and preventing future HIV transmission. This will require implementing new HIV case-finding strategies and improving the efficiency of current strategies in order to prioritize groups at high risk of HIV infection.

Syphilis is a known risk factor for HIV acquisition, and syphilis partner services may be an opportunity to identify individuals at high risk of testing HIV positive.⁶⁻⁹ Syphilis partner services includes contacting index case-patients for the purpose of assuring their treatment and the notification and treatment of their sex partners.¹⁰⁻¹² In Mississippi, syphilis incidence has increased by 315% from 2013 (9.8 per 100,000) to 2016 (30.9 per 100,000) and Mississippi is thought to have the second highest rate of primary and secondary syphilis among MSM in the US.¹³ Syphilis and HIV co-infection also continues to be common in the United States, particularly among MSM. In 2017, 45.5% of reported primary and secondary syphilis case

records among MSM were HIV-positive, compared to 8.9% among men who have sex with women (MSW), and 4.5% among women. Thus, syphilis partner services may be an opportunity to test and treat a significant number of individuals who are at high risk of HIV infection.

In concordance with CDC's recommendations for syphilis partner services programs,¹⁴ the Mississippi State Department of Health (MSDH) already attempts to provide partner services for all persons with newly diagnosed early syphilis (i.e., primary, secondary, and early latent syphilis) reported in the state. In 2014, MSDH added HIV testing into their routine syphilis partner services in order to increase HIV case finding among partners of syphilis index case-patients. Here, we evaluate the HIV and syphilis case finding effectiveness of syphilis partner services in Mississippi.

Methods

Syphilis Partner Services

Per Mississippi State law, medical providers and laboratories are required to report all new diagnoses of syphilis and positive syphilis serological tests to the MSDH. Syphilis case and laboratory reports are recorded in the MSDH Patient Reporting Investigation Surveillance Manager (PRISM), which MSDH uses to manage case investigations and partner services activities. After receiving a case report, public health staff (Disease Intervention Specialists [DIS]) contact the index case-patient to conduct an interview to verify treatment, collect demographic and risk information, and identify sex partners. DIS then attempt to contact named partners to test for syphilis, and collect demographic information. For partners diagnosed with new early syphilis infection, the DIS also collect risk information as part of the full partner services interview. DIS encourage all contacted partners to be treated for syphilis at the time of syphilis testing (i.e., prior to receiving the test result; also known as epidemiologic [epi]

treatment) to minimize delays in treating truly infected case-patients and assure the treatment of people with incubating syphilis. As of 2014, MSDH added partner HIV testing to their syphilis partner services activities. The DIS refer partners to the MSDH STD Clinic (Five Points Clinic) in Jackson, MS for rapid HIV testing. In addition, all DIS are trained to perform blood tests, and offer blood testing in the field as an alternative to rapid testing in the STD clinic. The DIS deliver HIV test results in the field when necessary, although partners are encouraged to go to the STD clinic to receive their results and posttest counseling.

Study Population and Data Sources

We identified all early syphilis case-patients and their partners from July 1, 2014 to December 31, 2016 using PRISM. Index case-patients were defined as a case record in PRISM with a diagnosis code for primary, secondary, or early latent syphilis (710, 720, or 730). Index case-patient characteristics, such as gender, gender of sex partners, previous HIV status, race, and age, were also extracted from PRISM. Because we were specifically interested in evaluating the impact of integrating HIV testing into *syphilis* partner services, we excluded index case-patients that were newly diagnosed with HIV within 30 days of their diagnosis of early syphilis infection. Partners of these case-patients would have likely received HIV testing as part of HIV partner services activities regardless of the index case-patient's syphilis infection status.

Partner Services Outcomes

Partner services outcomes and syphilis case finding among partners were extracted from PRISM. HIV testing and case finding among partners was obtained from a combination of PRISM, the MSDH laboratory information management system (Apollo), and MSDH's electronic HIV/AIDS reporting system (eHARS), which contains data on all persons diagnosed with HIV in Mississippi. While all positive HIV tests performed as part of partner services are

recorded in PRISM, negative HIV tests are not routinely entered into PRISM. Thus, to identify all negative HIV tests, we linked records from PRISM and Apollo using a deterministic matching algorithm that matched records on first name, last name and date of birth. To ensure all new HIV diagnoses were ascertained and to identify previous HIV-positive partners, we also linked the partner information from PRISM to eHARS. Partners were considered to be previously HIV-positive if they had an HIV diagnosis date in PRISM, eHARS, or Apollo prior to being named as a partner.

Partners were considered to be tested for HIV if they had an HIV test reported in PRISM or Apollo within 30 days after being named as a partner by an early syphilis index case-patient and were considered to be a new HIV diagnosis if they had an HIV diagnosis date in PRISM, eHARS, or Apollo within 30 days after being named as a partner and no evidence of a previous HIV diagnosis. Partners were considered to be tested for syphilis if they had evidence of a syphilis serological test in PRISM as part of the syphilis partner services investigation. Partners were considered to be a new case of syphilis if they had a diagnosis code for primary, secondary or early latent syphilis (710, 720, or 730).

Statistical Analysis

Separately for HIV and syphilis, we calculated the number of index case-patients needed to interview (NNTI) to identify a new case of HIV (or a new case of syphilis) among partners. We calculated the NNTI by dividing the total number of index case-patients by the number of partners newly diagnosed with HIV or syphilis, respectively. We calculated the syphilis test positivity and HIV test positivity among partners by dividing the numbers of partners who tested positive for syphilis or HIV by the number of partners tested for syphilis or HIV, respectively. We also measured traditional partner services outcomes, including partners named, contacted,

epidemiologically treated, and brought to treatment. Epidemiologic treatment was defined as partners who did not test positive for syphilis but received preventative treatment after DIS contact. Brought to treatment was defined as partners who tested positive for syphilis and received treatment after DIS contact. Partner services indices were estimated by dividing each partner services outcome by the total number of index case-patients among whom DIS initiated partner services. To identify priority groups for conducting syphilis partner services, we estimated the NNTIs and the test positivity rates for syphilis and HIV stratified by index case-patient gender/gender of sex partners, race, and HIV status, and age. All analyses were conducted using R version 3.3.3.

Results

From July 1, 2014 through December 31, 2016, 1619 case-patients of early syphilis were reported to the MSDH and 1535 (95%) were interviewed by DIS (Table 1). The median time from an index case-patient diagnosis to DIS interview was 5 days (interquartile range [IQR]: 1,14). A majority of index cases were MSM (57%), Black/African American (78%), and under 30 years of age (60%). About one-third (n=531) of index cases had been previously diagnosed with HIV. Among index case-patients previously diagnosed with HIV, 493 (93%) were MSM.

The 1535 early syphilis index case-patients interviewed by DIS named 2267 partners. Of these, 1867 (82%) were contacted by DIS as part of routine syphilis partner services (Table 2), 465 (21%) completed an interview; 895 (39%) were epidemiologically treated; and 448 (20%) were brought to treatment. 198 partners were treated for syphilis before they were contacted by DIS, and 11 partners refused treatment.

Table 3 summarizes the syphilis testing and case finding outcomes among partners. Of the 1867 partners contacted, 1507 (81%) were tested for syphilis, and among those tested, 695

(46%) partners were newly diagnosed with early syphilis. The syphilis test positivity was highest among partners of previously HIV positive (51%), MSM (48%), and White (48%) index case-patients. About 2.2 index case-patient interviews were needed to identify one new case of syphilis (Table 3). The NNTI was between 2 and 3 among subgroups by race, gender, gender of sex partners, and HIV status (Figure 1).

MSDH contacted 1479 HIV-negative partners of syphilis index case-patients during the study period. Of these, 741 (50.1%) were tested for HIV, and 24 (3.2%) tested newly HIV positive (Table 4). Partners of index case-patients who were previously HIV positive had the highest HIV test positivity (15.5%), followed by partners of MSM (6.2%). The HIV test positivity was lowest among MSW (0.7%) and women (0.4%). Of the 738 partners not tested for HIV, 140 (19%) were not tested because they were not located, 44 (6%) were not tested because they refused examination or partner services, and 553 (75%) did not have a documented reason for not testing. The proportion of partners tested for HIV did not vary substantially by index case characteristics.

Overall, 64 index case-patient interviews were needed to identify one new case of HIV among partners (i.e., NNTI=64). Among partners of previously HIV-positive index cases, the NNTI was 38 compared to an NNTI of 97 for HIV-negative index cases. The NNTI for partners of MSM was 41, compared to 317 and 328 for MSW and women, respectively. The NNTI for Black/African American index case-patients (NNTI = 55) was lower than the NNTI for White index case-patients (NNTI = 121). No cases of HIV were found among partners of other races.

Among partners of Black/African American MSM, 35.5 index case-patient interviews were needed to identify one new case of HIV, while among partners of White MSM, the NNTI was 76.5 (Figure 1). Only two cases of HIV were found among partners of Black/African

American MSW and women (one in each group) and no HIV cases were found among partners of White MSW and women.

Discussion

Through syphilis partner services, MSDH successfully identified a substantial number of new syphilis and HIV case-patients among partners of people newly diagnosed with syphilis. HIV case finding was particularly high among Black/African American MSM, a group that is at very high risk of HIV in Mississippi. Although only about half of all HIV-negative partners were tested for HIV, the HIV test positivity rate among MSM partners was high, highlighting both the value of integrating HIV testing in PS investigations for MSM with syphilis and of making HIV testing a specific, monitored outcome of these investigations in order to ensure that testing rates increase. Of note, even though almost half of newly identified HIV-positive partners were found through syphilis investigations of index case-patients who were HIV negative, HIV test positivity was much higher among the partners of HIV-infected index case-patients. It is uncertain whether this high positivity reflected transmission from unsuppressed HIV-positive index case-patients or just a high risk of undiagnosed HIV among MSM with HIV-positive partners. This issue merits further investigation to assess whether expanded efforts to test the partners of MSM with prevalent HIV diagnoses identifies previously undiagnosed partners or new HIV infections.

Syphilis case finding as a result of PS, particularly among MSM, was very high in Mississippi, supporting the value of this traditional intervention. The partner indices and syphilis case finding associated with syphilis partner services in Mississippi exceed PS outcomes reported from other jurisdictions.^{15–21} Notably, Mississippi had a relatively lower number of early syphilis index case-patients needed to interview to detect a new case of syphilis

(NNTI=2.2) compared to other evaluations of syphilis partner services conducted in the Southern United States near the same time (e.g., Texas [NNTI=6.7] and North Carolina [NNTI=6.9]).^{18,20} Mississippi's relatively lower syphilis NNTI may be reflective of the high burden of undiagnosed syphilis in the area. Partner services may be tapping into high prevalence networks, and as a result, identifying a large number of people with undiagnosed syphilis infection after conducting very few index case-patient interviews. This relatively low syphilis NNTI may also be a consequence of MSDH's prioritization of syphilis partner services in their department's STD control program. The program's DIS recognize partner elicitation and testing as important aspects of syphilis partner services, and MSDH's syphilis partner services outcomes may be a reflection of the DIS' efforts.

In contrast, Mississippi has a higher HIV NNTI (NNTI=64) associated with syphilis partner services than North Carolina (NNTI=43). This may reflect the relatively low proportion of partners who received HIV testing as a result of syphilis partner services in Mississippi. Increased offering of HIV testing to partners of syphilis case-patients could result in increased HIV case finding and thus a lower HIV NNTI in Mississippi than that observed in this study.

The low rate of HIV testing among HIV negative partners represents a potential opportunity to increase HIV case finding as a result of syphilis partner services. However, in many cases, the absence of HIV testing may represent a lack of documentation of a negative HIV test in HIV laboratory surveillance data. Although we attempted to address this issue by linking HIV surveillance and laboratory data, negative HIV tests – especially negative rapid HIV tests – were not systematically being entered into either data source during the study period. Thus, our findings may have underestimated the true proportion of partners who received HIV testing as a result of syphilis PS. Additional work is needed to determine the extent to which missing

documentation of HIV negative test results is responsible for this apparent gap, and whether there are barriers to HIV testing that were not systematically documented during this time.

Our findings highlight three key implications of syphilis PS. First, our findings demonstrate how syphilis PS can be used by a health department in the southeastern US to identify and interact with a large, often hard-to-reach population of MSM. Through syphilis PS, MSDH DIS had an opportunity to interact with 719 HIV negative MSM over a 30-month period, including 538 Black/African American HIV negative MSM. This resulted in the diagnosis of 411 new syphilis cases among MSM (322 among Black/African American MSM) and 22 new cases of HIV among MSM (20 among Black/African American MSM). These opportunities highlight how syphilis PS is a useful setting for actions aimed at reducing health disparities among MSM, especially African American MSM. Second, while integrating HIV testing for partners of MSW and women with syphilis may be worthwhile to increase routine HIV testing of a population that is potentially at high risk of new HIV infection, syphilis PS yielded very few new cases of HIV among partners of these groups. One possible reason for low HIV case finding is that the population of heterosexuals with HIV may be very small and difficult to identify. Among index case-patients who were MSW and women, only 5% (38/693) had previously been diagnosed with HIV, which reflects the low prevalence of HIV among this population.

Finally, these findings identify opportunities for integrating high impact HIV prevention activities into syphilis PS. Leveraging the DIS' interactions with Black/African American MSM as an opportunity to provide pre-exposure prophylaxis (PrEP) or a PrEP referral to syphilis case-patients and their partners could significantly reduce HIV incidence and address racial disparities in PrEP uptake.²² While Black/African American MSM have the highest burden of HIV in the United States, they represent a small fraction of all PrEP prescriptions filled as of 2016.^{23,24}

Furthermore, the rate of HIV diagnosis among Black MSM in Mississippi is 7.2 per 100 persons – the 2nd highest rate of HIV among Black MSM in the US.²⁵ Reducing HIV incidence among this population will require capitalizing on all HIV prevention opportunities, and syphilis PS represents a potentially fruitful opportunity to improve PrEP uptake, especially among Black/African American MSM. Indeed, MSDH began integration of PrEP referrals into STD PS at the end of 2017. The implementation and effectiveness of this new activity has not yet been evaluated, and more research is needed to ensure PrEP referrals are optimally integrated into STD PS in Mississippi.

This study has several limitations. First, because of nonsystematic documentation practices, there is limited information about the reasons why partners were not tested for HIV. While we were able to identify the proportion of HIV-negative partners that were not tested because they were unable to locate, refused examination, or refused partner services, the reasons for not testing a significant proportion of partners remain unclear. In addition, HIV testing, in particular negative HIV test results, are not routinely documented in the MSDH STD surveillance data system. Thus, our evaluation may have missed some HIV tests that were performed but not documented. We attempted to overcome this limitation by linking the STD surveillance data with HIV laboratory and case surveillance data using a deterministic matching algorithm. While this record linkage improved the completeness of our identification of all HIV test results during the study period, some HIV test outcomes may have been missed due to misclassification of some matches, and this could have underestimated the proportion of HIV-negative partners that were tested for HIV. Notably, positive HIV results are required to be reported to MSDH and are documented both in HIV laboratory and case surveillance data, so any nonsystematic documentation of HIV testing would not have had an effect on the number of new

HIV case-patients identified. Finally, some of the partners identified via partner services would likely have been tested and treated in the absence of public health partner services. It is also possible that additional partners would have been tested and treated following DIS interactions with index case-patients but not linked to PS efforts. However, it is unknown how many partners would have been contacted in the absence of partner services and how many additional partners were tested and treated following DIS interactions with index case-patients but not linked to syphilis PS.

Integrating HIV testing into syphilis partner services is potentially an effective strategy for identifying people newly infected with HIV in Mississippi, particularly among partners of Black/African American MSM and previous HIV-positive index case-patients. Additional research evaluating the processes and workflows associated with HIV testing as part of syphilis partner services in Mississippi is needed to improve integration of the two activities. In addition, evaluating the impact of integrating additional HIV prevention activities, including PrEP referrals and HIV care relinkage activities, is needed to identify strategies to maximize the opportunities for HIV prevention presented by syphilis partner services.

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Figure 1 Caption: Syphilis/HIV¹ number needed to interview (NNTI) by index patient race, gender, and gender of sex partners

¹HIV NNTIs are shown for Black/African American and White MSM only; NNTIs for Other race index case-patients and White MSW and women were not calculable because there were no cases of HIV identified among partners of these groups

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Figure 1

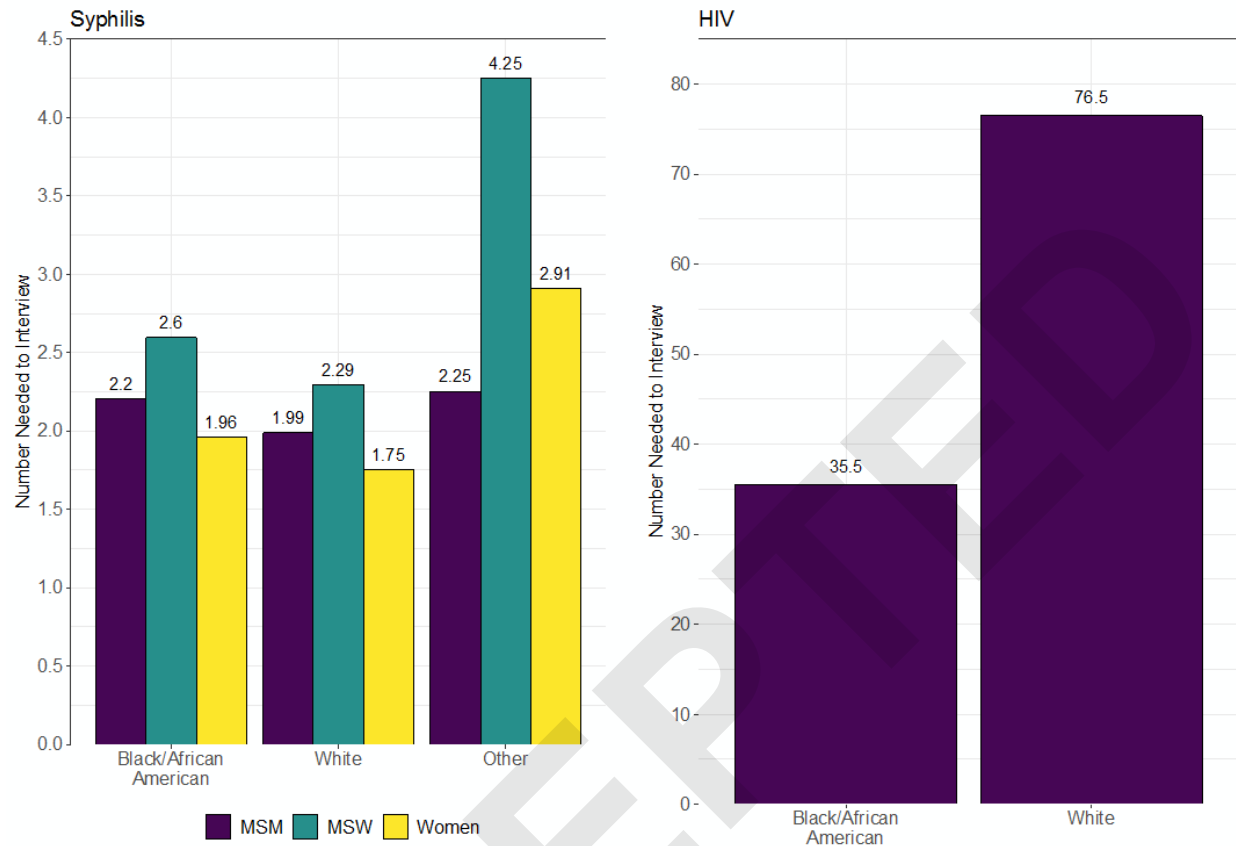


Table 1: Characteristics of syphilis index case-patients in Mississippi, 2014-2016, by gender/gender of sex partners

	Total N (%)	MSM N (%)	MSW N (%)	Women N (%)
N	1619	926	354	339
Age				
0-19	155 (10)	69 (8)	33 (9)	53 (16)
20-24	488 (30)	301 (33)	88 (25)	99 (29)
25-29	350 (22)	227 (25)	64 (18)	59 (17)
30-34	224 (14)	130 (14)	40 (11)	54 (16)
35-39	133 (8)	70 (8)	35 (10)	28 (8)
40-44	78 (5)	40 (4)	24 (7)	14 (4)
45+	190 (12)	88 (10)	70 (20)	32 (9)
Syphilis Stage				
Primary/Secondary	605 (37)	373 (40)	130 (37)	102 (30)
Early Latent	1014 (63)	553 (60)	224 (63)	237 (70)
HIV Status				
Negative	1088 (66)	433 (47)	324 (92)	331 (98)
Previous Positive	531 (33)	493 (53)	30 (9)	8 (2)
Race				
White	254 (16)	157 (17)	45 (13)	51 (15)
Black/African American	1257 (78)	742 (80)	269 (76)	253 (75)
Other	616 (38)	27 (3)	40 (11)	35 (10)

MSM = Men who have sex with men

MSW = Men who have sex with women

Table 2: Syphilis Partner Services Outcomes in Mississippi, 2014-2016 (N = 1619 Index Cases)

Partner Services		
Outcome	N (%)	Index¹
Partners Named	2267 (100)	1.40
Partners Contacted	1867 (82)	1.15
Partners Interviewed	465 (21)	0.29
Epidemiologic treatment ²	895 (39)	0.55
Brought to Treatment ^{3,4}	448 (20)	0.28

¹Indices are defined as the outcome divided by the total number of index cases (N = 1619)

²Partners who were preventatively treated for syphilis after DIS contact

³Partners who tested positive for syphilis and received treatment after DIS contact

⁴198 partners received treatment prior to DIS contact

Table 3: Syphilis Case Finding as a result of Syphilis Partner Services, by Index Case-Patient Characteristics

Index Case-Patient Characteristics	Index Case-Patient Interviews	Partners Named	Partners Tested for Syphilis (%¹)	New Syphilis Cases (%²)	NNTI
Total	1535	2267	1507	695 (46)	2.21
Gender					
MSM	890	1324	852	411 (48)	2.16
MSW	317	389	276	119 (43)	2.66
Women	328	554	379	165 (44)	1.99
HIV Status					
Negative	1040	1724	1184	529 (45)	1.96
Previous Positive	495	543	323	166 (51)	2.98
Race					
Black/African American	1201	1792	1168	542 (46)	2.22
White	241	364	257	123 (48)	1.96
Other	93	111	82	31 (38)	3.00

¹ Among partners named

² Among partners tested for syphilis

Table 4: HIV Case Finding as a result of Syphilis Partner Services, by Index Case Characteristics

Index Case-Patient Characteristics	Index Case-Patient Interviews	HIV-Partners Contacted	Partners HIV Tested (%¹)	New HIV Cases (%²)	NNTI
Total	1535	1479	741 (50)	24 (3.2)	64
Gender					
MSM	890	709	355 (50)	22 (6.2)	41
MSW	317	311	149 (48)	1 (0.7)	317
Women	328	459	237 (52)	1 (0.4)	328
HIV Status					
Negative	1040	1285	657 (51)	11 (1.7)	95
Previous Positive	495	194	84 (43)	13 (15)	38
Race					
Black/African American	1201	1098	575 (52)	22 (3.8)	55
White	241	286	122 (43)	2 (2)	121
Other	93	95	44 (46)	0 (0)	-

¹Among partners without a prior HIV diagnosis

²Among partners without a prior HIV diagnosis who tested for HIV