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# Integrating HIV testing into Syphilis Partner Services in Mississippi to improve HIV case finding

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## Abstract

**Background:** Mississippi (MS) has one of the highest rates of new HIV infections in the United States particularly among MSM. 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 cases of early syphilis (primary, secondary, and early latent) reported from 7/1/2014–12/31/2016, excluding cases with a new HIV diagnosis at the time of syphilis diagnosis. Among named sex partners of index cases, we identified all new cases of early syphilis and HIV. We calculated the number needed to interview (NNTI) as the number of syphilis index cases interviewed divided by the number of new cases of early syphilis or HIV identified among partners.

**Results:** We identified 1619 index cases of early syphilis, of whom 1535 (95%) were interviewed for PS. These index cases named 2267 partners, of whom 1868 (82%) were contacted by MSDH. Among partners, 1508 (81%) were tested for syphilis and 745 (56%) of the 1,321 partners who were not previously HIV diagnosed were tested for HIV. PS identified 696 new cases of early syphilis (syphilis test positivity=46%) and 24 new cases of HIV (HIV test positivity=3.2%). Overall, 64 index case interviews were needed to identify one new case of HIV among partners, and 2 interviews were needed to identify one new case of syphilis among partners. Among MSM partners tested for HIV, 6.2% tested newly HIV positive.

**Conclusions:** Syphilis PS allowed MSDH to interact with 1592 MSM over a 30 month period and was effective for identifying new cases of early syphilis and HIV. Increasing HIV testing among partners of syphilis cases could increase HIV case finding in MS.

## Introduction

Mississippi has the 7th highest rate of new HIV infections in the United States and has experienced an increase in the rate of new HIV infections since 2012, despite national decreases in HIV incidence during the same time period.[1,2] The HIV epidemic in

Mississippi is characterized by high rates of HIV infection among Black/African Americans, and in particular young, African American men who have sex with men (MSM).[3,4] In 2015, 80% of all new HIV diagnoses in Mississippi were among African Americans, and nearly half of diagnoses in the Jackson metropolitan area were among African-American MSM.[3] 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. Syphilis partner services includes contacting index cases for the purposes of treatment verification and partner elicitation, and contacting partners to notify them of potential syphilis infection, and to offer syphilis testing and treatment.[5–7] In Mississippi, syphilis incidence has increased by 315% from 2013 (9.8 per 100,000) to 2016 (30.9 per 100,000) and Mississippi has the second highest rate of primary and secondary syphilis among MSM in the United States.[8] 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.

Like many health departments in the United States, the Mississippi State Department of Health (MSDH) already provides partner services for all new early syphilis infections reported in Mississippi. In 2014, MSDH added HIV testing into their routine syphilis partner services in order to increase HIV case finding among partners of syphilis index cases. While this strategy has been a promising HIV case finding strategy in other settings, its impact has not been evaluated in Mississippi. 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 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, DIS contact the index case to conduct an interview to verify treatment, collect demographic and risk information, and identify sexual partners. DIS then attempt to contact named partners to test for syphilis and collect demographic and risk information. 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 cases. As of 2014, MSDH added partner HIV testing of partners to their syphilis partner services activities.

## Study Population and Data Sources

We identified all early syphilis cases and their partners from July 1, 2014 to December 31, 2016 using PRISM. Index cases were defined as a case recorded in PRISM with a final disposition code for primary, secondary, or early latent syphilis (710, 720, or 730). Index case 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 cases that were newly diagnosed with HIV at the same time as their early syphilis infection. Partners of these cases would have likely received HIV testing as part of HIV partner services activities regardless of the index case'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. However, all negative HIV tests performed as part of partner services are recorded in Apollo. 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 have been HIV tested if they had an HIV test reported in either PRISM or Apollo within 30 days of being named as a partner by an early syphilis index case. Partners 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, and were considered to be a new case of syphilis if they had a final disposition code for primary, secondary or early latent syphilis (710, 720, or 730). *Analysis*

Separately for HIV and syphilis, we estimated the number of index cases 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 cases by the number of partners newly diagnosed with HIV or syphilis, respectively. We estimated 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. Partner services indices were estimated by dividing each of these outcomes by the total number of index cases. 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 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 there were 1619 cases of early syphilis reported to MSDH and 1535 (95%) of these cases were interviewed by DIS. Most index cases had early latent syphilis (63%) (Table 1). A majority of index cases were MSM (57%), Black/African American (78%), and under 30 years of age (60%). About one-third (n=534) of index cases were previously HIV positive at the time of their early syphilis diagnosis.

The 1,535 early syphilis index cases who were interviewed 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; 1343 (59%) were epi treated; and 448 (20%) were brought to treatment. 198 partners were treated for syphilis prior to DIS contact, and 11 partners refused treatment.

Table 3 summarizes the syphilis testing and case finding outcomes among partners. In total, 1507 (81%) of the 1868 partners contacted were tested for syphilis, and 695 (46%) of those tested 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 cases. About 2.2 index case interviews were needed to identify one new case of syphilis (Table 3). The NNTI for syphilis was lowest among partners of White (1.96), female (1.99) and HIV negative (1.96) index cases, and highest among partners of previous HIV positive (2.98), MSW (2.66) and Black/African American (2.22) index cases. NNTIs were lower among partners of White index cases compared to partners of Black/African American index cases. Regardless of race, MSW had the highest NNTI and women had the lowest NNTI.

MSDH contacted 1479 HIV-negative partners of syphilis index cases 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 cases 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, 19% were not tested because they were not located, and 6% were not tested because they refused examination or partner services. The proportion of partners tested for HIV did not vary substantially by index case characteristics.

Overall, 64 index case 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 NNTI's of 317 and 328 for MSW and women, respectively. The NNTI for Black/African American index cases (55) was lower than the NNTI for White index cases (121). No cases of HIV were found among partners of other races.

Among partners of Black/African American MSM, 35.5 index case 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 cases of HIV 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 cases among partners of persons newly diagnosed with syphilis. HIV case finding was particularly high among Black/African American MSM, a group that is at particularly high risk of HIV in Mississippi. Although HIV testing was only offered to about half of all partners, the HIV test positivity rate was high among partners of previous HIV positive index cases and MSM, indicating that expanding HIV testing to all partners may identify more new cases of HIV among these populations. Our findings suggest that syphilis partner services in Mississippi presents opportunities for both syphilis and HIV prevention, and integrating HIV prevention activities, such as HIV testing, into syphilis partner services in Mississippi could have a positive impact on HIV prevention efforts.

This evaluation, to our knowledge, is the first evaluation of syphilis partner services conducted in Mississippi, and these results can be used by MSDH to improve the quality of syphilis partner services. Syphilis partner services in Mississippi has been successful in providing testing, identifying new cases, and offering treatment to partners of persons newly diagnosed with early syphilis. Through syphilis partner services, MSDH disease intervention specialists had an opportunity to interact with 719 HIV negative MSM, and, in particular, 538 Black/African American HIV negative MSM over the course of a 30 month study period. 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 findings indicate that integrating HIV testing into syphilis partner services is a potentially effective strategy for identifying new HIV positive cases in Mississippi, particularly among partners of Black/African American MSM and previously HIV positive index cases (a group among whom 13 new HIV cases were identified among partners). However, given that the HIV test positivity rate among these subgroups is high (8% and 15%, respectively), improving the proportion of HIV negative partners that are tested for HIV particularly among these groups could substantially increase HIV case finding. We found that nearly half of HIV-negative partners of syphilis index cases did not test for HIV as a result of syphilis partner services, representing a large missed opportunity to identify new HIV cases. The exact reasons why many partners were not tested is unclear, but may include (INSERT DAVID REASONS HERE). Encouraging HIV testing of all partners may substantially increase the number of new HIV cases identified as part of syphilis partner services.

Our findings also indicate opportunities for integrating high impact HIV prevention activities into syphilis partner services. Leveraging the DIS' interactions with Black/African American MSM as an opportunity to provide PrEP or a PrEP referral to syphilis cases and their partners could significantly reduce HIV incidence and address racial disparities in PrEP uptake. 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.[9,10]

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.[11] Reducing HIV incidence among this population will require capitalizing on all HIV prevention opportunities, and MSDH's interactions with Black MSM as a result of syphilis partner services represents a potentially fruitful opportunity to improve PrEP uptake among this population. Indeed, MSDH began integration of PrEP referrals into STD partner services 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 partner services in MS.

The partner indices, syphilis case finding and HIV case finding outcomes associated with syphilis partner services in Mississippi are in range of partner services outcomes reported from other jurisdictions.[12–18] Notably, Mississippi had a relatively lower number of early syphilis index cases needed to interview to detect a new case of syphilis (2.2) compared to other evaluations conducted near the same time (e.g., Texas [NNTI=6.7] and North Carolina [NNTI=6.9]).[15,17] In contrast, Mississippi had a higher HIV NNTI (64) associated with syphilis partner services than North Carolina (43). This may be a reflection of the relatively low proportion of partners who received HIV testing as a result of syphilis partner services. Increased offering of HIV testing to partners of syphilis cases could result in increased HIV case finding and thus a lower HIV NNTI in Mississippi than that observed in this study.

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. As noted above, some possible reasons include [ask David if he has ideas about reasons]. 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 reporting and case surveillance data using a fuzzy matching algorithm that matched records on first name, last name and date of birth. While this record linkage improved the completeness of our identification of all HIV test results during the study period, some HIV test results and outcomes may have been missed due to misclassification of some matches. Positive HIV results are required to be reported to MSDH and are documented both in HIV laboratory and case surveillance data. Thus, it is unlikely that the nonsystematic documentation of HIV testing had an effect on the number of new HIV cases identified. However, it is likely that we underestimated the number of negative HIV test results among partners, and thus underestimated the proportion of HIV negative partners that were tested for HIV.

Integrating HIV testing into syphilis partner services is potentially an effective strategy for identifying new HIV positive cases in Mississippi, particularly among partners of Black/African American MSM and previous HIV positive index cases. Given the high test positivity among these subgroups, increasing the proportion of HIV negative partners tested for HIV could potentially increase HIV case finding through syphilis partner services.

Additional research evaluating the processes and workflows associated with HIV testing as part of syphilis partner services in Mississippi is needed to improve the integration of HIV testing in syphilis partner services. 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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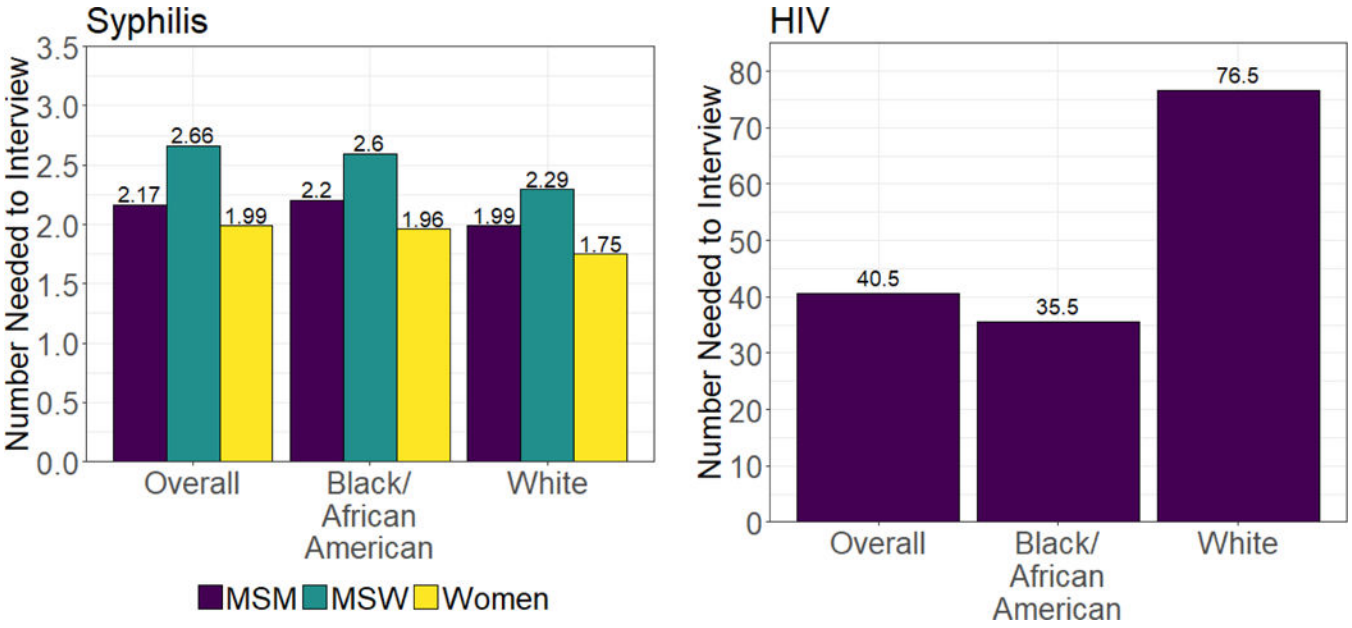


**Figure 1: Syphilis/HIV[1] Number Needed to Interview (NNTI) by race/gender.**

[1]HIV NNTIs are shown for MSM only; NNTIs for white MSW and women were not calculable

**Table 1:**

Characteristics of syphilis index cases in Mississippi, 2014–2016, by syphilis stage

| | Total N (%) | Primary & Secondary N (%) | Early Latent N (%) |
|---|---|---|---|
| **N** | 1619 | 605 | 1014 |
| **Age** | | | |
| 0–19 | 155 (10) | 61 (10) | 94 (9) |
| 20–24 | 488 (30) | 192 (32) | 296 (29) |
| 25–29 | 350 (22) | 132 (22) | 218 (21) |
| 30–34 | 224 (14) | 81 (13) | 143 (14) |
| 35–39 | 133 (8) | 50 (8) | 83 (8) |
| 40–44 | 78 (5) | 23 (4) | 55 (5) |
| 45+ | 190 (12) | 66 (11) | 124 (12) |
| **Gender/gender of sex partners** | | | |
| Women | 339 (21) | 102 (17) | 237 (23) |
| MSM | 925 (57) | 373 (62) | 552 (54) |
| MSW | 534 (33) | 208 (34) | 326 (32) |
| **HIV Status** | | | |
| Negative | 1088 (66) | 400 (66) | 688 (68) |
| Previous Positive | 531 (33) | 205 (34) | 326 (32) |
| **Race** | | | |
| White | 254 (16) | 98 (16) | 156 (15) |
| Black/African American | 1257 (78) | 476 (79) | 781 (77) |
| Other | 616 (38) | 227 (38) | 389 (38) |

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 (%) | Index[1] |
|---|---|---|
| Partners Named | 2267 (100) | 1.40 |
| Partners Contacted | 1867 (82) | 1.15 |
| Partners Interviewed | 465 (21) | 0.29 |
| Epidemiologic treatment[2] | 1343 (59) | 0.83 |
| Brought to Treatment[3] | 448 (20) | 0.28 |

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

[2] Partners who received treatment for syphilis regardless of syphilis infection status

[3] Partners who received treatment for a new syphilis infection

**Table 3:**

Syphilis Case Finding as a result of Syphilis Partner Services, by Index Case Characteristics

| Index Case Characteristics | Index Case 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 Characteristics | Index Case 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) | - |

[1]Among HIV- partners

[2]Among HIV- partners tested for HIV