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Incentivized community-based syphilis screening: uptake, yield, and cost

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Abstract

Background: High and increasing syphilis rates among American Indian/Alaska Native (AI/AN) communities and particularly among AI/AN women and infants call for immediate interventions to reach and offer syphilis testing to sexually active populations paired with timely treatment.

Methods: The Great Plains Tribal Epidemiology Center within the Great Plains Tribal Leaders Health Board (GPTLHB) partnered with a local non-tribal healthcare facility to offer free community-based syphilis testing in Rapid City, South Dakota, starting in December 2022 through June 2024. Participants received cash incentive cards for undergoing testing for syphilis, human immunodeficiency virus (HIV) and hepatitis C (HCV).

Results: Fifteen community testing events were conducted. Laboratory-based syphilis testing was performed on 1434 unique individuals, average age 38.8 years. Seventy-six (76) people were diagnosed with syphilis that had previously not been identified (prevalence 5.3% (76/1434); 51 (67.1%) were female. Treatment was provided to 80.3% of people with syphilis (61/76) within an average of 36 days. In total, the 15 events cost $158,019 ($75,000 administrative staff time + $5,100 laboratory staff time + $24,009 lab tests + $ 53,910 incentives) or $88 per test performed ($158,019/1797). The cost to identify a previously unidentified case was $$2,079 ($158,019/76 newly identified infected persons).

Conclusions: This community-based screening event revealed high prevalence of undiagnosed syphilis. Incentives supported community members to access screening services. Collaborations between clinical, tribal, and public health entities to bring diagnosis and treatment services to

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patients using a community-based approach have clear benefits but need ongoing supportive resources to be maintained.

Summary

A community-based screening program found that use of incentives resulted in high-uptake and syphilis case yield. The cost per case identified was $2,079.

Keywords

syphilis; community-based screening; American Indian/Alaska Native

Introduction

The total number of reported persons with syphilis in the United States increased 55% between 2020 and 2022.[1] Primary and secondary syphilis rates increased similarly, from 12.6/100,000 population in 2020 to 17.7/100,000 population in 2022, a 40% increase.[1] The primary and secondary syphilis rate among non-Hispanic American Indian and Alaska Native (AI/AN) persons increased 150% over this same period, from 26.8/100,000 to 67.0/100,000 population, resulting in the greatest increase in and the highest rates of syphilis for any racial or ethnic group.[1] Among the states, South Dakota experienced the greatest increase in primary and secondary syphilis rates, increasing 1039% from 2020 (7.4/100,000) to 2022 (84.3/100,000), ranking first in the nation in both 2021 and 2022.[1] Over this two-year period, 79.5% of the early syphilis cases in South Dakota occurred among AI/AN persons.[2]

The Great Plains Tribal Leaders Health Board (GPTLHB) is a tribal health organization composed of the 18 tribal nations and communities of North Dakota, South Dakota, Nebraska, and Iowa. GPTLHB houses the Great Plains Tribal Epidemiology Center (GPTEC), one of 12 federally mandated public health authorities created to provide and support public health activities in tribal communities in the 12 Indian Health Service Areas.[3] Per this mandate, GPTEC conducts all activities at the direction of the federally-recognized Tribes in the region and is defined as a public health authority for the purposes of the Health Insurance Portability and Accountability Act (HIPAA).[3]

In response to the rising syphilis rates among AI/AN people in the region, GPTEC partnered with a local non-tribal healthcare facility to offer free community-based syphilis testing in Rapid City, South Dakota. Herein, we describe this community testing program, including case yield, receipt and type of treatment among people with syphilis, and cost evaluation.

Materials and Methods

Screening venues, eligible population and incentives

GPTEC disseminated information about available syphilis screening prior to and during 15 community events between December 2022 and June 2024. All events occurred in an urban area in Western South Dakota. Syphilis testing was conducted in conjunction with community events including two at basketball tournaments, four at powwows, one at an HIV

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awareness walk, and one at a back-to-school event. Six stand-alone testing events were held at a tribal community college and one was held at a local housing unit. While the events were planned and advertised to attract AI/AN community members, anyone aged 18 and over was able to receive testing. As an incentive, prepaid cards worth $30, the maximum allowable amount under Indian Health Service guidelines, were provided to participants who underwent testing.[4]

Specimen collection and testing

Specimens were collected by laboratory personnel from a local healthcare organization at the testing event and transported to their healthcare facility for processing. Laboratory-based testing for syphilis followed a reverse algorithm: total syphilis antibody (Serodia *Treponema pallidum* particle agglutination, TP-PA) with reflex to a qualitative manual rapid plasma regain (RPR) and then, if abnormal, to manual RPR titer. Participants were also provided with hepatitis C virus (HCV; Hepatitis C antibody), and human immunodeficiency virus (HIV; HIV1 p24 Antigen/HIV1 Antibody/HIV2 Antibody) testing.

Results interpretation and reporting

At the time of testing, GPTEC public health medical staff reviewed the results and worked with the local tribal healthcare facility and the South Dakota State Department of Health to notify patients with positive syphilis test results and provide or refer for treatment. Positive test results were reported to the South Dakota Department of Health in accordance with state statute, and disease investigations were conducted by the state health department. GPTEC staff received testing results and worked with healthcare staff to contact patients and connect them to treatment. GPTEC did not provide treatment, conduct medical exams, or receive medical or public health case investigation records at the time of the events.

For this analysis, a positive syphilis test was defined as both a positive TP-PA and RPR. Participants with a positive result on only one of the tests (either TP-PA or RPR) were not considered to have a confirmed positive syphilis test result for this analysis but were reviewed by non-GPTEC clinical staff against state-based surveillance records in conjunction with state public health staff at the time of the result receipt to determine need for additional testing or clinical care. Participants were counted as having a confirmed syphilis test result from the first time they tested positive and were only counted as a possible new case one time.

Each positive syphilis result was reviewed to determine if it represented a new case based on available clinical and reportable disease surveillance data. A new case was defined as any participant with a positive test result that had no previous record of syphilis diagnosis, or whose results were consistent with reinfection.

For people with newly identified syphilis, treatment administration (yes or no), type (benzathine penicillin or doxycycline), and date of initiation were recorded. People with syphilis were counted as untreated if no treatment was confirmed within one year of the day of diagnostic testing. Staging was not evaluated as GPTEC did not have access to public health information collected.by the state health department at the time of most events.

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Analysis

Results from the testing events that occurred between December 15, 2022, and June 29, 2024, were included in the analysis, representing 15 events. Records were deduplicated to remove multiple results from anyone who participated in multiple events. Positive test results were retained for participants with duplicate results that were discordant. The number of positive results, test positivity (unique individuals with a positive TP-PA and RPR divided by the total number of unique individuals tested), prevalence rates, and treatment rates were calculated for syphilis using Microsoft Excel and R.

Computation of Cost of Screening Program

Four primary costs are involved in the community screening program: administrative staff time, laboratory staff time, laboratory tests, and incentives. All costs but laboratory staff time were assessed from the perspective of GPTEC, who organized the events, paid for the testing, and supplied the incentives. Each were calculated in 2023 US dollars. Laboratory staff time was assessed by the contracting laboratory. Administrative staff time included scheduling, organizing and advertising the events; creating educational materials; ordering and organizing gift cards and other giveaways; attending the event; and assisting in setting up and tearing down the event space. The laboratory staff time included administrative support (such as registering patients in the electronic health record and sending results), phlebotomy time at the events, and laboratory technician time to process the samples. The partnering organization did not charge a fee for the venipuncture. Laboratory test cost was calculated based on GPTEC records for syphilis only, although HIV and HCV were also drawn and added costs to the events. There was a charge for a TP-PA for each participant drawn. Separate charges were incurred for each qualitative RPR and RPR titer run in reflex to a positive TP-PA and a positive qualitative RPR, respectively. Each participant was provided with a $30 prepaid gift card every time they were tested. The total cost for the testing events was calculated using the sum of the above four costs for all 15 events. The cost per case was calculated by dividing the total cost of the events by the total number of unique people newly diagnosed with syphilis.

This activity was conducted as a public health surveillance effort by a public health authority (GPTEC), as authorized by 25 U.S.C. Section 1621m, for the purposes of identifying syphilis outbreak-associated infections and the evaluation of outbreak response measures and is considered non-research.[5] Review and determination as non-research was provided by the University of South Dakota IRB.

Results

Demographics

From December 15, 2022, to June 29, 2024, 1797 syphilis screening tests were performed on 1434 unique individuals, average age 38.8 years (range 16.1-81.2 years). 907 (63.2%) were female, average age 38.7 years (range 16.1-80.4 years), and 526 (36.7%) were male, average age 38.9 years (range 18.0-81.2 years) (Table 1).

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Syphilis test positivity (persons with both a positive TP-PA and RPR) was 10.5% (151/1434) overall, 11.8% (107/907) among females, and 8.4% (44/526) among males tested at the events.

Syphilis Results

Approximately half (50.3%, 76/151) of persons testing positive with treponemal test screening and nontreponemal test confirmation were identified as having undiagnosed syphilis, resulting in a prevalence of newly diagnosed syphilis of 5.3% (76/1434). The average age of people with syphilis was 35.1 years (range 18.1 – 59.1 years). 51 (67.1%) were female, and 25 (32.9%) were male. The average age of female persons with syphilis was 35.5 years (range 18.1 – 59.1 years), and the average age of males was 34.2 years (range 20.8-53.1 years). Females had a prevalence of newly diagnosed syphilis of 5.6% (51/907) and males had a prevalence of 4.8% (25/526).

Syphilis Treatment

Of the 76 people with syphilis who were identified, 80.3% (61/76) received treatment within one year of their testing date. Of female persons with syphilis, 88.2% (45/51) received treatment; 64.0% (16/25) of the males received treatment. People with syphilis were treated on average within 36days (4-229) from blood draw to medication administration overall, with female persons with syphilis averaging 36 days (4-229) to treatment, and males averaging 37 days (4-228).

All of the people with syphilis that were treated had treatment type available. Benzathine penicillin represented 60.7% (37/61) of the treatment provided while doxycycline was prescribed 39.3% (24/61) of the time. Females were prescribed benzathine penicillin 55.6% (25/45) and doxycycline 44.4% (20/45) of the time. Males were prescribed benzathine penicillin 75.0% (12/16) and doxycycline 25.0% (4/16) of the time.

Cost of Screening Program

As stated above, four primary costs were involved in the community screening program: GPTEC administrative staff time, laboratory staff time, laboratory tests, and incentives. Each event cost approximately $5,000 for administrative staff time and $340 for laboratory staff time, a total of $75,000 and $5,100, respectively, for the 15 events. The syphilis TP-PA labs cost $17,970 for the 15 events (1797 total TP-PA tests x $10 per TP-PA test). The RPR tests cost $ 11/test or $3,069 for all events (279 positive TP-PA tests reflexed to RPR testing x $11 per RPR test). The RPR titers cost $15 per RPR titer, or $2,970 total (186 positive RPR tests reflexed to RPR titer x $15 per RPR titer). Total lab tests costs were, therefore, $24,009. Participants were given $30 prepaid gift cards each time they were tested at an event for a total of $53,910 (1797 blood draws x $30 per card).

In total, the 15 events cost $158,019 ($75,000 administrative staff time + $5,100 laboratory staff time + $24,0091ab tests + $53,901 incentives) or $$88 per test performed ($158,019/1797). To find a new case of syphilis – one that had not been identified before the event – cost $ $2,079 per case ($158,019/76 newly identified people with syphilis).

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Discussion

Using a collaborative community-based model that included the provision of patient incentives, over fourteen hundred community members attended GPTEC events and were screened for syphilis in approximately eighteen months. Multiple venues for events allowed for variable access to screening in different locales. High rates of syphilis were observed among this adult general population with 5.3% of people tested being identified as new cases of syphilis. Provision of treatment was met with challenges related to access to benzathine penicillin, cost of treatment, and treatment completion. Case numbers may justify ongoing community outreach and screening events during syphilis outbreaks in AI/AN and other impacted communities and highlight the importance of continued support.

The successful partnering of GPTEC with local clinical health services allowed for identification of people with syphilis in community settings at no cost to participants. Key partners included a tribal public health authority (GPTEC), which provided funding for the events, staff, review of results, and referral for treatment; a local non-tribal healthcare facility (conducted testing); GPTLHB's tribal clinic (assisted with results review and provided treatment to eligible people with syphilis); and the state department of health (conducted case investigations and referred for treatment). This model of partnership could be used to expand public health testing, treatment, and partner services in AI/AN communities, with tribal public health authorities assuming a leadership role in outbreak response. Early events informed further expansion of services, such as offering treatment to people with known syphilis at events, which was made possible because of this collaboration between clinical and public health teams.

While the testing events were tailored to reach populations at potential risk, the venues and populations were not prioritized in other ways, such as persons in the corrections setting or people attending sexually transmitted disease (STD) clinics. However, the syphilis case positivity is comparable to that of a corrections or STD clinic setting.[6,7,8] Other focused community-based screening programs have had lower syphilis case positivity.[9,10,11,12] American Indians/Alaska Natives have shown an uncommon male to female ratio among people with syphilis, with AI/AN people having a lower male to female case ratio than other races and ethnicities.[1,13,14] This study demonstrated a similar heterosexual outbreak trend, with males having a prevalence of 4.8% and females having a prevalence of 5.6% or a male to female prevalence ratio of 0.86. The causes of this difference are not well studied or understood. However, the relatively high rates of syphilis among AI/AN women requires urgent attention as having a population with a disproportionate rate of infected females predicts ongoing high rates of congenital syphilis as is seen in AI/AN communities.

By working in partnership with clinical and public health staff, 80.3% of the newly identified people with syphilis were treated. The nearly 2 out of 5 people with syphilis were treated with doxycycline and not the CDC recommended treatment for all stages of syphilis, benzathine penicillin.[15] Females were less likely than males to be treated with benzathine penicillin. The testing period overlapped with a national benzathine penicillin shortage, announced by the CDC on July 20, 2023, which may have impacted clinician choice of treatment.[16] Staff reported challenges in contacting people with syphilis for result

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review, education, and treatment reflecting in long intervals from diagnosis to treatment which exceeded one month for both males and females. In populations that are at high-risk for syphilis and who face barriers to follow-up care, rapid testing with immediately available treatment may be preferable, as has been recommended by the National Syphilis and Congenital Syphilis Syndemic Federal Task Force.[17] However, in this study, half of patients with positive treponemal and nontreponemal test results were persons with previously diagnosed and treated syphilis. Such high proportions of persons with a history of treated syphilis would reduce the utility of rapid testing in the community setting due to risk of overtreatment. While treatment adherence was not evaluated in this review, local clinical and public health staff expressed concern that many people with syphilis did not complete prescribed courses of doxycycline. The impact of the benzathine penicillin shortage on prescribing practices and resulting changes in cure rates among people with syphilis requires further evaluation.

The laboratory cost of finding a case of syphilis through these screening events was $2079, in the range found by other studies.[10] The largest proportion of the cost was GPTEC administrative staff time to conduct the events, representing approximately half of the total cost. Incentives represented approximately a third of the total cost of case finding and nearly twice as much as the laboratory costs. Although costs could be reduced significantly by not providing or reducing the value of the incentives, this may have a negative impact on the number of people or the characteristics (such as sexual or other risk factors) of people who participate in the testing events, possibly decreasing the case identification rate of the testing events. While not the stated intention, providing incentives may address socioeconomic needs such as transportation which may otherwise be a barrier to accessing health screening.

Although providing treatment was outside the scope of this program, estimated treatment costs are significant and could be cost prohibitive for some jurisdictions. Indian Health Service and tribal facilities are able to receive benzathine penicillin through Federal Supply Schedule contracts, also used at other federal clinical facilities such as the U.S. Department of Veterans Affairs.[18,19] As of December 2024, the federal rate was $2,773for one box of ten 1.2 million unit benzathine penicillin prefilled syringes, or $555for a single dose of 2.4 million units of benzathine penicillin.[20] The estimated cost to provide all newly identified people with syphilis in this report (n = 76) with the CDC recommended benzathine penicillin treatment[15] ranges from $42,180 (76 people with syphilis x $555) for a single dose to $126,540 (76 people with syphilis x $1,665) for three doses. Thus, the projected total cost of the program, including recommended treatment for all identified people with syphilis, ranges from $200,199, assuming provision of a single dose of benzathine penicillin to all for treatment of an early stage of syphilis to $284,559 to provide three doses of benzathine penicillin assuming all people diagnosed had late latent/unknown duration syphilis, increasing the cost to both identify and treat each case by 27 to 80%. Treatment costs may be even higher in other settings as a reduced treatment cost rate was assumed as many patients received care through tribal or IHS facilities where benzathine penicillin is available at the federal rate. While identifying and treating persons with syphilis remains an important public health goal, cost, particularly of treatment with benzathine penicillin, may be an ongoing barrier for other jurisdictions.

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Limitations

Our methods and results can be considered for other areas with high or increasing syphilis rates. The number of testing events, number of people tested, and locations of testing events were limited due to staff availability despite strong partnerships between various community groups. Our analysis underestimates the total cost of this intervention. Not included in the cost calculations is clinical time to review the laboratory results and contact patients, public health disease intervention staff time, clinical staff time to administer treatment, and cost of treatment.

Further limiting outbreak control efforts were the difficulties in contacting participants testing positive after the events and the high cost of benzathine penicillin, even at a negotiated rate. Referring patients for syphilis treatment in facilities that procure benzathine penicillin at discounted pricing through the 340B program, could significantly reduce costs.[21]

Along with other tribal epidemiology centers and tribal public health departments, GPTEC has faced challenges in accessing public health data commonly available to non-tribal public health departments, including information on persons with reportable diseases such as syphilis.[22,23] Due to the limitations in data access but cognizant of the rising syphilis rates among AI/AN people in the region, GPTEC developed this community-based sexually transmitted infection screening program to help identify people with syphilis, HIV, and HCV and connect them to care. However, the analysis is limited by not having full information on people with syphilis, such as syphilis staging; thus, our costs for treatment are projections. As described above, this type of data is often not available to tribal epidemiology centers and tribal public health departments. While data access for GPTEC has improved since the start of the screening program, deficits in access still exist and hinder GPTEC's public health monitoring and response efforts. Continued work is needed to ensure that GPTEC and other tribal public health authorities have consistent access to, at a minimum, the same data held by non-tribal public health authorities.

Summary and conclusions

High and increasing syphilis rates among AI/AN communities and particularly among AI/AN women, and the resulting increased risk for congenital syphilis, call for immediate and innovative approaches to reach and offer syphilis testing to sexually active populations paired with timely treatment. Tribal communities with a high burden of syphilis among heterosexual persons are experiencing preventable adverse birth outcomes caused by congenital syphilis. Use of rapid testing in the community or clinical setting with immediately available treatment could help identify and prevent congenital syphilis.[12] Collaborations between clinical, tribal, and public health entities to bring diagnosis and treatment services to patients using a community-based approach has clear benefits but lacks ongoing data sharing and supportive resources to maintain. Additional interventions and evaluations such as this are needed to identify and prioritize cost-effective ways to further tailor programming to reach communities in need of syphilis and other sexual health screenings and treatment.

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Table 1: People tested for syphilis at 15 community-based syphilis testing events between December 2022 and June 2024 in Western South Dakota

	Total	Female	Male
Unique Individuals Tested (% of total)	1434 (100)	907 (63.2)	526 (36.7)
Average age, years (Range)	38.8 (16.1-81.2)	38.7 (16.1-80.4)	38.9 (18.0-81.2)
Test positivity rate*, % (number positive)	10.5 (151)	11.8 (107)	8.4 (44)

* individuals with a positive TP-PA and RPR divided by the total number of unique individuals tested

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Table 2: People newly diagnosed* with syphilis from 15 community-based syphilis testing events between December 2022 and June 2024 in Western South Dakota

	Total	Female	Male
Number (% of total)	76 (100)	51 (67.1%)	25 (32.9%)
Average age, years (range)	35.1 (18.1-59.1)	35.5 (18.1-59.1)	34.2 (20.8-53.1)
Syphilis prevalence *	5.3	5.6	4.8

* persons testing positive on both TP-PA and RPR were cross referenced in clinical and surveillance databases. A new case was defined as any participant with a positive test result that had no previous record of syphilis diagnosis, or whose tests results were consistent with reinfection.