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Bacterial Sexually Transmitted Disease Screening Outside the Clinic—Implications for the Modern Sexually Transmitted Disease Program

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Abstract

Background—The development of noninvasive nucleic acid amplification tests for chlamydia and gonorrhea has facilitated innovation in moving sexually transmitted disease (STD) screening to nonclinical settings. However, limited data are available to inform local STD programs on evidence-based approaches to STD screening in nonclinical settings in the United States.

Methods—We conducted a systematic review of the literature published since 2000 related to chlamydia, gonorrhea, and syphilis screening in US correctional settings, bathhouses and sex venues, self-collected at-home testing, and other nonclinical sites.

Results—Sixty-four articles met eligibility criteria and were reviewed. Although data on testing volume and positivity were available, there were scarce data on the proportion of new positives treated and the programmatic costs for the various screening programs. Screening in correctional settings identified a sizable amount of asymptomatic infections. The value and sustainability of screening in the other nonclinical settings examined was not clear from the published literature.

Conclusions—Local and state health departments should explore the development of sustainable jail and juvenile detention screening programs for STDs. Furthermore, local programs should pilot outreach and home-based STD screening programs to determine if they are identifying asymptomatic persons who would not have otherwise been found. Local programs are encouraged to present and publish their findings related to non–clinic-based screening to enhance the limited body of literature; data on the proportion of new infections treated and the local program costs are needed.

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Sexually transmitted disease (STD) screening activities in nonclinical settings remain a core activity of many domestic STD prevention and control programs. These targeted screenings have been seen as effective ways to find otherwise unrecognized or undiagnosed disease in a community and, through resultant case and partner treatment, provide opportunities to prevent further transmission.[1] Advances in testing technology, such as nucleic acid amplification tests (NAATs), have eliminated the need for clinical examinations to identify chlamydial and gonococcal infections.[2] This technological advancement has allowed for community-based and other non–clinic-based STD screening activities beyond traditional clinic-based settings, and numerous efforts to implement screening and case finding in a range of nonclinical settings have been documented.

Although non–clinic-based STD screening programs likely identify previously undiagnosed STDs, they are often episodically implemented (e.g., in response to an outbreak) and may require a large outlay of resources, both in staffing and laboratory costs that may not be sustainable in the long term. Findings on the effectiveness of non–clinic-based screening programs conducted in other countries may not be generalizable to the United States due to varied target populations and health care delivery systems as well as differences in the relative acceptability of screening in alternative settings. Evidence-based guidance is needed to help direct limited STD program resources in the United States, where health care is uniquely structured (e.g., reduced access to care, not a single-payer system, and co-payments for services) and sexual health services are mostly provided in STD and family planning clinic settings.[3,4] Previous reviews of non–clinic-based STD screening activities have not been restricted to settings in the United States; were not inclusive of data from syphilis, chlamydia, and gonorrhea screenings; and have not focused on the programmatic costs of implementation or the cost efficiency of case finding.[5,6] We review recently published reports on the outcomes of non–clinic-based STD screening programs (including corrections, bathhouse, and self-collected specimen home-based screenings). This review of the published literature can help inform the utility of and resources needed to implement these activities in the context of the local STD epidemiology in health jurisdictions in the United States.

METHODS

We conducted a systematic review of the published literature related to STD screening among incarcerated adolescents and adults, men who have sex with men (MSM) attending sex venues and bathhouses, self-collected home-based testing programs, and other non–clinic-based community settings. PubMed/Medline databases were searched using the following search terms:

Setting	Search terms
Incarcerated populations	(STD screening OR chlamydia screening OR
	syphilis screening) AND (jail OR juvenile detention OR corrections)
Sex venues and bathhouses	(chlamydia OR gonorrhea OR syphilis) AND (sex venue OR sex venue OR bathhouse)

Setting	Search terms
Other community settings	(chlamydia OR gonorrhea OR syphilis) AND (community screening OR outreach screening)
Internet and home collection	(chlamydia OR gonorrhea) AND (home screening OR self-collected OR home sampling OR home collection kits OR home screening OR self-sampling OR self-obtained vaginal specimens OR self-collected OR postal specimens OR Internet)

This review was limited to non–clinic-based screening activities that occurred after January 2000 and through December 2014, to ensure comparability across diagnostic technology (namely, NAAT-based testing for chlamydia and gonorrhea). Because cost considerations are a focus of this review and the United States has a unique system of health care delivery and reimbursement, we limited our review to articles describing screening activities conducted in the United States. Only articles written in English were considered. The reference lists of eligible articles and systematic reviews were also examined to find relevant publications, and conference abstracts were included in the review as well.

Publications included in this review were at a minimum required to report data on the number of persons tested for chlamydia, gonorrhea, or syphilis, and the percent positive for each infection. Additional data were abstracted from published reports on the number or proportion of infected persons who were subsequently treated for their infection. Cost data are critical to the evaluation of the value of non–clinic-based STD screening activities and programs. Because many local and state health departments are struggling to allocate scarce resources, understanding the costs and relative benefits of different screening activities can help prioritize programmatic work. When reported, we included data on programmatic costs associated with the programs reviewed. Specific program elements thus presented in this review include the following: setting, specimen type, diagnostic test, total screened, total number and proportion positive, proportion treated, cost per case identified, and total program cost as reported.

RESULTS

Incarcerated Populations

Literature searches identified 70 publications, of which 21 met the eligibility criteria to be included in the review of STD screening in correctional facilities. Chlamydia/gonorrhea positivity based on NAAT using urine specimens and syphilis positivity (based on screening with the rapid plasma reagin [RPR] test, and mostly followed with confirmatory treponemal tests) is summarized in Table 1. Screening efforts, most of which focused on chlamydia detection, yielded significant numbers of previously undiagnosed infections. There was a consistent pattern with regard to sex, age, and chlamydia positivity rates. Females had higher STD positivity compared with males, and, with the exception of one study in California,[22] adolescents girls had much higher STD positivity compared with adolescents boys, adult men, and adult women; this was especially evident in studies describing screening programs in both juvenile detention and adult correctional facilities within selected jurisdictions.[20,22,28] Chlamydia positivity among adult men ranged from 3.0% to 7.9%, and among women, positivity ranged from 5.9% to 14.6%. Chlamydia positivity ranged from 3.3% to 8.8% among adolescent boys, and 5.1% to 24.7% among adolescent girls. In contrast, gonorrhea positivity was low among adult men (1.5%–2.0%) and women (2.5%–3.4%). Gonorrhea positivity among adolescent boys (0.7%–1.5%) and girls (3.2%–7.3%) was also relatively low.

Seven studies describing syphilis screening generally showed a low prevalence of reactive serologies (<2%) among men and women. Screening in a Los Angeles jail yielded positive confirmatory serologic test results among 8% of MSM; however, only 1.6% of them were diagnosed as having infectious (primary, secondary, or early latent) stages of syphilis.[8] One study estimated staff and testing costs for syphilis serologic screening in 4 jurisdictions where the number of tested inmates in 2007 (the most recent year of data) ranged from 15,000 (Washington, DC) to nearly 90,000 (New York City), and the percent of new cases identified ranged from 0.2% to 0.4%, including early and high titer late-latent cases.[29] Reported cost per case identified (not including follow-up or treatment costs) was lowest in Washington, DC ($225), and highest in New York City ($3,280), where higher pricing for the RPR and higher testing volume contributed to elevated costs. Actual program costs may have been higher than reported, and individual sites had high variability in cost per case identified due to instability in the percentage of new cases among inmates tested.

Bathhouse and Sex Venue Screening

Literature searches initially identified 70 eligible publications, of which only 2 published reports described chlamydia and gonorrhea screening among MSM in sex venues; both were limited to urine screening (Table 2). In New York state, nearly 500 MSM urine specimens were collected, with an overall chla-mydia positivity of 2.1% and gonorrhea positivity of 0.4%.[37] Mayer et al.[38] screened 889 MSM and identified 12 chlamydia infections (1.3%) and 1 gonorrhea infection (0.1%). Neither of these 2 articles reported on the proportion of the positive infections identified at the sex venues that were treated or on program cost, although the testing described in Mayer et al. occurred for 77 months with multiple 3-hour testing sessions per month.

Four publications reported on syphilis serologic screening at MSM sex venues. Lewis et al.[29] described a number of sex venue–based screening events that identified 16 new syphilis diagnoses of all stages among 680 MSM (2.4%); the authors estimated that cost per new case identified ranged from $343 to $7451, although some programmatic costs may have been excluded. In a diverse geographic sample of MSM sex venue screenings, Ciesielski et al.[25] screened more than 2500 MSM and identified a total of 34 new syphilis diagnoses (1.4%) and 29 early syphilis cases (1.2%). A large screening program in Georgia tested 8304 MSM from 2006 to 2010 and identified 332 early syphilis cases (4.0%)[39]; all 332 were referred for syphilis partner services. Viele and colleagues[37] screened 174 MSM for syphilis in sex venues and reported a seropositivity of 2.3%, whereas Mayer et al.[38] screened 850 MSM in a New England bath house and reported a syphilis seroprevalence of 2.0%. None of these articles reported on the number of new syphilis cases that were treated or program cost.

Other Community-Based Screening Activities

Literature searches initially identified 1256 publications, of which 23 met the eligibility criteria (Table 2). Several publications reported on additional STD screening activities conducted in a variety of community settings. Grimley et al.[35] screened clients seeking services at a homeless shelter for chlamydia/gonorrhea; 9 chlamydia and 7 gonorrhea infections were identified among 140 persons tested, of which 8 and 6 were effectively treated, respectively. In addition, 133 syphilis serologic tests were performed and 1 new primary and secondary syphilis case identified (0.8%) and treated.[35] Among homeless youth in Denver, 13% were infected with chlamydia and 3.7% with gonorrhea; 61% of these new infections were treated.[40] A program conducted in collaboration with the family court screened more than 1500 adolescents on probation for chlamydia and gonorrhea and overall positivity of 8.4% with 96% of newly identified infections treated.[33] Mobile van,[30] community outreach,[32] and college campus–based screenings[31] also identified significant burdens of infection (Table 2). In a large sample of community-based organization-sponsored syphilis screening activities in 5 states, more than 11,000 tests were conducted, identifying 48 new syphilis diagnoses (0.4%).[29] Most of these studies provided no cost information, although limited cost data indicated community based organization screening cost higher than $2473 per case identified.[29]

A number of community-based screenings have targeted MSM populations. In New York City, Blank and colleagues[34] screened MSM bar patrons over the course of 9 testing events and identified a low prevalence of chlamydia (1.0%) and gonor-rhea (0.5%), but did identify 2 early syphilis cases. The events also offered hepatitis and other immunizations, and HIV testing; 7 new cases were identified (4.2%). The only published reports we identified that conducted extragenital testing among MSM found high pharyngeal gonorrhea positivity (8.5%), as well as 2 urogenital gon-orrhea (1.9%) and 3 chlamydia (2.5%) infections; rectal testing was not conducted.[36] Over a 5-year period in a range of geographic locations, 2549 syphilis serologic tests were conducted through mobile van testing, identifying 8 new early syphilis infections (0.3%).[25] Men who have sex with men bar–based syphilis screening of nearly 900 MSM identified 6 (0.7%) early syphilis infections.[25]

Only 2 reviewed articles directly reported any data on cost or effort. Each of the 9 MSM bar–based screenings in New York City cost $10,180, including clinic follow-up visits for patients testing positive but excluding testing and vaccine costs.[34] Aggregate data for all 9 screening events were reported, so the cost per positive case identified for each event was not available. However, across all screenings, total costs were $91,620, and 2 cases of gonorrhea, chlamydia, and early syphilis each were identified; although vaccines were offered and 7 cases of HIV were diagnosed, the outreach events may have been relatively costly.[34]

Internet-Based Screening and Home Specimen Collection

A total of 72 citations were retrieved based on the search strategy, of which 14 were eligible for review. An additional 4 references meeting inclusion criteria were identified from reference lists associated with the articles meeting the inclusion criteria, resulting in a total of 18 studies reviewed for this analysis. The reviewed articles are summarized in Table 3.

The earliest reported screening interventions in the United States to expand access to chlamydia and gonorrhea screening on a community basis or repeat screening of cases were implemented in San Francisco using home-collected urine specimens in the early 2000s.[57,58] Although uptake of home specimen collection kits was less than 50% among target populations in these early programs, there was a relatively high yield of gonorrhea among MSM and chlamydia among young women.[57] Gaydos and colleagues[56] then expanded access to home-based screening by creating a Web site (www.iwantthekit.org) through which vaginal swab collection kits could be ordered and returned by mail. The yield among girls and women age 14 years and older in the initial study was 10% and nearly all had confirmed treatment. This Internet-based program further expanded to accept self-collected penile swabs and urine from male participants. As with female participants, case yield was high with 13% chlamydia and 10% trichomonas positivity, but low for gonorrhea (1%).

To date 3 randomized controlled trials have been conducted to compare the uptake of clinic-based screening versus home-based collection; all have demonstrated that screening uptake was higher for home-based screening and that positivity was as high as 10% among these specimens.[49,52,55] Since 2006, numerous pilot programs across the United States have used Internet-based recruitment based on the www.iwantthekit.org model to reach priority populations who may be less likely to access care and those needing rescreening to identify repeat infection. Chlamydia positivity has been consistently high, ranging from 5.8% to 13% among females and 13.6% among males.[43] Gonorrhea positivity, however, has tended to be less than 2%. The return rate of kits requested varied widely from 30% to 70% across the 18 studies as well as the volume of test kits, depending on the target population and marketing strategy. The volume of testing, especially in programs that are marketed to larger geographic areas, has increased where more than 1500 tests were requested in a year in one program.[46]

Although most articles mentioned follow-up treatment at partner clinics and local health departments for cases identified through home-based screening, information on actual follow-up of cases was rare. Only 4 publications included the proportion of cases treated, which ranged from 62% in the “eSTI” program in 4 California counties,[41] 87% in the Los Angeles “I Know” program, to greater than 95% in the “iwantthekit.org”program.[54,56] No publications reported rates of partner management.

In the one cost-effectiveness model that evaluated Internet-based screening programs (using www.iwantthekit.org parameters) versus clinic-based screening, the Internet-based program prevented 35.5 more cases of pelvic inflammatory disease and was cost saving in a hypothetical cohort of 10,000 women with a chlamydia prevalence of 9.1%; sensitivity analyses showed that in most scenarios, Internet-based screening was cost saving greater than 6% prevalence.[59] Another cost-effectiveness analysis considered the costs of home-based screening versus clinic-based screening on a health systems basis and found that home screening might be cost-effective if there is a true shift in patients changing from clinic to home screening[60] as a result of lower direct costs for home-based screening. However, the cost savings associated with home screening were dependent on the proportion of users who were asymptomatic and would not seek out routine clinical services related to signs and symptoms of an STD, a factor that likely impacts total case yield. A preliminary cost-effectiveness analysis of the Los Angeles County Internet campaign[46] indicated that although the pilot program was probably not cost-effective given the formative and media costs, under some scenarios considered in sensitivity analysis, the program could deliver health benefits for approximately $100,000 (no formative or media costs included) to $200,000 (including formative and media costs) per quality-adjusted life-year saved with Internet testing versus clinic-based testing.[61]

Only 2 publications and 1 abstract noted the costs associated with implementing Internet-based recruitment. Although the www.iwantthekit.org and other home-based testing administered by STD programs are free to the participants, there are costs associated with Web site development, maintenance, reimbursement for treatment, and the follow-up care typically provided in affiliated local health department or other publicly funded health program partners. Jenkins and colleagues[48] noted that unless the absolute number of persons reached increased through Internet recruitment, even with high positivity, the program costs may not outweigh the costs of averted cases. The program costs increase beyond Web site development and maintenance when the additional cost of marketing home-based specimen collection is considered. For instance, in the California eSTI program, whose objective was to reach women in high-morbidity communities, the multiple social marketing strategies for maximum outreach included advertising via radio, bus, and train as well as street outreach. The health department cost per case detected was lowest for street outreach ($2419) compared with bus and train advertising ($5120).

DISCUSSION

Marginalized populations including MSM, adolescents of color, and incarcerated persons are disproportionately affected by STDs.[62] Access to culturally competent and appropriate sexual health services for these populations may be limited; non–clinic-based STD screening may be a good alternative. We reviewed the current published literature on a range of non–clinic-based STD screening programs. The potential impact and utility of these activities varied widely based on target population. Sexually transmitted disease screening for incarcerated populations seemed to be the most productive of the screening programs we reviewed. Sexually transmitted disease screening programs in correctional settings have been shown to be cost-effective and yield a large number of newly diagnosed chlamydia infections. Although gonorrhea and syphilis infections are less often detected, these screening programs are important in that they not only benefit incarcerated persons directly, but there is potential for a broader population-level impact through interruption of ongoing disease transmission when treated detainees return to their communities after release from corrections.[7] Only 2 publications on STD screening programs for MSM bathhouses and sex venues were identified, and these were limited to urogenital testing which likely missed many prevalent and asymptomatic extragenital infections.[63] A range of community settings were also examined, many of which showed low productivity and identified few new infections. However, some settings, such as probation and college campuses, resulted in higher positivity and may be productive sites for future screening activities. Finally, Web-based and home screenings are exciting new endeavors that leverage new information technology for reaching target populations and facilitate receipt of results and follow-up care in a timely and confidential manner. However, the number of participants in the programs reviewed was small and although positivity was high, the absolute number of new infections identified was low. This suggests that, at least among those programs evaluated here, the population-level impact is limited.

The limited program data available in the reviewed publications hindered a full evaluation of effective program uptake, delivery, and impact. We were able to assess screening program impact on reach (the number of persons tested and their level of risk) and yield (the number and proportion of new infections identified). However, most of the publications reviewed did not include data on programmatic costs, which limits an assessment of the cost-effectiveness of these activities. Cost-effectiveness analyses should state the cost perspective, time frame, analytic horizon, base year for costs, discount rate for future costs, and detail how cost data were collected or estimated.[64] Most of the studies in this review lacked at least some of these components, which limits confidence in the results presented and makes comparison across studies challenging.

In addition, few articles described the proportion of new infections identified through screening programs that were appropriately treated. Identification of new infections without appropriate treatment clearly does not benefit those who are infected and will have a minimal impact of community burden of disease. Ensuring treatment of cases identified in nonclinical settings can be challenging, particularly in correctional settings.[65] Health departments, community-based organizations, and other agencies conducting STD screening outside the clinic setting should be encouraged to publish and present details of their screening programs to better inform this important, but limited, body of research. Although cost per case treated is the most useful cost-effectiveness measure that can be directly observed by programs, cost per patient tested and cost per case detected can be useful, as well, in assessing competing nonclinical screening interventions. Final outcomes such as cost per quality-adjusted life-year typically require estimation based on observed outcomes.

Although a handful of published cost-effectiveness analyses of correctional screening have shown the cost-effectiveness of screening in this venue,[66–68] they were based on theoretical cohorts. In our review, programmatic cost data were lacking across the venues examined. Even STD screening in settings with high positivity may be less feasible if the costs to sustain the program are high and depend on public health resources. Cost considerations are crucial to evaluating the programmatic direction for local health department nonclinical screening activities. For example, a correctional screening program where existing jail staff collect specimens and ensure treatment would likely be relatively cost-effective compared with other nonclinical screening options because the only STD related costs would be related to specimen collection and testing. Correctional health staff would simply add the additional specimen collection tasks to an exam already being performed and could be negotiated as part of contracts with medical services provided by noncorrectional providers. However, if STD program staff are needed to travel to a correctional facility just to collect specimens, arrange for laboratory testing, and ensure treatment, program costs will be significantly higher.

Furthermore, in many of the settings we evaluated, the infrastructure costs, especially at the onset of the screening program, may be high and beyond the reach of a local program with limited resources. Even for cost-effective programs, these startup costs can be barriers to implementation. Finally, the context and value of identifying and treating a new STD infection must be weighed against the cost of inputs needed to treat the infection. In an acute STD outbreak setting, screening activities may be more expensive than general nonclinical screening, but the value of finding an additional undiagnosed STD infection may be higher. Cost-effectiveness analyses may only capture this added value if they account for averted future transmissions, which is typically accomplished via dynamic modeling.[69] Future screening activities should at a minimum include full documentation of programmatic costs and the proportion of new infections treated whenever possible.

Reviewing non–clinic-based syphilis screening programs was particularly challenging. Syphilis cannot be diagnosed based solely on serologic testing and generally requires not only trepone-mal and nontreponemal specific serologic testing, but also clinical examination and review of syphilis serologic histories.[70] Most syphilis screening programs we reviewed conducted only serologic testing. In addition, several of the publications reported the results of syphilis screenings in terms of “positivity” or “prevalence.” Consequently, it was not clear if syphilis identified through these screenings represented new early cases of syphilis or older treated infections, a distinction that has implications for treatment for the infected individual, the probability of ongoing syphilis transmission, and the cost-effectiveness of the program.

Our review of the current literature on non–clinic-based bacterial STD screening has a number of limitations. As a review of activities undertaken in the United States, important data on the potential effectiveness of non-clinic screening programs from other countries were purposefully omitted. To ensure comparability with respect to the use of newer NAAT-based chlamydia and gonorrhea screening, we only reviewed screening activities that occurred since 2000. However, even in our review of the more recent publications, we found a high level of variability in the NAAT technology used, which may have compromised the comparability of the various publications reviewed. We focused on chlamydia, gonorrhea, and syphilis screening programs and purposely did not include HIV screening programs. Whenever possible depending on the target population, HIV and STD screenings should be conducted in concert, or access to HIV screening should be facilitated for those testing positive for bacterial STDs. The addition of HIV screening to bacterial STD screening programs will likely increase the cost-effectiveness of these activities because the cost of a new HIV diagnosis is quite large.[71] In addition, incorporation of reduced transmission of HIV due to treatment of bacterial STDs can impact the cost-effectiveness of STD screening interventions even if HIV screening is not directly offered.[72] This review of the literature was not quantitative in design and meta-analytic summary measures of the intervention outcomes were not produced. Finally, the paucity of data on cost and treatment identified limited our ability to fully assess the full programmatic potential of non–clinic-based STD screenings.

Sexually transmitted disease screenings outside the clinic may help identify high-risk persons who may not normally intersect with regular clinical services. Here we reviewed the current literature regarding outcomes from chlamydia, gonorrhea, and syphilis screening in correctional settings, in sex venues and bath-houses, through Web-based platforms, and in general community outreach. Although correctional screening identified high positivity of all 3 infections among a population at high risk for STDs that may have limited access to medical care, the productivity of screening in the other settings was less clear. For programs seeking to reach high-risk persons via the Internet or other community-based outreach, there are clear advantages to participation as a result of reduced stigma associated with seeking STD testing, increased confidentiality of testing, and the ability to reach populations that do not access primary or reproductive health care. Generally, all the screenings programs identified some disease, but the costs associated with implementing and sustaining the activities may have made the programs relatively costly. The high initial costs, especially those associated with recruiting target populations to Internet-based or community-based outreach programs, may continue to be a barrier in the expansion of these strategies. In addition, if populations reached are already regularly engaging in care, screenings outside the clinical setting may only be shifting the locus of diagnosis and not truly uncovering hidden disease. Such programs will only be cost-effective if they can be delivered at a lower cost per case treated than clinical screenings, which many do not.

Future evaluations should include data on the proportion of new cases of STDs that were not only identified, but also treated. These data are critical to assess programmatic success and public health impact. Other data that may be of value also include verification of treatment among those newly identified as positive as well as screening and treatment (if necessary) of sexual partners. Furthermore, programs interested in developing non–clinic-based screening programs should include well-developed evaluation plans that include program costs, risk data on those participating, and verification of treatment when possible. These inputs will allow local and state programs the ability to evaluate the productivity and cost-effectiveness of these activities in populations in accordance with local epidemiology.

References

1. Centers for Disease Control (CDC). Syphilis trends in the United States. MMWR Morb Mortal Wkly Rep. 1981; 30:441–444. 449. [PubMed: 6792486]
2. Schachter J. DFA, EIA, PCR, LCR and other technologies: What tests should be used for diagnosis of chlamydia infections? Immunol Invest. 1997; 26:157–161. [PubMed: 9037620]
3. Pathela P, Klingler EJ, Guerry SL, et al. Sexually transmitted infection clinics as safety net providers: Exploring the role of categorical sexually transmitted infection clinics in an era of health care reform. Sex Transm Dis. 2015; 42:286–293. [PubMed: 25868143]
4. Golden MR, Kerndt PR. Improving clinical operations: Can we and should we save our STD clinics? Sex Transm Dis. 2010; 37:264–265. [PubMed: 20182405]
5. Hengel B, Jamil MS, Mein JK, et al. Outreach for chlamydia and gonorrhoea screening: A systematic review of strategies and outcomes. BMC Public Health. 2013; 13:1040. [PubMed: 24188541]
6. Cohen DA, Kanouse DE, Iguchi MY, et al. Screening for sexually transmitted diseases in non-traditional settings: A personal view. Int J STD AIDS. 2005; 16:521–527. [PubMed: 16105185]
7. Barry PM, Kent CK, Scott KC, et al. Is jail screening associated with a decrease in chlamydia positivity among females seeking health services at community clinics? San Francisco, 1997–2004. Sex Transm Dis. 2009; 36(2 suppl):S22–S28. [PubMed: 18418298]
8. Javanbakht M, Murphy R, Harawa NT, et al. Sexually transmitted infections and HIV prevalence among incarcerated men who have sex with men, 2000–2005. Sex Transm Dis. 2009; 36(2 suppl):S17–S21. [PubMed: 19125146]

9. Trick WE, Kee R, Murphy-Swallow D, et al. Detection of chlamydial and gonococcal urethral infection during jail intake: Development of a screening algorithm. Sex Transm Dis. 2006; 33:599–603. [PubMed: 16540885]
10. Chen JL, Bovée MC, Kerndt PR. Sexually transmitted diseases surveillance among incarcerated men who have sex with men—An opportunity for HIV prevention. AIDS Educ Prev. 2003; 15(1 suppl A):117–126. [PubMed: 12630604]
11. Cole J, Hotton A, Zawitz C, et al. Opt-out screening for *Chlamydia trachomatis* and *Neisseria gonorrhoeae* in female detainees at Cook County jail in Chicago, IL. Sex Transm Dis. 2014; 41:161–165. [PubMed: 24521720]
12. Hardick J, Hsieh YH, Tulloch S, et al. Surveillance of *Chlamydia trachomatis* and *Neisseria gonorrhoeae* infections in women in detention in Baltimore, Maryland. Sex Transm Dis. 2003; 30:64–70. [PubMed: 12514445]
13. Javanbakht M, Boudov M, Anderson LJ, et al. Sexually transmitted infections among incarcerated women: Findings from a decade of screening in a Los Angeles County Jail, 2002–2012. Am J Public Health. 2014; 104:e103–e109. [PubMed: 25211762]
14. Blake DR, Gaydos CA, Quinn TC. Cost-effectiveness analysis of screening adolescent males for chlamydia on admission to detention. Sex Transm Dis. 2004; 31:85–95. [PubMed: 14743071]
15. Crosby R, Voisin D, Salazar LF, et al. Family influences and biologically confirmed sexually transmitted infections among detained adolescents. Am J Orthopsychiatry. 2006; 76:389–394. [PubMed: 16981818]
16. Kahn RH, Mosure DJ, Blank S, et al. *Chlamydia trachomatis* and *Neisseria gonorrhoeae* prevalence and coinfection in adolescents entering selected US juvenile detention centers, 1997–2002. Sex Transm Dis. 2005; 32:255–259. [PubMed: 15788927]
17. Lofy KH, Hofmann J, Mosure DJ, et al. Chlamydial infections among female adolescents screened in juvenile detention centers in Washing-ton State, 1998–2002. Sex Transm Dis. 2006; 33:63–67. [PubMed: 16432475]
18. McDonnell DD, Levy V, Morton TJ. Risk factors for chlamydia among young women in a Northern California juvenile detention facility: Implications for community intervention. Sex Transm Dis. 2009; 36(2 suppl):S29–S33. [PubMed: 18209687]
19. Robertson AA, Thomas CB, St Lawrence JS, et al. Predictors of infection with chlamydia or gonorrhea in incarcerated adolescents. Sex Transm Dis. 2005; 32:115–122. [PubMed: 15668619]
20. Joesoef MR, Weinstock HS, Kent CK, et al. Sex and age correlates of chlamydia prevalence in adolescents and adults entering correctional facilities, 2005: Implications for screening policy. Sex Transm Dis. 2009; 36(2 suppl):S67–S71. [PubMed: 19125147]
21. Barry PM, Kent CK, Scott KC, et al. Optimising sexually transmitted infection screening in correctional facilities: San Francisco, 2003–2005. Sex Transm Infect. 2007; 83:416–418. [PubMed: 17567685]
22. Bauer HM, Chartier M, Kessell E, et al. Chlamydia screening of youth and young adults in non-clinical settings throughout California. Sex Transm Dis. 2004; 31:409–414. [PubMed: 15215695]
23. Schillinger JA, Dunne EF, Chapin JB, et al. Prevalence of *Chlamydia trachomatis* infection among men screened in 4 U.S. cities. Sex Transm Dis. 2005; 32:74–77. [PubMed: 15668611]
24. Solomon L, Flynn C, Muck K, et al. Prevalence of HIV, syphilis, hepatitis B, and hepatitis C among entrants to Maryland correctional facilities. J Urban Health. 2004; 81:25–37. [PubMed: 15047781]
25. Ciesielski C, Kahn RH, Taylor M, et al. Control of syphilis outbreaks in men who have sex with men: The role of screening in nonmedical settings. Sex Transm Dis. 2005; 32(10 suppl):S37–S42. [PubMed: 16205290]
26. Baillargeon J, Black SA, Leach CT, et al. The infectious disease profile of Texas prison inmates. Prev Med. 2004; 38:607–612. [PubMed: 15066363]
27. Kim AA, Martinez AN, Klausner JD, et al. Use of sentinel surveillance and geographic information systems to monitor trends in HIV prevalence, incidence, and related risk behavior among women undergoing syphilis screening in a jail setting. J Urban Health. 2009; 86:79–92. [PubMed: 18785013]

28. Al-Harthi L, Kovacs A, Coombs RW, et al. A menstrual cycle pattern for cytokine levels exists in HIV-positive women: Implication for HIV vaginal and plasma shedding. AIDS. 2001; 15:1535–1543. [PubMed: 11504986]
29. Lewis FM, Schillinger JA, Taylor M, et al. Needle in a haystack: The yield of syphilis outreach screening at 5 US sites—2000 to 2007. J Public Health Manag Pract. 2011; 17:513–521. [PubMed: 21964362]
30. Ellen JM, Bonu S, Arruda JS, et al. Comparison of clients of a mobile health van and a traditional STD clinic. J Acquir Immune Defic Syndr. 2003; 32:388–393. [PubMed: 12640196]
31. Sipkin DL, Gillam A, Grady LB. Risk factors for *Chlamydia trachomatis* infection in a California collegiate population. J Am Coll Health. 2003; 52:65–71. [PubMed: 14765760]
32. Morris SR, Bauer HM, Chartier M, et al. Relative efficiency of chlamydia screening in non-clinical settings in two California counties. Int J STD AIDS. 2010; 21:52–56. [PubMed: 20029065]
33. Johnson CC, Jones EH, Goldberg M, et al. Screening for *Chlamydia trachomatis* and *Neisseria gonorrhoeae* among adolescents in Family Court, Philadelphia, Pennsylvania. Sex Transm Dis. 2008; 35(11 suppl):S24–S27. [PubMed: 18607316]
34. Blank S, Gallagher K, Washburn K, et al. Reaching out to boys at bars: Utilizing community partnerships to employ a wellness strategy for syphilis control among men who have sex with men in New York City. Sex Transm Dis. 2005; 32(10 suppl):S65–S72. [PubMed: 16205296]
35. Grimley DM, Annang L, Lewis I, et al. Sexually transmitted infections among urban shelter clients. Sex Transm Dis. 2006; 33:666–669. [PubMed: 16773034]
36. Ponsart, D., Peterson, A., Macomber, K. Synergism: AIDS service organization and state health department link resources to meet STD screening and treatment needs of men who have sex with men (MSM) 2012 National STD Prevention Conference; March 12–15, 2012; Minneapolis, MN. 2012.
37. Viele, R., Moore, T., Laqueur, P., et al. Challenges and successes in integrating HIV, STD, and HCV testing in bathhouse and community settings with men who have sex with men (MSM). 2010 National STD Prevention Conference; Match 8–11, 2010; Atlanta, GA. 2010.
38. Mayer KH, Ducharme R, Zaller ND, et al. Unprotected sex, underestimated risk, undiagnosed HIV and sexually transmitted diseases among men who have sex with men accessing testing services in a New England bathhouse. J Acquir Immune Defic Syndr. 2012; 59:194–198. [PubMed: 22027871]
39. Parker, L., Strong, L., Scales, L., et al. Benefits of syphilis testing at non-traditional testing sites in Georgia. Paper presented at: 2012 National STD Prevention Conference; March 12–15, 2012; Minneapolis, MN. 2012.
40. Van Leeuwen JM, Rietmeijer CA, LeRoux T, et al. Reaching homeless youths for *Chlamydia trachomatis* and *Neisseria gonorrhoeae* screening in Denver, Colorado. Sex Transm Dis. 2002; 78:357–359.
41. Spielberg F, Levy V, Lensing S, et al. Fully integrated e-services for prevention, diagnosis, and treatment of sexually transmitted infections: Results of a 4-county study in California. Am J Public Health. 2014; 104:2313–2320. [PubMed: 25320878]
42. Ladd J, Hsieh YH, Barnes M, et al. Female users of Internet-based screening for rectal STIs: Descriptive statistics and correlates of positivity. Sex Transm Infect. 2014; 90:485–490. [PubMed: 24604333]
43. Dize L, Agreda P, Quinn N, et al. Comparison of self-obtained penile-meatal swabs to urine for the detection of *C. trachomatis*, *N. gonorrhoeae* and *T. vaginalis*. Sex Transm Dis. 2013; 89:305–307.
44. Fielder RL, Carey KB, Carey MP. Acceptability of sexually transmitted infection testing using self-collected vaginal swabs among college women. J Am Coll Health. 2013; 61:46–53. [PubMed: 23305544]
45. Gaydos CA, Barnes M, Jett-Goheen M, et al. Characteristics and predictors of women who obtain rescreening for sexually transmitted infections using the www.iwantthekit.org screening programme. Int J STD AIDS. 2013; 24:736–744. [PubMed: 23970594]
46. Rotblatt H, Montoya JA, Plant A, et al. There's no place like home: First-year use of the “I Know” home testing program for chlamydia and gonorrhea. Am J Public Health. 2013; 103:1376–1380. [PubMed: 23327247]

47. Reagan MM, Xu H, Shih SL, et al. A randomized trial of home versus clinic-based sexually transmitted disease screening among men. Sex Transm Dis. 2012; 39:842–847. [PubMed: 23064532]

48. Jenkins WD, Weis R, Campbell P, et al. Comparative effectiveness of two self-collected sample kit distribution systems for chlamydia screening on a university campus. Sex Transm Dis. 2012; 88:363–367.

49. Xu F, Stoner BP, Taylor SN, et al. Use of home-obtained vaginal swabs to facilitate rescreening for *Chlamydia trachomatis* infections: Two randomized controlled trials. Obstet Gynecol. 2011; 118(2 Pt 1):231–239. [PubMed: 21775837]

50. Jenkins WD, Rabins C, Barnes M, et al. Use of the Internet and self-collected samples as a sexually transmissible infection intervention in rural Illinois communities. Sex Health. 2011; 8:79–85. [PubMed: 21371388]

51. Gaydos CA, Barnes M, Aumakhan B, et al. *Chlamydia trachomatis* age-specific prevalence in women who used an Internet-based self-screening program compared to women who were screened in family planning clinics. Sex Transm Dis. 2011; 38:74–78. [PubMed: 21173720]

52. Graseck AS, Secura GM, Allsworth JE, et al. Home compared with clinic-based screening for sexually transmitted infections: A randomized controlled trial. Obstet Gynecol. 2010; 116:1311–1318. [PubMed: 21099596]

53. Chai SJ, Aumakhan B, Barnes M, et al. Internet-based screening for sexually transmitted infections to reach nonclinic populations in the community: Risk factors for infection in men. Sex Transm Dis. 2010; 37:756–763. [PubMed: 20644498]

54. Gaydos CA, Barnes M, Aumakhan B, et al. Can e-technology through the Internet be used as a new tool to address the *Chlamydia trachomatis* epidemic by home sampling and vaginal swabs? Sex Transm Dis. 2009; 36:577–580. [PubMed: 19543145]

55. Cook RL, Østergaard L, Hillier SL, et al. Home screening for sexually transmitted diseases in high-risk young women: Randomised controlled trial. Sex Transm Dis. 2007; 83:286–291.

56. Gaydos CA, Dwyer K, Barnes M, et al. Internet-based screening for *Chlamydia trachomatis* to reach non-clinic populations with mailed self-administered vaginal swabs. Sex Transm Dis. 2006; 33:451–457. [PubMed: 16652069]

57. Bloomfield PJ, Kent C, Campbell D, et al. Community-based chlamydia and gonorrhea screening through the United States mail, San Francisco. Sex Transm Dis. 2002; 29:294–297. [PubMed: 11984447]

58. Bloomfield PJ, Steiner KC, Kent CK, et al. Repeat chlamydia screening by mail, San Francisco. Sex Transm Dis. 2003; 79:28–30.

59. Huang W, Gaydos CA, Barnes MR, et al. Cost-effectiveness analysis of *Chlamydia trachomatis* screening via Internet-based self-collected swabs compared with clinic-based sample collection. Sex Transm Dis. 2011; 38:815–820. [PubMed: 21844736]

60. Smith KJ, Cook RL, Ness RB. Cost comparisons between home- and clinic-based testing for sexually transmitted diseases in high-risk young women. Infect Dis Obstet Gynecol. 2007; 2007:62467. [PubMed: 18273404]

61. Gift, TL. Cost-effectiveness of the “I Know” Homes Test Kit. 2010 National STD Prevention Conference; March 8–11, 2010; Atlanta, GA. 2010.

62. Centers for Disease Control and Prevention. STD Surveillance 2013. Atlanta, GA: CDC; 2014.

63. Marcus JL, Bernstein KT, Kohn RP, et al. Infections missed by urethral-only screening for chlamydia or gonorrhea detection among men who have sex with men. Sex Transm Dis. 2011; 38:922–924. [PubMed: 21934565]

64. Haddix, AC., Teutsch, SM., Corso, PS. Prevention Effectiveness. New York: Oxford University Press; 2003.

65. Centers for Disease Control and Prevention. Evaluation of Larger Jail STD Screening Programs, 2008–9. Jan 26. 2011

66. Gift TL, Lincoln T, Tuthill R, et al. A cost-effectiveness evaluation of a jail-based chlamydia screening program for men and its impact on their partners in the community. Sex Transm Dis. 2006; 33(10 suppl):S103–S110. [PubMed: 17003677]

67. Kraut-Becher JR, Gift TL, Haddix AC, et al. Cost-effectiveness of universal screening for chlamydia and gonorrhea in US jails. J Urban Health. 2004; 81:453–471. [PubMed: 15273268]

68. Gopalappa C, Huang YL, Gift TL, et al. Cost-effectiveness of screening men in Maricopa County jails for chlamydia and gonorrhea to avert infections in women. Sex Transm Dis. 2013; 40:776–783. [PubMed: 24275727]

69. Garnett GP. An introduction to mathematical models in sexually transmitted disease epidemiology. Sex Transm Dis. 2002; 78:7–12.

70. Workowski KA. Berman SCenters for Disease Control and Prevention (CDC). Sexually transmitted disease treatment guidelines, 2010. MMWR Recomm Rep. 2010; 59:1–110.

71. Hutchinson AB, Farnham PG, Dean HD, et al. The economic burden of HIV in the United States in the era of highly active antiretroviral therapy: Evidence of continuing racial and ethnic differences. J Acquir Immune Defic Syndr. 2006; 43:451–457. [PubMed: 16980906]

72. Chesson HW, Collins D, Koski K. Formulas for estimating the costs averted by sexually transmitted infection (STI) prevention programs in the United States. Cost Eff Resour Alloc. 2008; 6:10. [PubMed: 18500996]

Key Findings

- STD screening in correctional settings identifies a sizable amount of undiagnosed chlamydia, gonorrhea, and syphilis.
- STD screening in other community settings, including sex venues, college campuses, drug treatment, and bars, had variable yield.
- Self-collected, home-based chlamydia and gonorrhea screening is an exciting innovation; however, limited data are available to assess its population health benefit.
- Data related to the proportion of new infections that get appropriately treated and the costs of various non–clinic-based screening programs are largely unavailable.

TABLE 1

Correctional Screening

Reference No.	First Author (Publication Year)	Study Period	Location	Type of Facility	Test(s) Used	N	Positivity/Prevalence
Chlamydia and gonorrhea							
7	Barry (2009)	1997–2004	San Francisco, CA	Adult jails	LCR, SDA	42,952	Adult male Ct: 6.1% Adult female Ct: 7.3%
8	Javanbakht (2009)	2000–2005	Los Angeles, CA	Adult jails	NAAT	4157	Adult male (MSM) Ct: 3.0% Adult male (MSM) GC: 1.7%
9	Trick (2006)	2004	Chicago, IL	Adult jail	NAAT	5634	Adult male Ct: 4.9% Adult male GC: 2.0%
10	Chen (2003)	2000–2002	Los Angeles, CA	Adult jail	NAAT	1818	Adult MSM Ct: 3.1% Adult MSM GC: 1.5%
11	Cole (2014)	2011–2012	Chicago, IL	Adult jail	SDA	9256	Adult female Ct: 7.6% Adult female GC: 2.5%
12	Hardick (2003)	1999–2000	Baltimore, MD	Adult detention	LCR	1858	Adult female Ct: 5.9% Adult female GC: 3.4%
13	Javanbakht (2014)	2002–2012	Los Angeles, CA	Adult jail	NAAT	76,207	Adult female Ct: 11.4% Adult female GC: 3.1%
14	Blake (2004)	2001–2003	Massachusetts	Juvenile detention	NAAT	594	Adolescent male Ct: 4.8%
15	Crosby (2006)	2001–2003	Georgia	Juvenile detention	LCR, SDA	125	Adolescent female Ct: 16.8% Adolescent female GC: 3.2%
16	Kahn (2005)	1997–2002	Alameda County, CA; Los Angeles, CA; San Francisco, CA; Atlanta, GA; Maryland; New York City, NY	Juvenile detention	LCR, SDA, TMA, PCR	98,296	Adolescent male Ct: 5.1% (range by site 4.3%–8.8%) Adolescent female Ct: 15.6% (range by site 10.0%–20.0%)
17	Lofy (2006)	1998–2002	Washington	Juvenile detention	NAAT	3583	Adolescent female Ct: 14.0%
18	McDonnell (2009)	2002–2005	California	Juvenile detention	NAAT	914	Adolescent female Ct: 5.1%
19	Robertson (2005)	2002–2003	Southern city	Juvenile detention		1789	Adolescent male Ct: 8.1% Adolescent female Ct: 24.7% Adolescent male GC: 1.5% Adolescent female GC: 7.3%
20	Joesoef (2009)	2005	5 US states	Juvenile detention, adult jails	SDA, TMA, PCR	150,166	Adolescent male Ct: 6.0% Adolescent female Ct: 14.3% Adult male Ct: 4.6% Adult female Ct: 7.5%
21	Barry (2007)	2003–2005	San Francisco, CA	Juvenile detention, Adult jails	SDA, TMA	16,960	Adolescent and adult male Ct: 4.9% (adolescent male Ct: 3.3%) Adolescent and adult female Ct: 8.2% (adolescent female Ct: 9.6%)

Reference No.	First Author (Publication Year)	Study Period	Location	Type of Facility	Test(s) Used	N	Positivity/Prevalence
							Adolescent and adult male GC: 1.1% (adolescent male GC: 0.7%) Adolescent and adult female GC: 2.6% (adolescent female GC: 3.2%)
22	Bauer (2004)	2000–2002	California	Juvenile detention, adult jails	LCR, SDA, PCR, DNA Probe	9699	Adolescent male Ct: 5.8% Adolescent female Ct: 13.0% Adult male Ct: 7.9% Adult female Ct: 14.6%
23	Schillinger (2005)	1999–2003	Baltimore, MD; Denver, CO; Seattle, WA; San Francisco, CA	Juvenile detention, adult jails	LCR, SDA	16,323	Adolescent male Ct: 5.6% Adult male Ct: 6.5%
Syphilis							
8	Javanbakht (2009)	2000–2005	Los Angeles, CA	Adult jails	RPR/FTA	6008	Adult MSM: 8.2% (early syphilis: 1.6%)
10	Chen (2003)	2000–2002	Los Angeles, CA	Adult jail	RPR/FTA	2202	Adult MSM: 0.3%
13	Javanbakht (2014)	2002–2012	Los Angeles, CA	Adult jail	RPR/TPPA	9733	Adult female: 1.4%
24	Solomon (2004)	2002	Maryland	Adult jail	RPR/FTA	3914	Adult male and female: 0.6%
25	Ciesielski (2005)	2000–2003	Los Angeles, CA	Adult jail	RPR	3853	Adult MSM: 1.3% (early syphilis: 1.3%)
26	Baillargeon (2003)	1999–2001	Texas	Prisons, jails, substance abuse felony punishment facilities	RPR	336,668	Adult male and female: 655.2/100,000
27	Kim (2009)	1999–2001	San Francisco, CA	Adult jail	RPR/TPPA	1577	Adult female: 1.0%

Ct indicates *Chlamydia trachomatis*; FTA, fluorescent treponemal antibody; GC, Neisseria gonorrhoeae; LCR, ligase chain reaction; PCR, polymerase chain reaction; SDA, strand displacement assay; TMA, tissue microarrays; TPPA, *Treponema pallidum* particle agglutination.

TABLE 2

Bathhouse, Sex Venue, and Other Community Screenings

Reference No.	First Author (Publication Year)	Study Period	Location	Type of Facility	Test(s) Used	N	Positivity/Prevalence
Chlamydia and gonorrhea							
30	Ellen (2009)	200–2001	Baltimore, MD	Mobile van in high morbidity neighborhoods	LCR	412	Combined GC and CT: 5.6%
31	Sipkin (2003)	2000–2002	Sacramento, CA Male CT: 3.0%	College Campus	PCR	4086	Female CT:3.8%
32	Morris (2010)	2002–3	Two California Counties Male CT: 2.8%	Community Outreach	NAAT	630	Female CT:8.6%
33	Johnson (2008)	2004–2006	Philadelphia, PA Combined GC and CT male: 7.0%	Adolescent Probation	TMA	1594	Combined GC and CT female: 13.9%
34	Blank (2005)	2003–2004	New York, NY MSM GC: 0.5%	MSM bars	NAAT	183	MSM CT: 1.0%
35	Grimley (2006)	2004	2 Southeastern Cities GC: 5.0%	Homeless Shelter	TMA	140	CT: 6.4%
36	Ponsart (2012)	2011	Michigan MSM urogenital GC: 1.9% MSM urogenital CT: 2.5%	MSM community venues	NAAT	121 urine 106 pharyngeal	MSM pharyngeal GC: 8.5%
37	Viele (2010)	2008	New York State MSM GC: 0.4%	MSM bathhouse and community venues	NAAT	483	MSM CT: 2.1%
38	Mayer (2012)	2004–2010	Providence, RI MSM GC: 0.1%	MSM bathhouses	TMA	889	MSM CT: 1.3%
23	Schillinger (2005)	1999–2003	Denver, CO	Community-based organizations	LCR, PCR, SDA	332	Male CT: 11.4%
23	Schillinger (2005)	1999–2003	San Francisco, CA; Seattle, WA	College clinics	LCR, PCR, SDA	700	Male CT: 2.7%
23	Schillinger (2005)	1999–2003	Denver, CO	Drug treatment	LCR, PCR, SDA	105	Male CT: 3.8%
23	Schillinger (2005)	1999–2003	Denver, CO; San Francisco, CA	Street outreach	LCR, PCR, SDA	1987	Male CT: 3.1%
22	Bauer (2004)	2000–2003	Counties in CA Adolescent male CT: 3.1%	Adolescent community sites	LCR, PCR, SDA	1142	Adolescent female CT: 4.8%
22	Bauer (2004)	2000–2003	Counties in CA Adolescent male CT: 8.2%	Adult community sites	LCR, PCR, SDA	850	Adolescent female CT: 7.7%
29	Lewis (2011)	200–2007	Philadelphia, PA; Maricopa County, AZ; Washington DC; State of Florida	Community-based organizations	VDRL/MHA-TP	11,921	New syphilis diagnoses: 0.4%
Syphilis							

Reference No.	First Author (Publication Year)	Study Period	Location	Type of Facility	Test(s) Used	N	Positivity/Prevalence
29	Lewis (2011)	200–2007	Philadelphia, PA; Maricopa County, AZ; Washington, DC	MSM bathhouses	VDRL/MHA-TP	680	New syphilis [all stages] diagnoses: 2.4%
29	Ciesielski (2005)	1999–2004	Chicago, IL; Miami, FL; Houston, TX; New York, NY; Los Angeles, CA; San Francisco, CA	MSM bathhouses	VDRL/MHA-TP	2511	New early syphilis diagnoses: 1.2%
25	Ciesielski (2005)	1999–2004	Chicago, IL; Miami, FL; Houston, TX; New York, NY; Los Angeles, CA; San Francisco, CA	MSM bars	VDRL/MHA-TP	869	New early syphilis diagnoses: 0.7%
25	Ciesielski (2005)	1999–2004	Chicago, IL; Miami, FL; Houston, TX; New York, NY; Los Angeles, CA; San Francisco, CA	Mobile van in high morbidity neighborhoods	VDRL/MHA-TP	2549	New early syphilis diagnoses: 0.3%
34	Blank (2005)	2003–4	New York, NY	MSM bars	VDRL/MHA-TP	161	New early syphilis diagnoses: 1.2%
35	Grimley (2006)	2004	2 Southeastern cities	Homeless shelter	VDRL/MHA-TP	133	New early syphilis diagnoses: 0.8%
39	Parker (2012)	2006–2010	State of Georgia	MSM community venues	VDRL/MHA-TP	8304	New early syphilis “positivity”: 4.0%
37	Viele (2010)	2008	New York State	MSM bathhouse and community venues	VDRL/MHA-TP	174	Reactive syphilis
38	Mayer (2012)	2004–2010	Providence, RI	MSM bathhouses	VDRL/MHA-TP	850	Syphilis “prevalence”: 2.0%

CT indicates *Chlamydia trachomatis*; GC, *Neisseria gonorrhoeae*; LCR, ligase chain reaction; PCR, polymerase chain reaction; SDA, strand displacement assay; TMA, tissue microarrays; VDRL, Venereal Disease Research Laboratory; MHA-TP, Microhemagglutination Assay for Treponema pallidum antibodies.

TABLE 3

Internet and Home-Based Screening

Reference No.	First author (Publication Year)	Study Period	Location	Program	Test(s) Used	N	Positivity/Prevalence
41	Spielberg (2014)	2012	California (4 counties)	Internet; home collection	TMA	143	Females (age 18–30 y): CT 4.2%
42	Ladd (2014)	2009–2011	Alaska; Denver, CO; Maryland; Philadelphia, PA; Washington, DC; West Virginia; and selected Illinois counties	Internet; home collection	TMA	205	Females: ≥ 1 rectal STI (CT, GC, TV): 18.5%
43	Dize (2013)	2006–2009	Males: GC 8.8%	Internet; home collection	TMA	634	Males: CT 13.6%
44	Fielder (2013)	2009–2010	New York	Internet; home collection	SDA	310	Females: CT/GC 1%
45	Gaydos (2013)	2007–2010	Females: 0.7% GC	Internet; home collection	TMA	304	Females: 4.6% CT
46	Rotblatt (2013)	2009–2010	Los Angeles, CA	Internet; home collection	TMA	1543	Females: 8.5% CT
47	Reagan (2012)	2011	St Louis, MO	Home collection	SDA	200	Males (age 18–45 y): 2% CT/GC
48	Jenkins (2012)	2010	Illinois	Internet; home collection	TMA	3	Females: 0% CT
49	Xu (2011)	2005–2007	New Orleans, LA; St Louis, MO	Home collection	TMA	215	Females: 13.4% CT
50	Jenkins (2011)		Illinois Females: 1.2% GC Males: 1.9% CT Males: 0% GC	Internet; home collection	TMA	137	Females: 5.8% CT
51	Gaydos (2011)	2004–2008	Baltimore, MD Females: 1.3% GC	Internet; home collection	TMA	1171	Females: 10% CT
52	Graseck (2010)	2009	St Louis, MO Females: 0% GC	Home collection	SDA	268	Females: 1.1% CT
53	Chai (2010)	2006–2009	Baltimore, MD; Washington DC; West Virginia; Denver; Illinois Males: 1% GC	Internet; home collection	TMA	501	Males: 13% CT
54	Gaydos (2009)	2004–2008	Washington, DC; Maryland; West Virginia	Internet; home collection	TMA	1203	Females: 9.1% CT
55	Cook (2007)	2000; 2003	Western PA	Home collection	SDA	249	Females: 10% CT
56	Gaydos (2006)	2004–2005	Baltimore, MD	Internet; home collection	TMA, SDA, PCR	400	Females: 10.3% CT
57	Bloomfield (2003)	2000	San Francisco, CA	Home collection	SDA	63	Females: 3.2% CT
			Females (age 18–25 y): 13.3%				
58	Bloomfield (2002)		San Francisco, CA 3.9% GC	Home collection	SDA	76	1.3% CT

CT indicates *Chlamydia trachomatis*; GC, *Neisseria gonorrhoeae*; PCR, polymerase chain reaction; SDA, strand displacement assay; TMA, tissue mi-croarrays; TV, *Trichomonas vaginalis*.