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Economic Outcomes of Disease Intervention Specialist-Delivered Interventions for Sexually Transmitted Infections: A Systematic Review

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Abstract

Background: Although numerous studies have demonstrated the effectiveness of interventions delivered by disease intervention specialists (DIS), relatively few studies have assessed their economic outcomes. We performed a systematic literature review of the cost, cost-effectiveness, and cost-benefit of DIS-delivered interventions for sexually transmitted infections (STIs) in the United States.

Methods: Building on a recent systematic review of the effectiveness of DIS-delivered interventions, we reviewed economic outcomes associated with these interventions for STIs. We searched articles indexed in MEDLINE, Web of Science, CINAHL, and ProQuest from 2000 through December 2022, using these inclusion criteria: addressed an intervention of DIS-delivered interventions for STIs including partner services; United States setting; and included estimates for program cost, cost-effectiveness, or cost-benefit. Findings were summarized through narrative synthesis.

Results: Seven studies met the inclusion criteria. Overall, DIS-delivered interventions including STI partner services can be a cost-effective use of public health resources. In some scenarios, the cost of these interventions can be completely offset by averted medical costs. Cost and cost-effectiveness estimates of DIS-delivered interventions can vary across geographic settings and under different epidemiologic conditions.

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Conclusions: Although scarce, the available evidence suggests DIS-delivered interventions including STI partner services are an efficient use of public health resources. Health economic modeling studies are needed to facilitate conversion of intermediate cost-effectiveness outcomes (e.g., cost per syphilis case identified and treated) into standard cost-effectiveness outcomes (e.g., cost per quality-adjusted life year [QALY] gained).

Short Summary

A systematic review of the economic outcomes of STI interventions delivered by disease intervention specialists found that these interventions can be a cost-effective use of public health resources.

Keywords

sexually transmitted infections; disease intervention specialists; partner services; cost analysis; cost-effectiveness analysis

Introduction

For almost 100 years, disease intervention specialists (DIS) have worked to interrupt transmission of sexually transmitted infections (STIs) in the United States population.¹ Although DIS perform a wide range of important public health functions, a primary role is to ensure that recently diagnosed STI patients are treated, to identify the sex partners of these STI patients, and to facilitate testing and treatment of their partners.¹ Given that DIS activities can be time-consuming and labor-intensive,¹ studies of the impact, implementation costs, and cost-effectiveness of DIS activities are necessary to guide resource allocation decisions.

In 2024, Martin and colleagues published a systematic review of the effectiveness of partner services and other DIS-delivered interventions for HIV and STIs, finding evidence that DIS-delivered interventions can improve clinical outcomes among index patients and can improve population outcomes by testing and treating infected partners.² Although numerous studies have demonstrated the impact of DIS-delivered interventions,^{2–7} relatively few studies have assessed their cost or cost-effectiveness. The purpose of this analysis was to conduct a systematic review of the economic outcomes of DIS-delivered interventions for STI prevention. Specific review questions were: 1) What are the program costs and cost effectiveness of DIS-delivered interventions for STIs including partner services in the United States? 2) How do these outcomes vary across geographic settings, intervention, and infection? Cost effectiveness was defined broadly to include cost utility analysis and cost benefit analysis.

Materials and Methods

We extended Martin et al.'s recent systematic review of the effectiveness of DIS-delivered interventions for HIV and STIs,² which followed the National Academy of Medicine⁸ and Patient Centered Outcomes Research Institute (PCORI) methods⁹ with a registered protocol.¹⁰ The methods and results of our economic evidence review follow the Preferred

Reporting Systems for Systematic Reviews and Meta-analyses (PRISMA) reporting guidelines.¹¹ Our study did not undergo review by an institutional review board because it is a literature review. Deviations from the initial review of the effectiveness of DIS-delivered interventions are described below.

Our literature search started with the 1,915 unique records identified in Martin et al.'s DIS intervention effectiveness review,² which were located using a broad set of HIV, STIs, and tuberculosis search terms in PubMed/MEDLINE, CINAHL, ProQuest Dissertations & Theses Global, and Web of Science. To focus on economic outcomes, the 1,915 unique records identified in Martin et al.'s initial keyword search were first narrowed down to a subset of 295 records with one of the following words in the title or abstract: cost, affordable, budget, economic, or monetary; at this stage, an additional 42 records were removed due to a focus on tuberculosis, or being a conference abstract or duplicate (see Figure 1). The 253 records that underwent a first-round screening of the titles and abstracts used a hierarchical screening to exclude studies that did not meet criteria in the following order: economic analysis (cost, cost-effectiveness, or cost-benefit), United States setting, primary research, and DIS-delivered intervention including partner services. Thirty-four studies were subsequently assessed in a full-text review, which excluded studies based on the following hierarchical criteria: published before 2000, no STI-related outcomes reported, not a DIS-delivered intervention, or no economic outcomes reported. Additional studies were located based on hand-searching the references of all studies included in the initial review of intervention effectiveness and review articles located in the initial search.

Consistent with the prior program effectiveness review's screening methods,² one author screened articles in the first stage (title and abstract) and two authors screened articles in the second stage (full-text review). Quality control methods used in the recent program effectiveness review were having each author involved with the screening double-code at least 30 studies with the first author, progressing articles with unclear determinations to the full-text review, regular team meetings to discuss decisions, and having a third author review studies without a consensus decision. Similar procedures were used in this review.

To compile relevant information from the included articles, a data extraction sheet (Supplement 1) was developed based on the economic evaluation abstraction form used by the Centers for Disease Control and Prevention Community Guide to systematically abstract data from economic evaluation studies.¹² The data extraction form was reduced in scope and refined through pilot testing and consultation with all study authors on how to tailor it for this review. Extracted information included a description of the intervention, infection(s), study setting and population, analytic methods and comparison interventions, perspective (such as societal or healthcare), currency year (such as 2019 US dollars), and key findings. Two authors (AM, HK) extracted data from the screened articles, with one performing the initial extraction and a second reviewing the completed extraction sheet to verify numbers. Discrepancies were resolved with the lead author and consultation with other authors.

Study designs were classified into four main categories consistent with the Community Guide's data extraction sheet: cost analysis, cost-effectiveness analysis, cost-utility analysis, and cost-benefit analysis (Supplement 2). Cost analyses were defined as studies that

assessed the overall cost of a program or the cost per service rendered, such as cost per index case assigned or the cost per index patient interviewed. Cost-effectiveness analyses were defined as those that estimated the cost per benefit obtained by the intervention. This category typically included studies that estimated the cost per partner notified of exposure, the cost per partner reached, the cost per infected person identified, the cost per partner brought to treatment, and the cost per case of pelvic inflammatory disease (PID) averted. Cost-utility analyses were defined in the same way as traditional cost-effectiveness analyses, except that outcomes were reported in terms of the cost per quality-adjusted life year (QALY) gained or another metric that incorporates quality of life. Cost-benefit analyses were those that assessed the net cost of a DIS intervention in terms of the cost of delivering the DIS services minus the medical costs saved by the DIS activities. For this review, only the relevant outcomes were extracted. For example, Gift et al., 2008¹³ reported results for seven scenarios with different combinations of screening and partner notification among women, men, or both women and men. Information extracted was limited to three analyses that allowed for a direct assessment of the economic outcomes for adding partner notification to a given screening strategy. If there were numerous intermediate outcomes, the outcomes furthest downstream were selected (e.g., treatment of patients was prioritized over testing patients, which was prioritized over interviewing patients).

A narrative synthesis was used to summarize key findings due to differences in the nature of the interventions studied and economic outcomes reported. All costs were updated to 2023 dollars using the all items Consumer Price Index for all urban consumers (CPI-U) for the U.S. city average.¹⁴ Each study was also assessed with a checklist on the completeness of reporting (Supplement 3). Although assessment of study design features such as whether adequate sensitivity analyses were performed could directly assess study rigor, this review focused on reporting completeness because common questions to assess study quality are subjective and the variability in study designs make it difficult to evaluate consistently. The following steps were used to develop the criteria used in the completeness of reporting checklist: reviewing common checklists for assessing the quality of economic analyses^{15–17} and a checklist used in a recent systematic review of HIV and syphilis testing costs in low- and middle-income countries,¹⁸ identifying common elements that were in multiple checklists and that were related to completeness of reporting, refining the list of potential items to those that would be relevant to all seven included studies considering the variability in the methodologies used, and creating clear operational definitions of the checklist items to improve inter-rater reliability. Two authors (AM, HK) conducted the reporting completeness assessment, with one performing the initial assessment and a second verifying the decisions.

Results

Table 1 summarizes the study characteristics. The earlier studies included in this review (published from 2001 through 2010) evaluated economic outcomes related to partner notification for either chlamydia^{13,19} or syphilis.^{20,21} The two chlamydia studies examined partner notification with different levels of screening.^{13,19} One syphilis study compared partner notification with selective screening to selective screening alone²⁰ and the other compared partner notification to selective screening as different interventions.²¹ The more recent studies examined HIV/STI or STI partner services as a broader intervention, with two

quantifying the cost effectiveness and cost of the program^{22,23} and one examining the cost effectiveness and cost of a DIS-directed peer network strategy to identify and test persons at high risk for syphilis or HIV.²⁴ The study settings and populations were diverse: inmates in a Massachusetts correctional facility,¹⁹ a four-city study (Baltimore, Denver, San Francisco, and Seattle),¹³ New York State excluding New York City,²² Louisiana,²⁰ Houston,²¹ a three-county study in Washington State,²³ and North Carolina metropolitan areas.²⁴

Overall, the studies provide evidence that DIS-delivered interventions including STI partner services can be a cost-effective use of public health resources (Table 2). In some instances, such as adding partner notification to a chlamydia screening program in a correctional facility,¹⁹ the cost of these interventions can be completely offset by averted medical costs. Cost and cost-effectiveness estimates of DIS-delivered interventions can vary across geographic settings and under different epidemiologic conditions.

Partner Notification for Chlamydia

The net cost of adding partner notification to a chlamydia screening program in a Western Massachusetts correctional facility, reflecting the cost of providing partner services to infected male inmates including DIS salaries and clinic visits for female sex partners less averted PID costs among notified female partners, was close to zero (approximately \$1 per inmate) for all screening scenarios examined.¹⁹ These results suggested that the costs of adding partner notification, including DIS salaries, were almost completely offset by the reduction in PID sequelae costs achieved by locating and treating female sex partners. In a simulated population based on data from a multi-city cohort study, the cost effectiveness of adding partner notification to an existing chlamydia screening program varied substantially depending on whether partner notification services were offered to women, men, or both.¹³ The cost per QALY gained was \$145,878 when adding partner notification for infected women when screening women only, \$11,577 when adding partner notification for infected men when screening men and women, and \$52,359 when adding partner notification for women and men when screening men and women. The relatively low cost per QALY of adding partner notification for men likely reflects the fact that averting chlamydia sequelae in female partners on average provides more health benefits and medical cost savings than averting chlamydia sequelae in male partners.

Partner Notification for Syphilis

In a Louisiana study, the incremental cost per primary and secondary syphilis case treated or prevented by adding partner notification to an existing selective screening program was \$3,988 when excluding the benefits of prophylactic treatment of notified partners.²⁰ The incremental cost effectiveness ratio was lower in scenarios that included the benefits of future infections averted through prophylactic treatment of notified partners. In a Houston study that compared partner notification to selective screening, the cost per syphilis case detected varied by stage of syphilis.²¹ In the base case, the cost per case detected was lower for selective screening than for partner notification, but the results were fairly similar. In sensitivity analyses, partner services had a lower cost per case detected than selective screening when (1) assuming a higher contact index or (2) including the benefits of prophylactic treatment of contacts notified through partner notification.

HIV/STI or STI Partner Services

A study of the New York State HIV/STI partner services program estimated that the cost per partner brought to treatment or preventatively treated for STI exposure was highest for syphilis (\$2,411), followed by gonorrhea (\$3,431) and chlamydia (\$3,237).²² However, the majority of staff time was spent on chlamydia investigations (\$4.44 million compared to \$2.50 million for gonorrhea and \$860,000 for syphilis) because the number of chlamydia cases far exceeded the number of gonorrhea and syphilis cases. In another study, the costs to deliver partner services varied across the infections and counties: total program expenditures were highest for early syphilis in Spokane County (\$291,831), gonorrhea in King County (\$496,509), and chlamydia in Pierce County (\$235,141).²³ Similarly, there was variability in the cost per key performance indicator across infections and counties. Authors attributed this to the different epidemiologic characteristics and available support services in the three counties. For an intervention in which DIS received enhanced training to engage social and sexual networks of persons recently diagnosed with HIV or syphilis, the cost per new positive HIV or syphilis diagnosis was \$8,730 and ranged from \$5,821 to \$13,095 in sensitivity analyses.²⁴ The authors noted that even considering the new HIV diagnoses alone, the program was likely cost-saving based on published estimates of the threshold value of detecting new HIV infections.

Reporting Completeness

Overall, the seven studies largely met the 10 items in the reporting completeness checklist (Table 3). The two studies that did not report on an uncertainty analysis used health department programmatic data to calculate the total program expenditures and cost-effectiveness outcomes such as the cost per partner treated; as such, scenario analyses were not relevant.^{22,23} Three studies did not have contextual information because they were based on the full population.^{20–22} One study did not report the currency year.²⁰

Discussion

This systematic review detected seven studies published since 2000 that provided original data on the cost or cost-effectiveness of DIS-delivered interventions including partner services for STIs. Although these studies varied in design and scope, this body of evidence suggests three key findings.

The first key finding is that, overall, DIS-delivered interventions including partner services can achieve gains in health at a reasonable cost and might even be cost-saving, meaning that the DIS-delivered intervention pays for itself in averted medical costs. For example, Gift et al. (2006)¹⁹ found that adding partner notification to an existing chlamydia screening program for male inmates was almost but not quite cost-saving, even without considering the full scope of potential benefits, such as the benefits of secondary transmissions prevented through partner notification.

The second key finding is that the cost and cost-effectiveness estimates for similar interventions and infections can vary substantially across geographic location and under different epidemiologic conditions. For example, in the Silverman et al. 2019 study,²³ the

cost per syphilis case assigned was roughly four times as high in Spokane County than in King County or Pierce County. The authors hypothesize that such differences might arise because a large share of syphilis cases in Spokane County occurs among heterosexual persons, including a sizeable contingent of suspected methamphetamine users, whereas in King and Pierce counties most cases are among men who have sex with men. As another example, as shown in the Reynolds et al. (2001) study,²¹ the cost of partner notification relative to selective screening for syphilis varied substantially by stage of syphilis (e.g., the cost per syphilis case detected by partner notification was higher for primary and secondary syphilis than for early latent syphilis), highlighting the importance of epidemiologic context.

The third key finding is that most studies examined intermediate outcomes, such as the cost per partner notified or the cost per infected person treated, without considering averted medical costs or other downstream benefits of treating STIs. Although these intermediate results are not as easy to interpret as traditional cost-effectiveness results, these studies nonetheless help to quantify the benefits of partner notification. However, differences in analytic method (e.g., whether offset medical costs are included) can make it difficult to compare findings across studies.

The study by Williams et al. (2022)²⁴ provided a detailed explanation of how to interpret their intermediate cost-effectiveness analysis in terms of a cost-benefit analysis. For example, they noted that even if they excluded the syphilis-related benefits of the intervention, the cost per new HIV infection identified by the intervention (\$26,191 [\$21,975 unadjusted for inflation]) was lower than the cost-saving threshold of \$32,532 [\$27,296 unadjusted] per HIV infection identified in a prior published mathematical modeling study by Farnham et al. (2012).²⁵ Thus, Williams et al. were able to conclude that the intervention was cost-saving without having to do complex modeling to estimate the number of HIV infections averted by the intervention or the lifetime medical costs saved by the intervention. The work by Farnham et al. (2012)²⁵ to identify cost-effectiveness and cost-saving thresholds for the cost per new HIV infection detected based on behavioral changes associated with awareness of HIV serostatus highlights the potential for similar work in the STI field to estimate these thresholds for intermediate DIS outcomes for STIs. For example, health economic studies could be conducted to develop conversion factors that allow intermediate cost-effectiveness results (such as \$2,144 per syphilis patient brought to treatment in the Johnson et al. (2017) study²²) to be easily converted into cost per QALY results.

Even though DIS deliver important public health services and these services reflect a cost-effective use of public health resources, demands on DIS have increased in recent years due to larger caseloads because of higher STI rates.¹ Further, many DIS face challenges such as low pay, high staff turnover, morale, and safety concerns.^{1,26} Becher and colleagues describe cost-effectiveness considerations of strategies to assess potential DIS retention strategies, noting that costs incurred to keep skilled DIS can be offset by avoiding the costs of having to hire and train new employees.²⁶

We faced several key challenges in conducting this literature review and summarizing the results of the included studies. First, the studies we reviewed are not easily comparable

to one another. For example, one study estimated the cost per syphilis case detected by partner notification and another estimated the cost per QALY gained by partner notification for chlamydia.^{13,21} Second, for many studies, it was difficult to determine the precise interventions being evaluated. This difficulty was heightened by changes in terminology used to describe DIS activities over time. This limitation was addressed in part by our inclusion criterion that the intervention had to be DIS-delivered, to avoid articles about partner notification or expedited partner therapy more generally when not delivered by DIS. This inclusion criterion helped to clarify the specific interventions being evaluated in the included studies but led to the exclusion of potentially relevant studies. For example, we excluded a modelling-based study of the cost-effectiveness of partner notification for chlamydia, because the study did not specifically assess DIS-delivered partner notification nor did it include DIS-specific costs.²⁷ Third, although we excluded studies published prior to 2000 with the goal of focusing on more recent studies, most of the studies included in our review were published in 2010 or earlier. Thus, the health economic data we reviewed are dated, highlighting the need for updated studies on the cost-effectiveness of DIS-delivered interventions. Similarly, we did not address potential publication bias.

In summary, despite limitations, our systematic literature review compiles useful data on the health economics of DIS activities for STI prevention and control, such as partner notification. The available evidence suggests that DIS-delivered interventions are a cost-effective use of public health resources. Economic evidence can be a useful supplement to impact evaluations to inform resource allocation decisions. However, additional studies are needed to update the existing body of evidence. For example, health economic modeling studies could help to promote future evaluations of DIS activities by facilitating the conversion of intermediate cost-effectiveness outcomes (e.g., cost per syphilis case identified and treated) into standard cost-effectiveness outcomes (e.g., cost per QALY gained). Another gap is to update the evidence with more recent data to reflect large shifts in morbidity, treatment, and prevention since the publication of the studies we reviewed, including but not limited to Food and Drug Administration approval of HIV pre-exposure prophylaxis in 2012,²⁸ increases in reported rates of STIs and congenital syphilis,^{1,29,30} and the 2024 clinical guidelines on the use of doxycycline postexposure prophylaxis for bacterial STI prevention.²⁹ Another fruitful area of further research is assessing economic outcomes in a wider range of settings, particularly in smaller health departments with fewer resources.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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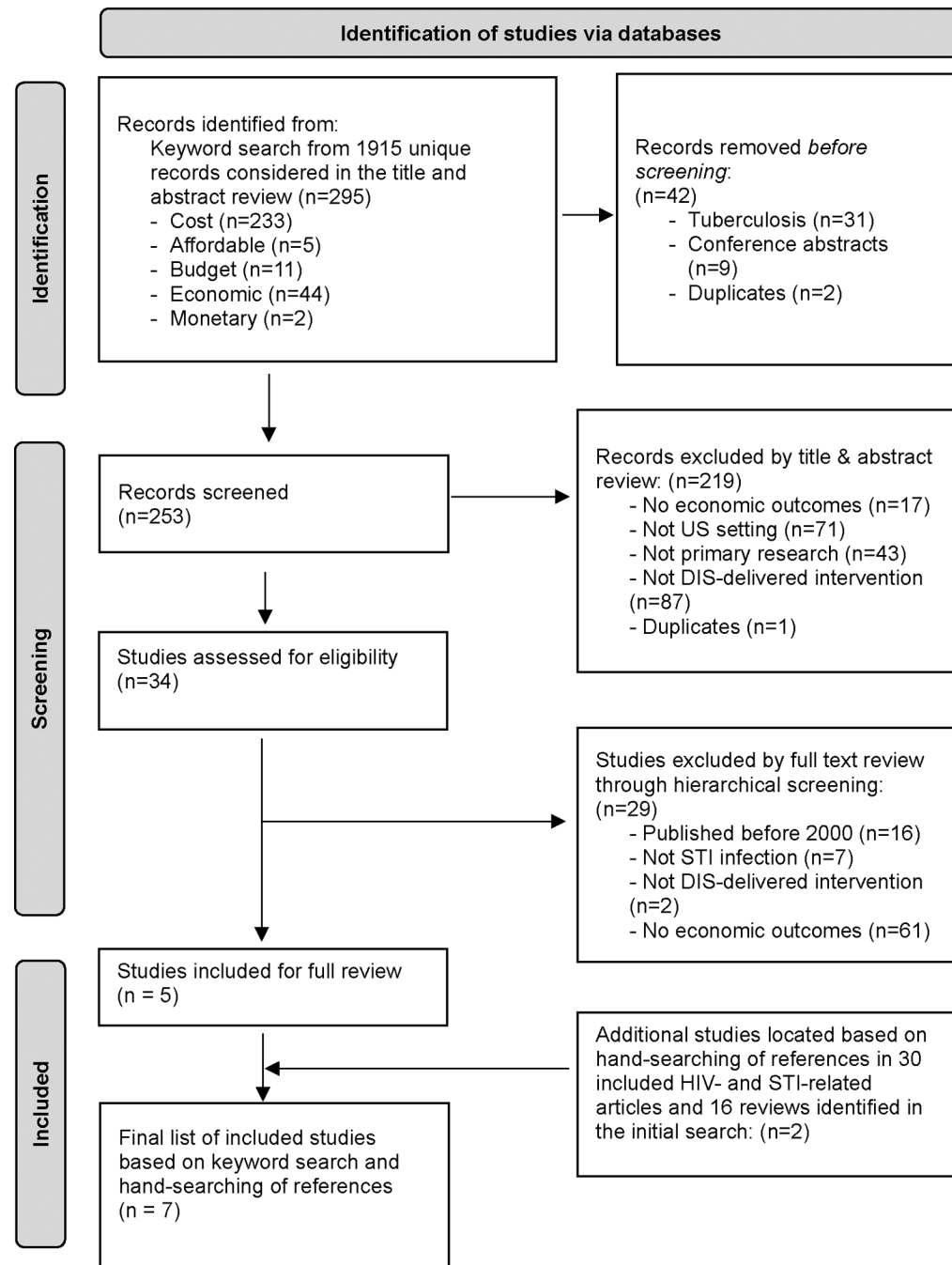


Figure 1. Flow diagram of included studies

The initial search followed the methods used in a recent review of the effectiveness of interventions delivered by disease intervention specialists (DIS).² The initial search terms were broad and covered sexually transmitted infections (STIs), human immunodeficiency virus (HIV), and tuberculosis. Records were limited to those with economic outcomes (cost analyses, cost-effectiveness analyses, and cost-benefit analyses) and a focus on STIs.

Characteristics of studies examining economic outcomes of disease intervention specialist-delivered partner services for sexually transmitted infections

Table 1.

Study	Intervention and infection	Study setting and population	Analytic method and comparison ^d	Perspective and currency year
Gift et al., 2006 ¹⁹ ^b	Intervention: Alternative screening approaches plus PN Infection: Chlamydia	Male inmates in a correctional facility in Western Massachusetts (mean age: 30 years)	Analytic methods: Cost benefit analysis Comparison intervention: Adding PN to four screening approaches: 1) universal screening (baseline practice in the facility), 2) age-based screening for men <25 years of age, 3) age-based screening for men <30 years of age, 4) symptom-based testing	Perspectives: Correctional institution and healthcare system Currency year: 2001 US dollars
Gift et al., 2008 ¹³	Intervention: Alternative screening and PN approaches Infection: Chlamydia	Simulated population of 100,000 persons aged 15–34 years, with 50% men and 50% women, based on data from a four-city male screening cohort study (Baltimore, Denver, San Francisco, and Seattle)	Analytic method: Cost utility analysis Comparison intervention: Three scenarios of screening and PN: 1) PN for women when 35% of women are screened annually, 2) PN for men when 35% of women are screened annually and 1% of men are screened annually through venue-based testing, and 3) PN for men and women when 35% of women are screened annually and 1% of men are screened annually through venue-based testing; for each scenario, the comparison is to the same level of screening without PN.	Perspective: Societal Currency year: 2006 US dollars
Johnson et al., 2017 ²²	Intervention: HIV/STI partner services Infections: Chlamydia, gonorrhea, HIV, and syphilis ^c	Newly-diagnosed persons in New York State excluding New York City	Analytic methods: Cost effectiveness analysis, cost analysis Comparison intervention: None	Perspective: Public health agency program Currency year: 2014 US dollars
Rahman, 2010 ²⁰	Intervention: PN with selective screening Infection: Syphilis	Persons diagnosed with early syphilis in Louisiana (age: 72% of cases were aged 25–44 years)	Analytic method: Cost effectiveness analysis Comparison intervention: Selective screening without PN	Perspective: Healthcare delivery system Currency year: Not explicitly reported, assumed to be 2009 US dollars ^c
Reynolds et al., 2001 ²¹	Intervention: PN Infection: Syphilis	Persons diagnosed with early syphilis in Houston, Texas excluding persons screened in private facilities	Analytic methods: Cost effectiveness analysis, cost analysis Comparison intervention: Selective screening in public STI clinics, correctional facilities, drug treatment centers, and prenatal or family planning clinics	Perspective: Public health agency program Currency year: 1996 US dollars
Silverman et al., 2019 ²³	Intervention: STI partner services Infections: Chlamydia, gonorrhea, syphilis	Newly-diagnosed persons eligible for partner services in three high-morbidity local health jurisdictions in Washington State	Analytic methods: Cost effectiveness analysis, cost analysis Comparison intervention: None	Perspective: Public health agency program Currency year: 2016 US dollars
Williams et al., 2022 ²⁴	Intervention: DIS-directed peer network strategy to identify and test persons at high risk for syphilis or HIV	Populations at risk for STIs in four North Carolina metropolitan areas who were recently diagnosed with HIV or syphilis who presented to care in STI clinics and referred for partner services	Analytic methods: Cost effectiveness analysis, cost analysis Comparison intervention: None	Perspective: Societal Currency year: 2019 US dollars

Study	Intervention and infection	Study setting and population	Analytic method and comparison ^d	Perspective and currency year
	Infections: HIV, syphilis ^d			

Abbreviation: human immunodeficiency virus (HIV), partner notification (PN), sexually transmitted infection (STI), United States (US)

^aThe study design is limited to the outcomes reported for this review; for example, the primary analysis of Gift et al., 2006¹⁹ is a cost effectiveness analysis but only the cost benefit analysis and cost analysis were relevant for this review.

^bThe primary focus of this study was to compare the cost-effectiveness of four screening strategies. It was included in this review because each screening strategy included partner notification; only the partner notification outcomes were extracted for consistency with the review’s research question.

^cThis study was assumed to be 2009 US dollars based on multiple references to 2009 cost data, although the cases are from 2007.

^dAlthough the study included HIV, only STI-related outcomes or combined STI/HIV outcomes were extracted in this review.

Summary of studies examining economic outcomes of disease intervention specialist-delivered partner services for sexually transmitted infections

Table 2.

Study	Finding on key economic outcomes: Costs are in 2023 US dollars, except unadjusted costs where noted
Gift et al., 2006 ¹⁹	• Per 1,000 male inmates, the net cost of adding PN to an existing chlamydia screening program was \$155 (\$90 unadjusted 2001 US dollars) for symptom-based testing, \$981 (\$570 unadjusted) for age-based screening for men <25 years, \$1,273 (\$740 unadjusted) for age-based screening for men <30 years, and \$1,376 (\$800 unadjusted) for the universal screening scenario.
Gift et al., 2008 ¹³	• Compared to an equivalent screening scenario without PN, the incremental cost per QALY gained by adding PN to an existing chlamydia screening program was: 1) \$145,878 (\$96,517 unadjusted 2006 US dollars) when 35% of women are screened annually and women receive PN; 2) \$11,577 (\$7,660 unadjusted) when 35% of women are screened annually and 1% of men are screened through venue-based testing, and women receive PN; and 3) \$52,359 (\$34,642 unadjusted) when 35% of women are screened annually and 1% of men are screened through venue-based testing, and both women and men receive PN.
Johnson et al., 2017 ²²	• The cost per partner infected and brought to treatment or preventively treated for STI exposure was \$2,144 (\$1,666 unadjusted 2014 US dollars) for syphilis, \$3,431 (\$2,666 unadjusted) for gonorrhea, and \$3,237 (\$2,515 unadjusted) for chlamydia. • The total program cost was \$8,816,690 (\$6,850,063 unadjusted), including HIV; the allocated program cost based on staff effort spent conducting disease investigations for each infection was \$859,648 (\$667,897 unadjusted) for syphilis, \$2,501,697 (\$1,943,675 unadjusted) for gonorrhea, and \$4,438,604 (\$3,448,541 unadjusted) for chlamydia.
Rahman, 2010 ⁴⁰	• The incremental cost per primary and secondary syphilis case treated/prevented by adding PN to an existing selective screening program was \$3,988 (\$2,808 unadjusted 2009 US dollars) when excluding the benefits of prophylactic treatment of notified partners and ranged from \$1,584 to \$3,237 (\$1,115 to \$2,279 unadjusted) when including future infections averted through prophylactic treatment of the notified partners.
Reynolds et al., 2001 ²¹	• Although the total direct costs were higher for selective screening (\$1,124,622 [\$579,101 unadjusted 1996 US dollars]) than for PN (\$445,749 [\$229,529 unadjusted]), selective screening was more cost-effective than PN in detecting P&S syphilis and maternal syphilis (P&S syphilis, selective screening: \$2,567 [\$1,322 unadjusted] per case detected, PN: \$3,031 [\$1,561 unadjusted] per case detected; maternal syphilis, selective screening: \$6,776 [\$3,489 unadjusted], PN: \$29,715 [\$15,301 unadjusted]). • The cost per case detected for selective screening and PN were similar for early latent and early syphilis (early latent, selective screening: \$1,093 [\$563 unadjusted], PN: \$1,060 [\$546 unadjusted]; early syphilis, selective screening: \$767 [\$395 unadjusted], PN: \$787 [\$405 unadjusted]). • In sensitivity analysis, PN was more cost-effective than selective screening for detecting primary syphilis if the contact index (a measure for DIS productivity) was increased to 2.0 from the base case value of 1.71, and PN was more cost-effective than selective screening for detecting secondary syphilis if the contact index was increased to 3.0. • In sensitivity analysis, when the benefits of prophylactic treatment of contacts notified though PN were incorporated into the analysis, PN was more cost-effective than selective screening.
Silverman et al., 2019 ²³	• Total program expenditures by STI varied by county and infection (early syphilis, King: \$280,033 [\$220,576 unadjusted], Pierce: \$64,679 [\$51,017 unadjusted 2016 US dollars], Spokane: \$291,831 [\$229,869 unadjusted]; gonorrhea, King: \$496,505 [\$391,089 unadjusted], Pierce: \$228,350 [\$179,866 unadjusted], Spokane: \$141,983 [\$111,837 unadjusted]; chlamydia, King: \$236,740 [\$186,475 unadjusted], Pierce: \$235,141 [\$185,215 unadjusted], Spokane: \$74,971 [\$59,053 unadjusted]). • The cost per partner treated after DIS interview with an index patient varied by county and infection (early syphilis, King: \$3,011 [\$2,372 unadjusted], Pierce: \$579 [\$456 unadjusted], Spokane: \$1,780 [\$1,402 unadjusted]; gonorrhea, King: \$7,758 [\$6,111 unadjusted], Pierce: \$807 [\$636 unadjusted], Spokane: \$1,405 [\$1,107 unadjusted]; chlamydia, King: \$3,642 [\$2,869 unadjusted], Pierce: \$891 [\$702 unadjusted], Spokane: \$2,142 [\$1,687 unadjusted]). • The cost per partner identified with a new HIV diagnosis after DIS interview with an index patient varied by county and infection (early syphilis, King: \$140,017 [\$110,288 unadjusted], Spokane: \$291,831 [\$229,869 unadjusted]; gonorrhea, King: \$496,509 [\$391,089 unadjusted], Spokane: \$141,983 [\$111,837 unadjusted]; chlamydia, King: \$236,740 [\$186,475 unadjusted]). (This outcome measure was not estimated for counties with no HIV diagnoses for a given STI.) • The cost per partner services client accepting a PrEP referral from a DIS varied by county and infection (early syphilis, King: \$6,830 [\$5,380 unadjusted], Pierce: \$3,242 [\$2,554 unadjusted], Spokane: \$72,957 [\$57,467 unadjusted]; gonorrhea/chlamydia, King: \$4,730 [\$3,726 unadjusted], Pierce: \$7,856 [\$6,188 unadjusted], Spokane: \$7,748 [\$6,103 unadjusted]). (For this outcome, gonorrhea and chlamydia were combined.)
Williams et al., 2022 ^{24 c}	• The total program cost of the peer network strategy to identify, test, and refer patients at high risk of HIV and syphilis was \$130,951 [\$109,873 unadjusted 2019 US dollars] • The cost per new positive HIV or syphilis diagnosis was \$8,730 [\$7,325 unadjusted], with a range of \$5,821 to \$13,095 [\$4,994 to \$10,987 unadjusted] when assuming different rates of HIV and syphilis positivity). • The discussion section provides an illustration of how to interpret the results in term of a cost-benefit analysis, showing that the intervention was cost-saving when considering a published estimate of the value of identifying new HIV infections.

Abbreviation: disease intervention specialist (DIS), human immunodeficiency virus (HIV), partner notification (PN), pre-exposure prophylaxis (PrEP), primary and secondary (P&S), sexually transmitted infection (STI), United States (US)

^aThe healthcare system and correctional facility cost outcomes were calculated by the review study authors.

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The cost outcome for the third scenario with both women and men receiving PN was calculated by the systematic review study authors. Although HIV is not a focus of our literature review, the outcome “cost per new positive HIV or syphilis diagnosis” is reported in this table because this outcome was the main result presented by the study authors. Ranges were reported as “not applicable” for the total program cost and cost per patient tested; only the cost per new positive HIV or syphilis diagnosis had a sensitivity analysis range because the value varied for different rates of HIV and syphilis positivity.

Table 3.

Reporting completeness of studies examining economic outcomes of disease intervention specialist-delivered partner services for sexually transmitted infections

Study	Study objectives	Intervention and comparators	Study population	Contextual information	Perspective	Currency, date, conversion	Inputs (cost data, effectiveness data)	Outcome measures	Uncertainty	Study limitations
Gift et al., 2006 ¹⁹	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Gift et al., 2008 ¹³	Yes	Yes	Somewhat	Somewhat	Yes	Yes	Yes	Yes	Yes	Yes
Johnson et al., 2017 ²²	Yes	Yes	Yes	Not applicable	Yes	Yes	Yes	Yes	No	Yes
Rahman, 2010 ²⁰	Yes	Yes	Yes	Not applicable	Yes	No	Yes	Yes	Yes	Yes
Reynolds et al., 2001 ²¹	Yes	Yes	Yes	Not applicable	Yes	Yes	Yes	Yes	Yes	Somewhat
Silverman et al., 2019 ²³	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes
Williams et al., 2022 ²⁴	Yes	Yes	Yes	Yes	Somewhat	Yes	Yes	Yes	Yes	Yes