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Cost-Effectiveness of Screening Men in Maricopa County Jails for Chlamydia and Gonorrhea to Avert Infections in Women

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Abstract

Background—Chlamydia and gonorrhea infections can lead to serious and costly sequelae in women, but sequelae in men are rare. In accordance with the Centers for Disease Control and Prevention guidelines, female jail inmates in Maricopa County (Phoenix area), Arizona, are screened for these infections. Owing to lack of evidence of screening benefits in men, male inmates are tested and treated based on symptoms only.

Methods—We developed a probabilistic simulation model to simulate chlamydia and gonorrhea infections in Maricopa County jail male inmates and transmissions to female partners per year. We estimated the cost-effectiveness of screening as the cost per infection averted. Costs were estimated from the perspective of the Maricopa County Department of Public Health and the Correctional Health Services.

Results—Compared with symptom-based testing and treating strategy, screening male arrestees of all ages and only those 35 years or younger yielded the following results: averted approximately 556 and 491 cases of infection in women at a cost of approximately US $1240 and $860 per case averted, respectively, if screened during physical examination (between days 8 and 14 from entry to jail), and averted approximately 1100 and 995 cases of infections averted at a cost of US $1030 and $710 per infection averted, respectively, if screened early, within 2 to 3 days from entry to jail.

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Conclusions—Screening of male inmates incurs a modest cost per infection averted in women compared with symptom-based testing. Screening in correctional settings can be used by public health programs to reduce disease burden, sequelae, and associated costs.

Correctional facility inmates are at higher risk for sexually transmitted infections with rates considerably higher than those of the general population.[1] In women, chlamydia (CT) and gonorrhea (GC) can cause serious and costly sequelae, including pelvic inflammatory disease, which can lead to chronic pelvic pain, ectopic pregnancy, and infertility. Estimates in the literature have indicated that screening and treating women for these infections so as to avert sequelae are cost-effective compared with symptom-based testing.[2] The Centers for Disease Control and Prevention (CDC) and US Preventive Services Task Force provide guidelines and recommendations for screening women for these infections.[3] The CDC does not provide similar guidelines for screening of male adults because the sequelae of male infection (epididymitis) are not severe.[4] The US Preventive Services Task Force gives male screening for CT an "I" (incomplete evidence) rating, and cost-effectiveness analyses of male screening have reached varying conclusions.[5] However, studies have estimated probable benefits of screening men in high-prevalence settings such as in jails.[6] Although 2 studies associated jail-based male screening programs with a reduction in disease burden in the community[7,8] another study of a Philadelphia program found no such evidence.[9]

A pilot screening study conducted by the Arizona Arrestee Reporting Information Network (AARIN) indicates high prevalence rates of CT and GC infections among men and women in Maricopa County (Phoenix area) jails.[10] Among male arrestees, 7% and 4.6% were tested positive for CT and GC, respectively, and among female arrestees, 10% and 5% were tested positive for CT and GC, respectively (see Table 1 for age-based rates). The reported cases of CT and GC in the general population in year 2010 were approximately 0.41% and 0.06% of Maricopa residents, respectively.[10,11]

The Maricopa County Correctional system provides medical care to more than 130,000 persons per year, with annual operating costs of approximately $50 million per year.[12] The Maricopa County Correctional Health Services (CHS) currently screens women arrestees 35 years and younger for CT and GC infections during the time of physical examination (PE). Male arrestees are not screened because of the unavailability of evidence of screening benefits and limited resources. However, the high prevalence of infections among male arrestees in Maricopa jails evidenced in the AARIN study indicates that a large population of women could be exposed to untreated male infections and thus be put at risk for serious sequelae. We used available data on the Maricopa jail population, including local prevalence data from the AARIN study and demographics data from the Maricopa county jails, to simulate infection in jail inmates and transmission to female partners upon their release during 1 calendar year. We estimated the number of infections averted in women by screening of male inmates in Maricopa County jails compared with the current strategy of symptom-based testing and treating. We also estimated the costs incurred for such a screening program and cost-effectiveness as the cost per infection averted in women.

METHODS

Model

We developed a stochastic individual simulation model (in NetLogo 4.1.3 software) by individually simulating each male arrestee from the time of entry into jail to either, release from jail if person is not infected at the time of release (both uninfected and infected but treated before release), or until recovery from infection if person is infected at the time of release. We simulated 100,000 male inmates, which was approximately the number of inmates entering jails in Maricopa County each year. The time-unit in the simulation is a calendar day. Age at entry into jail (Table 1) and length of stay in jail (distributed as 39%, 50%, 52%, 62%, 74%, and 99% stay in jail <1, 2, 3, 8, 14, and 365 days, respectively) for each person in the simulation were assigned to match those of male inmates in the Maricopa County jails. At the time of entry, the proportion of arrestees infected with CT, GC, or both was simulated to match the age-based prevalence of these infections reported in the AARIN pilot study. We assumed that there were no new infections during the duration of stay in jail. For those who were released from jail with infection, we simulated possible transmissions to women as follows. Upon release from jail, assuming a heterosexual population, each person was assigned a female partner and variables that defined the sexual relationship, such as duration of partnership, number of sex acts, and condom use. When a relationship ended, a person could have a new partner, and the sexual behavioral variables were reassigned with different values to define the new partnership. During each time-unit after release from jail, the probability that the infected inmate could transmit the infection to his uninfected female partner was calculated using the Bernoulli equation.

$$p=1-[(1-\alpha)^{n(1-f)}(1-\beta)^{nf}]$$

where p is the probability of transmission per time-unit, α and β are the probabilities of transmission per unprotected and protected sex act, respectively, n the number of sex acts for that time-unit, and f the proportion of protected sex acts. Transmission beyond that of infected persons released from jail to uninfected female partners was not modeled. See Tables 1 and 2 for a list of data parameters and assumptions used in the model. To model stochasticity among individual persons, where applicable, parameter values were assigned by drawing random numbers from probability distributions. The number of sex acts per person per year was uniformly distributed. For each new sexual partnership of a person, duration of the partnership was exponentially distributed with mean estimated using number of partners per year. The number of sex acts per partnership was assigned proportional to the duration. Condom use was distributed by age. The probability of transmission per sex act was determined based on a uniform distribution. The duration of infection was also uniformly distributed.

Scenarios

We simulated a population of 100,000 male inmates each under 5 scenarios: (1) *symptom-based testing*: this was the *baseline* and is equivalent to the current scenario where male inmates who seek medical help based on symptoms are tested for CT and GC; (2) *screen all*

during PE: this scenario proposes screening all male arrestees for CT and GC during the routine PE offered to all inmates, which usually occurs between days 8 to 14 from the time of entry to jail; (3) *screen all inmates 35 years or younger during PE*: given that the prevalence of the infections was lower in the older population of jail inmates (Table 1) and to reflect current CDC screening recommendations for women in correctional facilities, this scenario proposes screening only male arrestees who are 35 years or younger during the routine PE; (4) *screen all on days 2 to 3*: given that approximately 62% to 74% of inmates are released from jail by the time of PE, this scenario proposes screening all male arrestees for CT and GC on the second or third day from the time of entry into jail; and (5) *screen all inmates 35 years or younger on days 2 to 3*: this scenario proposes screening only male arrestees who are 35 years or younger on the second or third day from the time of entry to jail.

In all scenarios, we made the following assumptions. Testing would be done using a urine-based combination assay for both CT and GC. We assumed that 73% of all inmates in jail at the time of screening would agree to test, which is the proportion in Maricopa County jails accepting a PE. It takes approximately 2 to 3 days to receive test results and approximately 5 to 7 days from time of test before an inmate who is tested positive receives treatment. All inmates who are tested positive and are in jail were provided with and accepted the necessary treatment. Infected inmates who were released from jail before this time were followed up and, if found (with a probability of 80% [expert opinion]), were treated. Chlamydia would be treated with 1 dose of azithromycin and GC or co-infection with 1 dose of azithromycin plus 1 dose of ceftriax-one. We kept track of test and treatment costs incurred by each inmate, which are covered by the CHS or by the Maricopa County Department of Public Health (MCDPH) (Table 3). In each scenario, we also assumed that infected inmates who were not tested while in jail but developed symptoms after release from jail would seek medical help, that is, get tested and treated outside the jail. We assumed that those costs would be incurred by a different entity outside of MCDPH or CHS and hence were not included in our analyses. Testing costs, treatment costs, and personnel wages for follow-up were provided by Maricopa County Health Department in 2011 dollars, and a microcosting direct measurement technique was used to estimate cost inputs. To derive the labor costs for follow-up and treatment, we multiplied the staff time associated with each activity by the compensation, that is, wages plus benefits.

Sensitivity Analysis

We test for the sensitivity of results on age-based proportion accepting screening, age-based length of stay in jail, earlier availability of treatment for those infected, and additional cost of early screening, that is, on days 2 to 3 instead of with PE (Table 4).

Evaluation Measures

Under each scenario, using the simulation model, we estimated the number of infections in women, that is, transmissions from infected male inmates after release from jail, and the testing and treatment costs incurred by the CHS and MCDPH. For every scenario, we ran the simulation 30 times each with 100,000 inmates to obtain mean and confidence interval values of the results. All costs are in 2011 dollars. We estimated the average cost-

effectiveness of scenarios 2 through 5 by dividing the net cost of a scenario by the net number of infections averted compared with scenario 1. By arranging scenarios in order of effectiveness, that is, decreasing order in number of new infections in women, we also estimated incremental cost-effectiveness ratios (ICERs) as incremental cost per infection averted in pairwise comparisons of a strategy with the next most effective strategy and eliminated weakly dominated scenarios. A scenario is weakly dominated if its ICER is greater than that of a more effective scenario, and hence, if all scenarios are feasible and acceptable, weakly dominated scenarios can be eliminated. We then reestimated ICERs among the remaining scenarios. In "Results," we round estimated values to the nearest 10th unit.

RESULTS

In all scenarios, of the 100,000 inmates entering jail each year, approximately 10,330 were estimated to be infected with CT or GC at the time of entry (Table 5). Under the baseline scenario (scenario 1), where male inmates were tested and treated for CT and GC only if they sought medical help because of occurrence of symptoms, approximately 2150 infected inmates had received treatment by time of release from jail, whereas the rest of the 8160 inmates were still infected and unaware of their infection at the time of release. Upon release from jail, these infected inmates transmitted the infection to approximately 6090 women. Scenario 1 cost approximately $114,960, of which, 50% was incurred by CHS and the remaining 50% by MCDPH.

Under the scenario where all male inmates were offered CT and GC screening along with their PE (scenario 2), which occurred anywhere between days 8 and 14 from the time of entry to jail, approximately 2600 infected inmates had received treatment by time of release from jail, whereas the rest of the 7740 remained infected and unaware of their infection at the time of release. The infected inmates comprised those who were released before testing day or did not accept the test (6930) and those who were tested but released from jail before the test results became available (810). These male inmates transmitted the infection to approximately 5530 women. When only inmates 35 years or younger were offered screening along with their PE (scenario 3), of the infected male inmates, approximately 2570 were tested and treated before release, approximately 7050 infected male inmates left jail before screening day or declined testing, and the remaining 740 infected male inmates were tested but had left the jail before receiving results. These infected men transmitted the infection to approximately 5600 women. Therefore, although a smaller population was screened in scenario 3 compared with scenario 2, given the lower prevalence of CT and GC and data indicating lower sexual risk behavior among older male population than younger men, there was not much difference in the number of transmissions. Scenarios 2 and 3 cost approximately $802,540 and $535,930, respectively. In scenario 2, testing and treatment incurred 92% and 8% of total cost, respectively. In scenario 3, testing and treatment incurred 88% and 12% of total cost, respectively. In both scenarios, CHS and MCDPH incurred 59% and 41% of the total cost, respectively.

When all inmates were offered the test on days 2 to 3 from he time of entry to jail instead of delaying until PE day (scenario 4), there were approximately 7140 inmates with infection at

the time of their release from jail. The released infected inmates comprised approximately 5730 inmates who had either left the jail before test day or refused to get tested and had 1,410 inmates who were tested but released before their test results were available. When only inmates 35 years or younger were offered the test on days 2 to 3 from the time of entry to jail (scenario 5), there were approximately 7250 with infection at the time of release, including approximately 1280 who had been tested but had not yet received test results by the time of release. Infected male inmates in scenarios 4 and 5 transmitted the infection to approximately 5000 and 5090 women, respectively. Scenarios 4 and 5 cost approximately $1,249,460 and $819,740, respectively. In scenario 4, testing and treatment incurred 92% and 8% of total cost, respectively. In scenario 5, testing and treatment incurred 89% and 11% of total cost, respectively. In both scenarios, CHS and MCDPH incurred 59% and 41% of the total cost, respectively.

Compared with baseline, scenarios 2 and 3 prevented approximately 560 and 490 cases of infection in women, respectively, whereas scenarios 4 and 5 prevented approximately 1100 and 995 cases, respectively. Average cost-effectiveness, that is, the average cost per infection averted compared with the baseline (scenario 1), was approximately $1240, $860, $1030, and $710 in scenario 2, 3, 4, and 5, respectively (Table 5). Pairwise comparisons to estimate ICERs indicated that scenarios 2 and 3 were weakly dominated and, hence, were eliminated (Table 6). Pairwise comparisons among the remaining scenarios resulted in ICERs of approximately $710 and $4130 per infection averted in scenarios 5 and 4, respectively, compared with their next effective alternative (Table 6).

Sensitivity analyses indicate that scenario 5 has the least cost per infection averted compared with baseline in all cases, except for when the additional cost of screening early (on days 2–3) is $7 per inmate, in which case scenario 3 has the least cost (Fig. 1). Infections averted in women were the highest when there was a faster turnaround of test results and treatment availability (Table 7).

DISCUSSION

Estimates indicate that offering CT and GC screening for male inmates in Maricopa jails followed with treatment for those infected could avert a large number of infections in women that could have been transmitted by infected male inmates released from jail. Although screening all male inmates averted the most cases of infections compared with screening only younger inmates, it was also relatively costly. Results suggest that screening only inmates 35 years or younger has the potential to avert a considerable number of infections in women. Only approximately 26% to 38% of inmates stay in jail longer than 8 to 14 days (time of PE) and, as such, implementing the screening as soon as possible following arrest should be considered. Screening early, within 2 to 3 days when 48% to 50% are still in jail, averted twice the number of infections. Screening male inmates 35 years or younger on days 2 to 3 of entry to jail has the least cost per infection averted compared with symptom-based testing if early screening has no additional costs or is less than $7 per inmate screened. If early screening costs an additional $7 or more per inmate screened then screening inmates 35 years or younger on PE day had the least cost per infection averted compared with symptom-based testing.

The model is subject to certain limitations. We estimated costs of testing and treatment of CT and GC only and did not include costs averted from sequelae in men or infection and sequelae in women. We estimated only first-level transmission and did not include any of the downstream transmissions from the infected women to others. We also did not include the potential impact of partner services. We assumed sexual behavior equivalent to the general population, but it is likely that some of the inmates are involved in higher-risk behavior. All of the above could have underestimated costs averted and infections averted. Also, individual programs may face different costs for specimen collection or testing and lead to results that differ from what we found.

Public health programs and correctional health systems are frequently faced with priority versus resource challenges. Our estimates indicate that screening male inmates for CT and GC could avert a considerable number of infections and hence possibly prevent cases of costly sequelae in women. These results are consistent with studies on screening at similar high-prevalence settings.[13,14] Averting these infections could possibly translate to reducing disease burden in the community, as indicated in some studies.[7,8] Another study that did not find any such evidence showed an unaccounted decrease in infections in the community in both control and case groups.[9] The costs incurred per infection averted are within range of costs incurred in other screening programs that indicate that screening of men for CT and GC is cost-effective in high-prevalence settings.[5,13] Our results indicate that, from the perspective of MCDPH and CHS, screening male inmates 35 years or younger has a lower incremental cost per infection averted compared with screening male inmates of all ages, which is consistent with CDC's guidelines for screening women.[4] Early screening and treatment availability could avert the most infections. In conclusion, in addition to screening women for early detection of CT and GC for prevention of severe sequelae, screening men in high-prevalence settings such as jails could prevent the occurrence of these infections in a large number of women.

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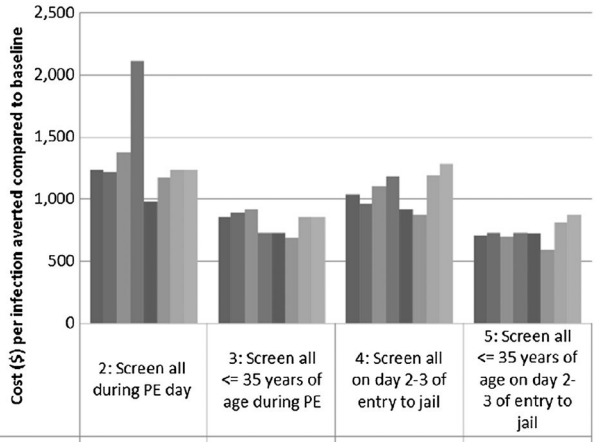

	2: Screen all during PE day	3: Screen all <= 35 years of age during PE	4: Screen all on day 2-3 of entry to jail	5: Screen all <= 35 years of age on day 2-3 of entry to jail
Base	1,237	858	1,032	709
Test acceptance:80% if ≤age 35;60% if >age 35	1,212	892	959	726
Test acceptance:60% if ≤age 35;80% if >age 35	1,377	918	1,105	690
% leaving jail by 8-14 days: 90% if age≤35; 51% if age >35	2,108	729	1,182	724
% leaving jail by 8-14 days: 60% if age≤35; 96% if age >35	978	730	919	720
Infected inmates get treated by day 3 to 4 from time of test	1,173	683	873	586
Additional cost of screening early: $5 per inmate screened	1,237	858	1,189	811
Additional cost of screening early: $7 per inmate screened	1,237	858	1,284	873

Figure 1.

Average cost-effectiveness measure (in dollars per infection averted compared with baseline symptom-based testing scenario) under sensitivity analyses.

TABLE 1

Demographic and Behavioral Characteristics of Maricopa County Male Arrestee Population

	Age Group, y										
	15–17	**18–19**	**20–24**	**25–29**	**30–34**	**35–39**	**40–44**	**45–54**	**55–64**	**>65**	**Source**
Age distribution of arrestees	4%		22%	19%	16%	11%	10%	14%	4%	1%	CHS
Prevalence of infection											
CT	18%		9%	11%	8%	3%	0%	0%	0%	0%	10
GC	7%		7%	7%	2%	3%	2%	3%	0%	0%	10
Sexual behavior											
Mean duration of partnership (mo)*,†	16	14	17	27	41	40	57	57	57	57	15
Proportion without partner on day of release, %‡	18	12	7	6	5	6	9	9	9	9	15
No. sex acts per year*,§	20–41	73–127	73–127	62–108	51–93	51–93	48–86	48–86	40–73	32–62	16
Proportion condom protected sex§	0.58	0.39	0.39	0.27	0.18	0.18	0.14	0.14	0.09	0.09	17

*Number of partners/sex acts estimated as average of reported number of partners/sex acts weighted by proportion reporting under each category of number of partners/sex acts among those sexually active.

†Assuming a person is in a partnership, its remaining duration, that is, the duration before the partnership ends, is determined as an exponentially distributed random number. The mean duration (in months) was estimated as 12 divided by (number of partners per year − 1).

‡Estimated using proportion who has had sex but currently does not have a partner. The same proportion is used to determine the duration of no partnership as a geometrically distributed random number. These values are also applied after a partnership ends to determine the proportion that would not immediately have a new partner.

§Note that in simulating transmissions in a partnership, the behavior of both persons involved, that is, the inmate and his female partner assuming heterosexual, is considered. Because the source data for sex acts and condom use are from the general population, assuming female partners are from the general population and assuming not much age difference between inmates and their partners, we used sex acts and condom use data of women.

TABLE 2
Assumptions for Epidemiologic, Testing, and Treatment Parameters for CT and GC

Variable	Value/Range	Source
Epidemiologic variables For CT		
Incubation period, d*	7–21	18
Duration of infection, d*		
Symptomatic, men	10–21	19,20
Asymptomatic, men	120–365	
Proportion of CT infections that are symptomatic	0.5	18,21
Transmission probability male to female per unprotected sex act	0.56–0.84	22
Relative risk of transmission with condoms	0.42	23
Epidemiologic variables For GC		
Incubation period, d*	8	19
Duration of infection, d*		19,20
Symptomatic, men	12	
Asymptomatic, men	180	
Proportion of GC infections that are symptomatic, male	0.6	21,24
Transmission probability male to female per unprotected sex act	0.5–0.7	25
Relative risk of transmission with condoms	0.42	23
Test and treatment efficacy		
Test performance, %		
CT sensitivity (NAAT)	86.8	26,27
GC sensitivity (NAAT)	88.9	26,27
CT specificity (NAAT)	98.3	28
GC specificity (NAAT)	99.5	28
Treatment efficacy, %		
Azithromycin (1 g) against CT	96.5	29
Azithromycin (1 g) and ceftriaxone against GC	89	30

*For each inmate, duration of infection was a random number between the lower and upper bounds. For asymptomatic cases, the number of days into the infection at the time of entry to jail was a random number between 0 and the assigned length of infection plus incubation period. Assuming persons who show symptoms before entry to jail would have sought medical help, for symptomatic persons, the number of days into the infection at the time of entry to jail was a random number between 0 and length of incubation period; that is, symptoms occur only after entry to jail.

NAAT indicates nucleic acid amplification test.

TABLE 3
Unit Costs (per Inmate) of Testing and Treatment

Variable	Cost* Incurred by CHS	Cost* Incurred by MCDPH
Test costs per inmate tested in jail	18.18†	11.30‡
Treatment costs if infected inmate is in jail at time of receiving treatment§		
CT infection	8.82	
GC infection or CT and GC coinfection	10.11	
Cost to find inmate if released from jail before receiving treatment¶		41.91
Treatment costs if inmate released from jail before receiving treatment‖		
CT infection		22.74
GC infection or CT and GC coinfection		25.24

Source: MCDPH and CHS; costs determined using microcosting direct measurement.

*All costs are in 2011 US dollars.

†Aptima CT/GC combo test kit.

‡Cost for NAAT for CT and GC test (including test reagents, collection, amplification reagent, tips, requisitions, and other disposable items) and processing of sample (including courier delivery of specimens to and from laboratory and labor costs for clinicians and technicians for processing specimen).

§Treatment costs include costs for drugs and indirect costs in obtaining and delivering drugs.

¶Labor costs to follow-up and perform disease investigation duties.

‖Includes cost for drugs and labor costs of clinicians in the MCDPH clinics.

TABLE 4

Sensitivity Analyses Parameters

Parameter	Base Value	Sensitivity Analysis Value
Proportion accepting screening for CT and GC	73% for all ages	a. 80% for age ≤35 y and 60% for age >35 y b. 60% for age ≤35 y and 80% of >35 y
Proportion of inmates leaving jail by days 8 to 14 from time of entry to jail	74% for all ages	a. 90% for age ≤35 y and 51% for age >35 y b. 60% for age ≤35 y and 96% for age >35 y
Length of time from day of test for treatment availability for those infected	5–7 d	3–4 d
Additional cost of screening on days 2–3 (applicable for scenarios 4 and 5 only), $ per inmate screened	$0	a. $5 b. $7

TABLE 5

Scenario Results for a Hypothetical Cohort of 100,000 Male Inmates*

Measure	Scenarios				
	1: Symptom-Based Testing (Baseline)†	2: Screen All During PE Day†,‡	3: Screen All ≤35 y of Age During PE†,‡	4: Screen All on Days 2–3 of Entry to Jail†	5: Screen All ≤35 y of Age on Days 2–3 of Entry to Jail†
No. male inmates infected at time of entry to jail§	10,313 (10,109–10,548)	10,344 (10,170–10,566)	10,358 (10,135–10,523)	10,322 (10,096–10,501)	10,354 (10,144–10,604)
No. uninfected male inmates screened	—	21,505 (21,228–21,683)	12,694 (12,557–12,857)	34,544 (34,261–34,803)	20,415 (20,221–20,557)
No. infected male inmates tested and treated while in jail¶	2149 (2061–2250)	2607 (2560–2693)	2572 (2464–2625)	3186 (3086–3270)	3108 (3039–3162)
No. male inmates infected at time of release from jail					
Number not tested	8021 (7878–8167)	6926 (6823–7052)	7051 (6920–7195)	5728 (5628–5825)	5968 (5820–6138)
Number tested but not received results¶	143 (95–190)	811 (753–858)	735 (668–787)	1408 (1359–1458)	1278 (1209–1331)
No. women infected from transmissions	6087 (5974–6249)	5531 (5439–5647)	5597 (5462–5727)	4988 (4911–5086)	5092 (4971–5239)
Infections averted in women	Baseline	556	491	1099	995
Total cost of scenario‖	114,961 (110,804–119,751)	802,539 (794,885–811,409)	535,925 (530,244–541,231)	1,249,464 (1,240,422–1,258,696)	819,738 (812,319–826,155)
Cost breakdown by type and payer (% of total cost)**					
Testing costs—CHS	36%	56%	54%	57%	55%
Testing costs—MCDPH	23%	35%	34%	35%	34%
Treatment costs—CHS	14%	3%	4%	2%	3%
Treatment costs—MCDPH	27%	5%	8%	5%	7%
Incremental cost per infection averted in women compared with baseline	Baseline	1237	858	1032	709

*Means and 95% confidence intervals of the variables were calculated by running the simulation 30 times each with 100,000 male inmates. There were approximately 100,000 male inmates entering Maricopa county jails each year.

†Under each scenario, an inmate was randomly assigned a test day, that is, a random day between 8 and 14 under scenarios 2 and 3 and a random day between 2 and 3 under scenarios 4 and 5. Symptomatic persons who show symptoms before test day would seek medical help within a day of showing symptoms. An inmate would be eligible for testing while in jail only if his release from jail is any day after his assigned test day or, in symptomatic cases, any day after day of showing symptoms.

‡PE was conducted on days 8 to 14 from the time of entry to jail.

§The model is stochastic; that is, the outcome of events such as the infection status of a person is determined by drawing random numbers from a distribution, and therefore, there are variations in results across runs. The overlap of confidence intervals across the scenarios indicates that the number of infected inmates is not statistically different across scenarios.

¶Infected inmates who were tested because of symptoms or screening program.

||Costs incurred by CHS and MCDPH only. All costs are in 2011 US dollars.

**Test costs are for screening or testing inmates in jail, which is paid by both CHS and MCDPH, as indicated in Table 3. If an inmate is in jail at the time of treatment, all treatment costs are incurred by CHS. If an inmate has left the jail, all treatment costs including finding inmate are incurred by MCDPH.

TABLE 6

Incremental Cost-Effectiveness of Alternative Screening Scenarios

Scenarios*	No. Women Infected	Total Cost†	Incremental Cost-Effectiveness ($/Infection Averted)‡		
			Comparison (1)	Comparison (2)	Comparison (3)
1: Symptom-based testing (baseline)	6087	114,961	—	—	—
3: Screen all ≤35 y of age during PE	5597	535,925	859	859 (weakly dominated)	—
2: Screen all during PE day	5531	802,539	4040 (weakly dominated)	—	—
5: Screen all ≤35 y of age on days 2–3 of entry to jail	5092	819,738	39	562	708
4: Screen all on days 2–3 of entry to jail	4988	1,249,464	4132	4132	4132

*Scenarios are listed in order of effectiveness, that is, decreasing order in number of women infected.

†All costs are in 2011 US dollars.

‡The incremental cost-effectiveness is a pairwise comparison to estimate the incremental cost per infection averted compared with the previous scenario and determine the most cost-effective strategy as follows. Scenarios are listed by increasing effectiveness, that is, decreasing order in number of new infections in women. Under comparison (1), for each scenario the incremental cost per infection averted compared with the previous scenario is estimated. Scenario 2 has a higher cost per infection averted than scenario 5 and infects more women (ie, weakly dominated) and hence is eliminated in subsequent comparisons. For each remaining scenario, under comparison (2), the incremental cost per infection averted compared with the previous scenario is estimated, and scenario 3 is eliminated as weakly dominated. This is repeated in comparison (3), and because there are no more weakly dominated scenarios, we stop here. The scenario with the least cost per infection averted under the final comparison (3) is chosen as the most cost-effective strategy.

TABLE 7

Costs and Infections Averted in Sensitivity Analysis Cases

Sensitivity Analysis Parameter	1: Symptom-Based Testing (Baseline)	2: Screen All During PE Day	3: Screen All ≤35 y of Age During PE	4: Screen All on Day 2–3 of Entry to Jail	5: Screen All ≤35 y of Age on Days 2–3 of Entry to Jail
Total costs					
Base	114,961	802,539	535,925	1,249,464	819,738
Test acceptance: 80% if age ≤35 y; 60% if age >35 y	119,202	794,350	571,029	1,232,832	876,599
Test acceptance: 60% if age ≤35 y; 80% if age >35 y	117,563	760,915	471,155	1,168,097	701,954
% Leaving jail by 8–14 d: 90% if age ≤35 y; 51% if age >35 y	101,799	782,729	344,462	1,244,869	699,290
% Leaving jail by 8–14 d: 60% if age ≤35 y; 96% if age >35 y	133,923	825,703	712,120	1,269,335	949,670
Infected inmates get treated by days 3–4 from the time of the test	104,208	790,034	530,145	1,233,731	803,603
Additional cost of screening early: $5 per inmate screened	114,961	802,539	535,925	1,422,185	921,814
Additional cost of screening early: $7 per inmate screened	114,961	802,539	535,925	1,525,817	983,059
Infection’s’ averted					
Base	Baseline	556	491	1099	995
Test acceptance: 80% if age ≤35 y; 60% if age >35 y	Baseline	557	507	1162	1043
Test acceptance: 60% if age ≤35 y; 80% if age >35 y	Baseline	467	385	951	847
% Leaving jail by 8–14 d: 90% if age ≤35 y; 51% if age >35 y	Baseline	323	333	967	825
% Leaving jail by 8–14 d: 60% if age ≤35 y; 96% if age >35 y	Baseline	707	792	1235	1132
Infected inmates get treated by days 3–4 from the time of the test	Baseline	585	624	1294	1193
Additional cost of screening early: $5 per inmate screened	Baseline	556	491	1099	995
Additional cost of screening early: $7 per inmate screened	Baseline	556	491	1099	995