The Cost-Effectiveness of Screening Men Who Have Sex With Men for Rectal Chlamydial and Gonococcal Infection to Prevent HIV Infection

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Background: Men who have sex with men (MSM) who have a current or recent history of rectal *Chlamydia trachomatis* (*CT*) and *Neisseria gonorrhoeae* (*GC*) infection are at greater risk for HIV than MSM with no history of rectal infection. Screening and treating MSM for rectal *CT*/*GC* infection may help reduce any increased biological susceptibility to HIV infection.

Methods: We used 2 versions of a Markov state-transition model to examine the impact and cost-effectiveness of screening MSM for rectal *CT*/*GC* infection in San Francisco: a static version that included only the benefits to those screened and a dynamic version that accounted for population-level impacts of screening. HIV prevention through reduced susceptibility to HIV was the only potential benefit of rectal *CT*/*GC* screening that we included in our analysis. Parameter values were based on San Francisco program data and the literature.

Results: In the base case, the cost per quality-adjusted life year gained through screening MSM for rectal *CT*/*GC* infection was $16,300 in the static version of the model. In the dynamic model, the cost per quality-adjusted life year gained was less than $0, meaning that rectal screening was cost-saving. The impact of rectal *CT*/*GC* infection on the risk of HIV acquisition was the most influential model parameter.

Conclusions: Although more information is needed regarding the impact of rectal *CT*/*GC* screening on HIV incidence, rectal *CT*/*GC* screening of MSM can potentially be a cost-effective, scalable intervention targeted to at-risk MSM in certain urban settings such as San Francisco.

Men who have sex with men (MSM) who have a current or recent history of rectal *Chlamydia trachomatis* (*CT*) and/or *Neisseria gonorrhoeae* (*GC*) infection are at greater risk for HIV than MSM with no history of rectal infection.[1–3] This increased risk may be attributable to biological factors, behavioral factors, or both.[1–3] Screening and treating MSM for rectal *CT* and *GC* infection may help reduce any increased biological susceptibility to HIV infection and identify men at increased risk for HIV infection.[1–3]

The burden of rectal sexually transmitted diseases (STDs) among MSM has been well documented.[4–10] However, most infections are asymptomatic, suggesting that routine screening is needed to identify and treat rectal STDs.[6,10] Although the Centers for Disease Control and Prevention recommends rectal screening for *CT* and *GC* infection among men who have had receptive anal intercourse in the past year,[11] rectal screening rates are limited. For example, most MSM with HIV in urban areas are not screened for rectal *CT* or *GC* infection in any given year, although screening rates can vary from clinic to clinic.[12] San Francisco is one example of a setting with relatively high rectal screening rates because the San Francisco Department of Health (SFDPH) has supported extragenital testing in a variety of clinical sites. The purpose of this study was to estimate the impact and cost-effectiveness of screening for rectal *CT* and *GC* infection among MSM in San Francisco, using estimates of current rectal screening coverage rates.

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The findings and conclusions in this report are those of the authors and do not necessarily represent the views of the Centers for Disease Control and Prevention.

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MATERIALS AND METHODS

The Model

We used a Markov state-transition model to examine the potential impact of screening MSM for rectal *CT* and *GC* infection. The model consists of 4 mutually exclusive health states based on HIV infection status and rectal *CT*/*GC* infection status (Fig. 1), where *CT*/*GC* denotes *CT* and/or *GC* infection. Transition from one state to another occurs when rectal *CT*/*GC* infection is acquired, when rectal *CT*/*GC* infection is cleared, or when HIV is acquired. The incidence rate of rectal *CT*/*GC* infection is $\lambda_{STD}\Omega_{STD}$ and $\hat{\lambda}_{STD}\Omega_{STD}$ among those without and with HIV, respectively, where λ_{STD} and $\hat{\lambda}_{STD}$ are the incidence rates of rectal *GC* infection at the onset of the screening program among those without and with HIV, respectively, and Ω_{STD} is an adjustment factor to account for changes in the prevalence of *CT*/*GC* in sex partners over time as a result of the screening program. The clearance rate (r) of rectal *CT*/*GC* infection is a function of 2 factors: duration of infection and screening rates. The HIV incidence rate among those without rectal *CT*/*GC* infection is $\lambda_{HIV}\Omega_{HIV}$, where λ_{HIV} is the HIV incidence at the onset of the screening program and Ω_{HIV} is an adjustment factor to account for changes in the prevalence of HIV in sex partners over time. The rate of HIV incidence among those with rectal *CT*/*GC* infection was assumed to be Θ times that of those without rectal *CT*/*GC* infection. The population of MSM was assumed to be 65,000, with an initial HIV prevalence of 25%.[13] Initially, 1511 of the 48,750 MSM without HIV and 1576 of the 16,250 MSM with HIV were assumed to have rectal *CT*/*GC* infection. We performed all calculations using Excel 2007 (Microsoft Corporation, Redmond, WA). A more detailed description of the model is provided in a supplemental appendix available from the lead author upon request (http://links.lww.com/OLQ/A58).

Parameter Values

Parameter values and costs applied in the model were based on the literature and on data from SFDPH, as listed in Table 1. Data

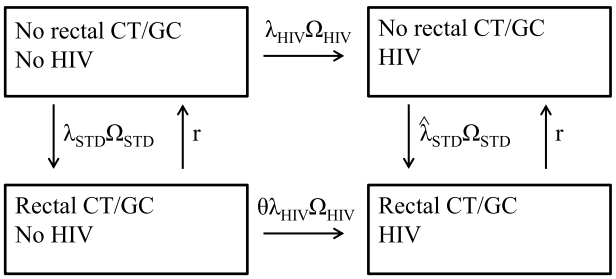

Figure 1. Illustration of the model. The 4 health states are mutually exclusive, and transition occurs when rectal *CT*/*GC* infection is acquired, when rectal *CT*/*GC* infection is cleared, or when HIV is acquired. The HIV incidence rate among those without rectal *CT*/*GC* infection is $\lambda_{HIV}\Omega_{HIV}$, where λ_{HIV} is the HIV incidence at the onset of the screening program and Ω_{HIV} is an adjustment factor to account for changes in the prevalence of HIV in sex partners over time. The rate of HIV incidence among those with rectal *CT*/*GC* infection is assumed to be Θ times that of those without rectal *CT*/*GC* infection. The incidence rate of rectal *CT*/*GC* infection is $\lambda_{STD}\Omega_{STD}$ and $\hat{\lambda}_{STD}\Omega_{STD}$ among those without and with HIV, respectively, where λ_{STD} and $\hat{\lambda}_{STD}$ are the incidence rates of rectal *CT*/*GC* infection at the onset of the screening program among those without and with HIV, respectively, and Ω_{STD} is an adjustment factor to account for changes in the prevalence of *CT* and *GC* in sex partners over time as a result of the screening program. The clearance rate of rectal *CT*/*GC* infection (r) is a function of 2 factors: duration of infection and screening rates.

from SFDPH were used to estimate annual incidence rates of rectal *CT*/*GC* infection in MSM with and without HIV (0.129 and 0.041, respectively, as described in Table 1). HIV incidence among MSM without rectal *CT*/*GC* infection was based on HIV incidence rates reported by SFDPH and additional assumptions (as described in Table 1).[13] The relative risk Θ of acquiring HIV among those with rectal *CT*/*GC* infection was 1.9 (range, 1.2–2.6), based on HIV incidence reported in a retrospective cohort analysis of HIV-uninfected MSM diagnosed as having rectal *CT*/*GC* infection,[1] along with the calculation of HIV incidence among MSM without rectal *CT*/*GC* (Table 1).

Duration of rectal *CT*/*GC* infection in the absence of screening was assumed to be 9 months (range, 6 months–1 year).[14,15] The annual rates of rectal *CT*/*GC* screening was assumed to be 0.37 (range, 0.15–0.65) in MSM without HIV and 0.58 (range, 0.25–1) in MSM with HIV (Table 1).

The San Francisco City Clinic uses Gen-Probe APTIMA Combo 2 for testing rectal specimens,[1] for which sensitivities and specificities of 92.3% and 98.7%, respectively, have been reported for rectal *GC* (93.5% and 97.7%, respectively, for rectal *CT*).[16] For simplicity, we assumed 100% sensitivity and specificity of screening. Treatment has been documented in more than 95% of those with rectal *CT*/*GC* in San Francisco, with a median time to treatment of 2 days (SFDPH, unpublished data). Given this high rate of treatment, we assumed for simplicity that all rectal *CT*/*GC* infections detected through screening would be treated successfully immediately upon detection.

We estimated 2 model versions: a static version and a dynamic version. The static version included benefits of rectal *CT*/*GC* screening only to those who are screened, whereas the dynamic version included benefits of rectal *CT*/*GC* screening to those who are screened, their partners, their partners' partners, and so on.

TABLE 1. Parameter Values Used in a Model to Estimate the Impact and Cost-Effectiveness of Screening MSM for Rectal Chlamydial and Gonococcal Infection to Prevent HIV

Parameter	Base Case	Lower Bound	Upper Bound	Source
Annual incidence rate of rectal *CT*/*GC*, MSM without HIV (λ_{STD})	0.041	0.026	0.062	Calculated*
Annual incidence rate of rectal *CT*/*GC*, MSM with HIV ($\hat{\lambda}_{STD}$)	0.129	0.084	0.160	Calculated*
Annual HIV incidence rate among those without rectal *CT*/*GC* (λ_{HIV})	0.0124	0.0112	0.0134	13†
Relative risk of acquiring HIV among those with rectal *CT*/*GC* (Θ)	1.9	1.2	2.6	1,13‡
Duration of *CT*/*GC* infection in the absence of screening (d), years	0.75	0.5	1	14,15
Lifetime number of QALYs lost per HIV case	6.95	4.85	9.05	19
Lifetime cost per case of HIV	$314,000	$236,000	$391,000	20,21
Cost of rectal *CT*/*GC* screening	$41	$25	$56	18,22
Cost of rectal *CT*/*GC* treatment	$50	$43	$58	18,23
Annual rate of rectal *CT*/*GC* screening among MSM without HIV	0.37	0.15	0.65	Assumed§
Annual rate of rectal *CT*/*GC* screening among MSM with HIV	0.58	0.25	1.00	Assumed§

All costs are in 2011 US dollars. For more information, see supplemental appendix, http://links.lww.com/OLQ/A58.

*Incidence rates were approximated as prevalence rates divided by duration. Prevalence rates of 3.1% and 9.7% were estimated for MSM without and with HIV, based on 462 and 676 cases of rectal *CT*/*GC* detected, respectively, among approximately 15,131 and 6984 MSM screened, respectively. These estimated case numbers for rectal *CT*/*GC* reflect the assumption that rectal *CT*/*GC* cases for which HIV status was unknown were distributed in the same proportion as the known cases (SFDPH, unpublished data). The annual rates of screening shown in the bottom rows of the table correspond to annual probabilities of screening of 31% and 44% for MSM without and with HIV, respectively. Assuming 48,810 MSM without HIV and 15,873 MSM with HIV,[13] there would be approximately 15,131 MSM without HIV (31% of 48,810) and 6984 MSM with HIV (44% of 15,873) screened each year. In the model, the number of MSM was rounded to 65,000, and HIV prevalence was rounded to 25%.

†HIV incidence among MSM without rectal *CT*/*GC* was based on HIV incidence rates reported by SFDPH as follows. Assuming that (1) rectal *CT*/*GC* prevalence among MSM without HIV is 3.1%, (2) HIV incidence among MSM with rectal *CT*/*GC* is 2.36% (calculated as the weighted average among men with 0, 1, and 2 prior rectal infections in the previous 2 years),[1] and (3) HIV incidence among MSM overall is 1.27%, as reported in the 2010 SFDPH HIV/AIDS Annual Report,[13] HIV incidence among those without rectal *GC* can be estimated as $[0.0127 - (0.031 * 0.0236)]/(1 - 0.031) = 0.0124$.

‡The relative risk of acquiring HIV among those with rectal *CT*/*GC* was 1.9 (calculated as 0.0236 divided by 0.0124) in the base case, with a lower bound of 1.2 (0.0149/0.0124) and an upper bound of 2.6 (0.0326/0.0124). For the lower and upper bounds, the numerators (0.0149 and 0.0326) are from the 95% confidence interval of HIV incidence among those with rectal *CT*/*GC* from the 2010 study by Bernstein et al.[1]

§Based on STOP AIDS Behavioral Risk Assessments, San Francisco 2010 (personal communication, Jennifer Hecht to Kyle Bernstein, February 15, 2012), and adjusted for potential overreporting, as described in the supplemental appendix, http://links.lww.com/OLQ/A58.

CT/*GC* infection denotes *CT* and/or *GC* infection; *CT*/*GC* screening denotes screening for both *CT* and *GC* infections.

In the dynamic version, the adjustment factor (Ω_{STD}) was used to account for changes in the prevalence of *CT*/*GC* infection in sex partners over time as a result of rectal *CT*/*GC* screening. The adjustment factor in week $t + 1$ was calculated based on the ratio of rectal *CT*/*GC* prevalence in week t in the scenario of rectal screening to rectal *CT*/*GC* prevalence in week t in the scenario of no-rectal screening, raised to the power of 0.5. The ratio was raised to the power of 0.5 because rectal *CT*/*GC* screening was assumed to have less of an impact on genital *CT*/*GC* prevalence than on rectal *CT*/*GC* prevalence, similar to the way in which female-only STD screening might have less of an impact on male STD prevalence than female STD prevalence.[17] The adjustment factor (Ω_{HIV}) for changes in the prevalence of HIV in sex partners was calculated in an analogous manner as the adjustment factor for *CT*/*GC* (Ω_{STD}). The adjustment factors (Ω_{HIV} and Ω_{STD}) were varied only in the dynamic version of the model; in the static model, both values were set equal to 1 and held constant.

The number of quality-adjusted life years (QALYs) lost per HIV infection, the direct costs for testing and treatment for *CT*/*GC* infection, and the direct lifetime medical cost per case of HIV were drawn from the literature.[18–23] All costs were updated to 2011 US dollars using the medical care component of the consumer price index (www.bls.gov/cpi/data.htm).

Cost-Effectiveness

The study question we addressed is as follows: what is the cost-effectiveness of current screening and treatment for rectal *CT*/*GC* infection among MSM in San Francisco compared with a strategy of no screening? HIV prevention was the only benefit of rectal *CT*/*GC* screening that we assessed; we did not include other health and economic benefits of treating rectal *CT*/*GC* infection. Costs and benefits were assessed from the health system perspective; we did not include nonmedical costs such as patient time and transportation costs or indirect costs (lost productivity) of HIV or rectal STDs. All future costs and benefits were discounted at 3% annually. We applied a 10-year time frame and a lifetime analytic horizon; that is, we included all program costs over the 10-year time frame (STD screening and treatment costs) as well as the lifetime costs and lifetime number of QALYs lost for the HIV cases that occurred over the 10-year time frame.

The cost-effectiveness of screening was expressed in terms of cost per QALY gained and calculated as the incremental cost of *CT*/*GC* screening divided by the incremental number of QALYs gained by *CT*/*GC* screening. The incremental cost of *CT*/*GC* screening was calculated as the total costs of *CT*/*GC* screening (cost of screening for both *CT* and *GC*; cost of treating *CT*, *GC*, or both; and HIV costs) minus the HIV costs in the scenario of no-*CT*/*GC* screening. The incremental number of QALYs gained by *CT*/*GC* screening was calculated as the lifetime number of QALYs lost due to HIV in the scenario of no-*CT*/*GC* screening minus the lifetime number of QALYs lost due to HIV in the screening scenario.

Sensitivity Analysis

In sensitivity analyses, we varied the parameter values according to the ranges described in Table 1 to see how the estimated cost per QALY gained by rectal *CT*/*GC* screening would change. We first conducted 1-way sensitivity analyses, calculating the cost per QALY gained by rectal *CT*/*GC* screening when varying one parameter at a time from its lower bound to its upper bound value while holding all other parameters at their base case values. The parameters varied in the 1-way sensitivity analyses were as follows: the incidence of rectal *CT*/*GC* infection (λ_{STD} and $\hat{\lambda}_{STD}$), HIV incidence among those without rectal *CT*/*GC* infection (λ_{HIV}), the relative risk of HIV among those with rectal *CT*/*GC* infection (Θ), the duration of *CT*/*GC* infection (d), the lifetime cost and number of QALYs lost per HIV case, the cost of rectal *CT*/*GC* screening and treatment, and the rate of rectal *CT*/*GC* screening. We then conducted probabilistic sensitivity analyses in which all of these parameter values (except the rate of *CT*/*GC* of screening) were varied simultaneously, assuming a uniform distribution for each parameter between its lower and upper bound values. Finally, we conducted a threshold analysis to determine what values of Θ (the relative risk of acquiring HIV among those with rectal *CT*/*GC* infection) would result in cost-effectiveness ratios of $25,000, $50,000, and $100,000 per QALY gained by rectal *CT*/*GC* screening.

RESULTS

In the base case, the cost per QALY gained by screening MSM for rectal *CT*/*GC* infection was $16,300 in the static

TABLE 2. Estimated Impact, Cost, and Cost Per QALY Gained by Screening MSM for Rectal Chlamydial and Gonococcal Infection*

Model Result	No Screening	Screening, Static Version of Model†	Screening, Dynamic Version of Model‡
Prevalence of rectal *CT*/*GC* in MSM after 10 y	4.9%	3.7%	2.8%
Percent reduction in rectal *CT*/*GC* due to screening	0.0%	25.4%	43.1%
No. HIV cases averted by screening	0.0	24.4	46.2
No. QALYs lost due to HIV	35,099	34,929	34,778
Costs of screening and treatment for rectal *CT*/*GC*	$0	$10,417,600	$10,324,800
HIV treatment costs	$1,585,764,500	$1,578,102,800	$1,571,266,700
Total costs	$1,585,764,500	$1,588,520,400	$1,581,591,500
Incremental cost (compared to no screening)	—	$2,755,900	−$4,173,000
Incremental number of QALYs gained (compared with no screening)	—	169.6	320.9
Cost-effectiveness ratio (incremental cost per QALY gained)	—	$16,300	<$0 (cost-saving)

The cost-effectiveness ratio shows the incremental cost per QALY gained by rectal *CT*/*GC* screening of MSM compared with no screening.
*All costs are in 2011 US dollars, and cost estimates are rounded to the nearest $100.
†Results from the static version of model include benefits of screening and treatment only to those who are screened (i.e., "indirect effects" of screening are not included).
‡Results from the dynamic version of model include benefits of screening and treatment to those screened, their partners, their partners' partners, and so on (i.e., indirect effects of screening are included).

TABLE 3. One-Way Sensitivity Analyses: Incremental Cost Per QALY Gained Screening MSM for Rectal Chlamydial and Gonococcal Infection When Varying One Parameter Value at a Time

	Range of Cost Per QALY Estimates When Varying Parameter From Its Lower to Upper Bound Value ($ per QALY)	
Parameter Varied	**Static Version of the Model**	**Dynamic Version of the Model**
No parameters varied (base case)	16,300	<0
Incidence of rectal *CT*/*GC*, MSM without HIV (λ_{STD})	<0–44,700	<0–2,300
Incidence of rectal *CT*/*GC*, MSM with HIV (λ_{STD})	15,700–16,600	<0
HIV incidence among those without rectal *CT*/*GC* (λ_{HIV})	12,400–21,800	<0
Relative risk of HIV among those with rectal *CT*/*GC* (Θ)	0–227,800	<0–98,400
Duration of *CT*/*GC* infection (d)	0–73,200	<0–13,500
Lifetime no. QALYs lost per HIV case	12,500–23,300	<0
Lifetime cost per case of HIV	5200–27,500	<0
Cost of rectal *CT*/*GC* screening	<0–37,700	<0
Cost of rectal *CT*/*GC* treatment	15,900–16,700	<0
Annual rate of rectal *CT*/*GC* screening (per year)	10,900–24,400	<0

Cost per QALY estimates are reported in 2011 US dollars and are rounded to the nearest $100. For λ_{STD}, λ_{HIV}, Θ, d, and the lifetime cost per case of HIV and number of QALYS lost per case of HIV, applying the lower bound value resulted in less favorable cost-per-QALY estimates than applying the upper bound value. For all other parameters, applying the lower bound value generally resulted in more favorable cost per QALY estimates than applying the upper bound value.

version of the model and less than $0 in the dynamic version of the model (Table 2). Thus, when taking into account dynamic reductions in *CT*/*GC* prevalence among MSM over time as a result of rectal *CT*/*GC* screening, the cost per QALY gained was less than $0, meaning that rectal screening is cost-saving. In 1-way sensitivity analyses, the estimated cost per QALY gained by screening ranged from less than $0 to $227,800 in the static version of the model and from less than $0 to $98,400 in the dynamic version of the model (Table 3). The 2 most influential parameters were the relative risk of acquiring HIV among those with rectal *CT*/*GC* infection and the duration of rectal *CT*/*GC* infection. In the 1-way sensitivity analyses, the cost per QALY gained did not exceed $50,000 in the static version of the model or $5000 in the dynamic version of the model, except when varying the relative risk of HIV or the duration of rectal *CT*/*GC* infection.

In the probabilistic sensitivity analyses, the cost per QALY gained by rectal *CT*/*GC* screening ranged from less than $0 to $403,100 in 90% of the simulations using the static version of the model and from less than $0 to $120,100 in 90% of the simulations using the dynamic version of the model (Table 4). In the static version of the model, the cost per QALY was less than $0 (cost-saving) in 31% of the simulations and was less than $100,000 in 75% of the simulations. In the dynamic version of the model, the cost per QALY was less than $0 (cost-saving) in 59% of the simulations and was less than $100,000 in 94% of the simulations.

In threshold analyses of the relative risk of acquiring HIV among those with rectal *CT*/*GC* infection (not shown), cost per QALY estimates of $25,000, $50,000, and $100,000 were obtained when the relative risk was set to 1.80, 1.60, and 1.40, respectively, in the static version of the model and when the relative risk was set to 1.43, 1.33, and 1.20, respectively, in the dynamic version of the model.

DISCUSSION

Our results suggest that screening MSM for rectal *CT*/*GC* infection can be a cost-effective intervention to reduce HIV infection, particularly when taking into account the population-level reductions in *CT*/*GC* prevalence in MSM over time as a result of screening and treatment. In many scenarios we examined, screening MSM for rectal *CT*/*GC* infection was cost-saving, meaning that the discounted costs of screening and treatment were less than the discounted cost of averted HIV infections. Although there is no official cost-per-QALY cutoff to determine whether public health interventions in the United States are cost-effective, a threshold of $50,000 per QALY is often cited (a QALY can be thought of as 1 year of life in perfect health).[24,25] In our sensitivity analyses, the cost per QALY gained by rectal screening was less than $50,000 in 60% of the simulations when using the static version of the model and in 85% of the simulations when using the dynamic version of the model. Our base-case estimate of the cost per QALY gained by screening MSM for rectal *CT*/*GC* ($16,300 in

TABLE 4. Probabilistic Sensitivity Analyses: Incremental Cost Per QALY Gained Screening MSM for Rectal Chlamydial and Gonococcal Infection When Varying Numerous Model Parameter Values Simultaneously

	Static Version of the Model	**Dynamic Version of the Model**
Cost per QALY (base case)	$16,300	<$0
Cost per QALY (5th percentile across the 3000 simulations)	<$0	<$0
Cost per QALY (95th percentile across the 3000 simulations)	$403,100	$120,100
Percent of simulations in which the cost per QALY was <$0	31	59
Percent of simulations in which the cost per QALY was <$25,000	48	76
Percent of simulations in which the cost per QALY was <$50,000	60	85
Percent of simulations in which the cost per QALY was <$100,000	75	94

Cost per QALY estimates are reported in 2011 US dollars and are rounded to the nearest $100.

the static version of the model) is consistent with estimates of the cost per QALY gained by screening women and high-risk heterosexual men for urogenital *CT* infection[26,27] and compares favorably with many clinical preventive services and public health interventions.[28]

The degree to which rectal *CT*/*GC* increases susceptibility to HIV is the most important input in our model. The cost per QALY gained by screening MSM for rectal *CT*/*GC* was less than $25,000 in the dynamic version of our model when the relative risk of acquiring HIV among MSM with rectal *CT*/*GC* infection (compared with MSM without rectal *CT*/*GC* infection) was at least 1.43. Thus, if rectal *CT*/*GC* infection increases susceptibility to HIV by at least 43%, then screening MSM for rectal *CT*/*GC* infection would be a highly cost-effective strategy for HIV prevention, according to our dynamic model results. Such an increase in susceptibility seems plausible, given that a case-control study found an odds ratio of 4.73 (95% confidence interval, 1.75–12.76) for HIV seroconversion among MSM with rectal gonorrhea compared with MSM controls.[2] Furthermore, among MSM with a current rectal *CT*/*GC* infection, HIV seroconversion was 8 times more likely among MSM with 2 prior *CT*/*GC* infections than among MSM without a prior *CT*/*GC* infection.[1] In addition, there is a substantial overall body of evidence suggesting that STDs can facilitate the acquisition and transmission of HIV.[29–34] However, it is difficult to determine how much of the increased risk of HIV in those with rectal *CT*/*GC* infection is attributable to biological factors and how much is attributable to other factors such as sexual behaviors and sex partner characteristics.[3,33,34] Future research is needed to help determine more precisely the causal role of rectal *CT*/*GC* infection on HIV acquisition.[1,3]

Our study is subject to several important limitations. First, data are limited regarding the 2 most important parameters in our analysis: the relative risk of acquiring HIV among those with rectal *CT*/*GC* infection (vs. those without) and the duration of rectal *CT*/*GC* infection. To address this limitation, we conducted sensitivity analyses to show how the results can change when these key assumptions are varied. Second, we did not account specifically for repeat rectal *CT*/*GC* infections. Evidence suggests that the risk of HIV seroconversion is higher for MSM with 1 and 2 repeat rectal *CT*/*GC* infections than for MSM with a single rectal *CT*/*GC* infection.[1] Third, we used a relatively simple approach to estimate the impact of a rectal *CT*/*GC* screening program. Given that the cost per QALY gained by rectal *CT*/*GC* screening was notably lower in the dynamic version of our model than in the static version, future studies could use a more complex dynamic transmission model to examine the potential impact of screening in more detail. Fourth, we made several simplifying assumptions such as 100% sensitivity and specificity of screening and that all rectal *CT*/*GC* infections detected would be treated successfully immediately upon detection. Although these optimistic assumptions can result in cost-effectiveness estimates that are unduly favorable to rectal screening, our analysis was otherwise conservative in that HIV prevention through reduced susceptibility to HIV was the only potential benefit of rectal *CT*/*GC* screening that we included. For example, we did not consider the possibility that rectal *CT*/*GC* screening in MSM with HIV could reduce the probability of HIV transmission to their sex partners. Similarly, we focused solely on biological impacts of rectal *CT*/*GC* infection on HIV acquisition, although it is possible that rectal *CT*/*GC* screening could reduce the risk of HIV acquisition and transmission through behavioral impacts, as well. Rectal *CT*/*GC* screening could be markedly more cost-effective than we estimated, had we included all of these potential benefits of screening. Fifth, we assumed that our model inputs would be constant over time. For example, we did not allow for the possibility that increased use of antiretroviral therapy might affect the average cost per case of HIV, the average impact of HIV on length and quality of life, and the HIV incidence rate. Finally, our model used parameter values specific to MSM in San Francisco, and our results might not be generalizable to other areas.

Despite limitations, our model offers a useful approximation of the health impact and cost-effectiveness of rectal *CT*/*GC* screening in San Francisco to reduce future HIV acquisition. If rectal *CT*/*GC* infection does indeed increase susceptibility to HIV, rectal *CT*/*GC* screening of MSM could be a cost-effective tool to prevent HIV and might even pay for itself in terms of averted HIV treatment costs. The Centers for Disease Control and Prevention has called for a high-impact HIV prevention approach, defined as the use of combinations of "scientifically proven, cost-effective, and scalable interventions targeted to the right populations in the right geographic areas."[35] Although more information is needed regarding the impact of rectal *CT*/*GC* screening on the risk of HIV acquisition, our analysis shows that rectal *CT*/*GC* screening of MSM can potentially be a cost-effective, scalable intervention targeted to at-risk MSM in certain urban settings such as San Francisco.

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