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Estimates of the Lifetime Productivity Costs of Chlamydia, Gonorrhea, and Syphilis in the United States

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Abstract

Background: Productivity costs of STIs reflect the value of lost time due to STI morbidity and mortality, including time spent travelling to, waiting for, and receiving STI treatment. The purpose of this study was to provide updated estimates of the average lifetime productivity cost for chlamydia, gonorrhea, and syphilis, per incident infection.

Methods: We adapted published decision tree models from recent studies of the lifetime medical costs of chlamydia, gonorrhea, and syphilis in the United States. For each possible outcome of infection, we applied productivity costs that we obtained based on published health economic studies. Productivity costs included the value of patient time spent to receive treatment for STIs and for related sequelae such as pelvic inflammatory disease in women. We used a human capital approach and included losses in market (paid) and non-market (unpaid) productivity. We conducted one-way sensitivity analyses and probabilistic sensitivity analyses.

Results: The average lifetime productivity cost per infection was $28 for chlamydia in men, $205 for chlamydia in women, $37 for gonorrhea in men, $212 for gonorrhea in women, and $411 for syphilis regardless of sex, in 2023 US dollars. The estimated lifetime productivity costs of these STIs acquired in the United States in 2018 was $795 million.

Conclusions: These estimates of the lifetime productivity costs can help in quantifying the overall economic burden of STIs in the United States beyond just the medical cost burden and can inform cost-effectiveness analyses of STI prevention activities.

Summary:

The estimated lifetime productivity cost per infection for men and women, respectively, was $28 and $205 (chlamydia), $37 and $212 (gonorrhea), and $411 and $411 (syphilis).

The lifetime direct medical costs of sexually transmitted infections (STIs) acquired in the United States in 2018 have been estimated at $17.6 billion when including sexually-transmitted HIV and $2.4 billion when excluding sexually-transmitted HIV, in 2023 dollars.[1] Though substantial, the direct medical costs of STIs represent only one of the three main components of the economic burden imposed by STIs. The other two main components

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of the economic burden are productivity costs and intangible costs.[1,2] Productivity costs of STIs reflect the value of lost time due to STI morbidity and mortality, including time spent travelling to, waiting for, and receiving STI treatment and life years lost due to premature death. This lost time could have been used for other productive activities, including working at a paid job or performing non-paid tasks such as providing childcare or eldercare. Intangible costs are typically the hardest to quantify and include the cost of outcomes such as pain and suffering, stigma and shame, and adverse effects on intimate relationships.[1,3]

Although recent direct medical cost estimates are available for all major STIs in the United States, [1,4–8] estimates of average productivity costs of STIs (per infection) are dated,[9,10] and more recent productivity cost estimates are limited only to the costs incurred by those who miss work for STI treatment.[11,12] Data on the intangible costs of STIs are even more limited, as there are very few published estimates available.[3] The purpose of our study was to provide current estimates of the productivity costs of chlamydia, gonorrhea, and syphilis in the United States, thereby addressing one of the two major gaps in the current STI economic burden literature. These productivity cost estimates can help to quantify the full economic burden of STIs in the United States and can inform analyses of the impact and cost-effectiveness of STI prevention activities.

Methods

Overview

We used published decision tree models to estimate the productivity costs of three STIs: chlamydia, gonorrhea, and syphilis.[4,5] We included these three STIs because (1) decision tree models of infection and sequelae have been published and (2) estimates of productivity losses are available to inform these decision trees. Although a decision tree model is available for trichomoniasis,[4] we opted not to include trichomoniasis in this study due to the uncertainty in the probability of pelvic inflammatory disease (PID) attributable to infection. Inclusion of other STIs such as genital herpes or human papillomavirus was beyond the scope of this study.

We included the productivity costs of STI morbidity (lost productivity due to patient time spent traveling to the point of care, waiting for care, and receiving care for STIs and sequelae) and STI mortality (lost productivity from years of life lost due to an STI-attributable death). We used a human capital approach in which the value of lost time was based on wages. Our productivity cost calculations included foregone market productivity (lost wages due to missed work) and foregone non-market productivity (the lost value of unpaid activities such as household chores, childcare and eldercare, shopping, and travel related to these activities). We included non-market productivity not only to provide a more comprehensive assessment of the productivity losses associated with STIs, but also to be consistent with current health economics recommendations to include the loss of uncompensated productive activities when assessing productivity losses.[13]

For each of the three STIs, we estimated the average lifetime productivity cost per incident infection. Except where noted, all costs are reported in 2023 US dollars. As is standard in

health economic analyses in the United States, we discounted future costs to present value at an annual rate of 3%.[13] Although the main purpose of our analysis was to estimate the average lifetime productivity cost of STIs on a per-infection basis, we also calculated the total lifetime productivity costs attributed to STIs acquired in 2018 in the United States, the most recent year for which we have published estimates of STI incidence for all three STIs.[14] Specifically, we estimated the total productivity cost of each STI by multiplying our estimates of the average productivity cost per infection by the published estimates of the number of incident infections in 2018.[14–16]

Decision tree models

To estimate the productivity costs of chlamydia and gonorrhea, we used the decision tree models used by Kumar and colleagues (2021) to estimate the direct medical costs of these STIs, per infection (Supplemental Figure 1).[4] To estimate the productivity costs of syphilis, we used the decision tree model used by Chesson and Peterman (2021) to estimate the direct medical cost of syphilis, per infection (Supplemental Figure 2).[5]

We did not make any changes to these decision trees except that we assigned productivity costs instead of direct medical costs to each possible outcome of infection. The probabilities we applied were the same as in original studies; the probabilities used in the Kumar study were based primarily on epidemiologic models[15] and the probabilities used in the Chesson and Peterman study were based on a range of sources including STI surveillance reports[17] and syphilis mortality data obtained from Centers for Disease Control and Prevention (CDC) Wonder (https://wonder.cdc.gov/). The base case productivity costs we applied are described in the following section, and the Technical Appendix provides a more complete description of all model parameter values, ranges, and sources.

Productivity costs for outcomes of STIs

To adapt the published decision tree models of the lifetime direct medical costs of chlamydia, gonorrhea, and syphilis, we needed to apply productivity cost estimates for each outcome (Table 1) instead of the direct medical cost estimates used in the original analyses. For chlamydia and gonorrhea, the decision trees required the following three productivity cost estimates: productivity cost of a physician visit to receive treatment for the given STI, productivity cost per case of PID in women, and the productivity cost per case of epididymitis in men. For syphilis, the decision tree required eight productivity cost estimates: two estimates of the productivity costs of physician visits to receive treatment for syphilis (one for treatment for primary and secondary [P&S] or early non-P&S syphilis and one for treatment in the late stage) and estimates of the average cost per case for each the following six outcomes: early neurosyphilis or ocular syphilis, late benign syphilis, cardiovascular syphilis, tabes dorsalis, meningovascular syphilis, and general paresis.

Productivity cost of medical visit for treatment of chlamydia or gonorrhea—We calculated the base case productivity cost per outpatient STI medical visit ($65.68) as 3.7 hours x $17.75 per hour, the lower bound value ($28.10) as 2.1 hours x $13.38 per hour, and the upper bound value ($130.12) as 5.3 hours x $24.55 per hour. As described in the Technical Appendix, the base case value of 3.7 hours reflects the estimated hours of

productivity loss per visit for office-based testing for chlamydia among young women at high risk for chlamydia,[18] and is conservative when compared to published estimates of 6 to 10 hours of work lost per case of outpatient treatment of chlamydia or gonorrhea among patients with documented work absences.[11,12] We assumed that time spent for the clinic visit would have otherwise been used for market (paid) or non-market (unpaid) productivity. We valued the productivity cost of clinic visits at $17.75 per hour, which we calculated based on annual productivity estimates among ages 15–34 years in the United States[19] rather than for the overall population because teenagers and young adults bear a disproportionate burden of STIs. In doing so, we assumed 8 hours of productivity per day.[20]

Productivity cost per case of PID, epididymitis—The lifetime productivity cost per case of PID, which includes the possibility of long-term sequelae such as chronic pelvic pain, ectopic pregnancy, and infertility, was based primarily on the number of days of productivity lost due to PID as reported by Blandford and Gift (2006),[10] except that we applied updated estimates of the probability of long-term sequelae per case of PID and the cost per day of lost productivity (Technical Appendix Table A1). Our updated productivity cost estimate per case of PID of $2,173 (range: $819–$4,499) is notably higher than the estimate by Blandford and Gift (2006) of $1,037 ($1,020–$1,053) when updated for inflation to 2023 dollars.[10] The main reason for this difference is that we included non-market (unpaid) productivity costs in addition to market (paid) productivity costs in our estimate.

To estimate the productivity cost per case of epididymitis, we multiplied the estimated number of days of lost productivity per case by the productivity cost per day. We assumed 5 lost days of productivity per case of epididymitis,[21] corresponding to a productivity cost of $710 (range: $268–$1,470) per case.

Productivity costs of syphilis outcomes—The productivity cost estimates for the possible outcomes of syphilis were calculated based on the estimated patient time costs for each outcome (Technical Appendix Tables A2-A3). Specifically, for each outcome, we calculated estimates of the number of medical visits, hospitalization days, years of long-term care, and years of life lost due to the given outcome, based primarily on the health resources required for each outcome as reported by Chesson and Peterman (2021).[5] We assumed each medical visit for syphilis treatment would impose a productivity cost of $65.68 as described above for chlamydia and gonorrhea. We applied a productivity cost of $142 per day of hospitalization, $50,014 per year of long-term care, and $50,014 per year of life lost, based on recent estimates of annual productivity in the United States[19] as described in the Technical Appendix. We applied the same value ($50,014) per year of long-term care as per year of life lost, under the assumption that patients in long-term care would no longer be productive in terms of market or non-market output.[19]

As an example of the productivity cost estimates for a possible outcome of syphilis, each case of general paresis was assumed to require an average of 3 physician visits, 10 hospitalization days, 3.39 years of long-term care, and 13.03 life years lost, for an average cost per case of $822,847 when discounted to the time of diagnosis of general paresis [(3 x

$65.68) + (10 x $142) + (3.39 x $50,014) + (13.03 x $50,014) = $822,847] and $339,002 when discounted to the time of infection (Technical Appendix Tables A2–A5).

Sensitivity analysis

To examine how the estimated productivity costs changed when key assumptions were changed, we conducted one-way sensitivity analyses for each STI in which one parameter in the decision tree model was varied at a time (to its lower bound value then to its upper bound value) while holding all other parameter values at their base case values. We also conducted probabilistic sensitivity analyses for the productivity cost of each STI, in which we calculated the productivity cost per infection 10,000 times for each STI, each time drawing a random value for each model parameter according to the assumed distribution for each parameter.

Other than our use of productivity cost inputs instead of direct medical cost inputs, the sensitivity analyses we conducted were practically identical to those conducted in the direct medical cost analyses on which our study is based.[4,5] The lower and upper bound values of the productivity cost parameters used in the one-way sensitivity analyses and the corresponding distributions used in the probabilistic sensitivity analyses are shown in Table 1 (see Technical Appendix Tables A6–A8 for details on the probabilities applied in the decision trees).

Results

The average lifetime productivity cost per infection was $28 for chlamydia in men, $205 for chlamydia in women, $37 for gonorrhea in men, $212 for gonorrhea in women, $411 for syphilis in men, and $411 for syphilis in women (Table 2). For syphilis, time spent receiving treatment accounted for about $200 of the lifetime cost, including but not limited to $72 for treatment in the P&S stage, $75 for treatment in the late syphilis stage, and $28 for those treated but not reported as cases (Table 3). Although long-term consequences of syphilis were estimated to be rare (~0.2% of infections), these long-term outcomes accounted for over $200 in productivity costs per infection, including $101 for cardiovascular syphilis, $23 for tabes dorsalis, $38 for meningovascular syphilis, and $45 for general paresis. For chlamydia in men, (1) treatment of symptomatic infection and (2) sequelae following untreated infections each accounted for about one third of the average cost per infection. For gonorrhea in men, treatment of symptomatic infection accounted for about three fourths of the average cost per infection. For chlamydia and gonorrhea in women, the outcome of “asymptomatic infection, not treated, sequelae” accounted for about three fourths of the average cost per infection.

In one-way sensitivity analyses, the estimated productivity costs of chlamydia and gonorrhea in men were most sensitive to assumptions of the productivity costs of treatment for infection, the productivity costs of sequelae, the probability of sequelae, and the probability that the infection is symptomatic (Figure 1). The estimated productivity costs of chlamydia and gonorrhea in women were most sensitive to assumptions regarding the probability of sequelae and the productivity costs of sequelae. The estimated productivity costs of syphilis were most sensitive to the probability of long-term sequelae (Figure 1).

In the probabilistic sensitivity analyses, the 2.5th and 97.5th percentiles ranged from about 30% to 250% of the base case values (Table 2). Estimates for chlamydia and gonorrhea were relatively more uncertain for women (ranging from about 30% to 250% of the base case) than for men (ranging from 50% to 200% of the base case). For syphilis in women and syphilis in men, the 2.5th and 97.5th percentiles ranged from about 40% to 240% of the base case values.

When combined with published estimates of STI incidence in 2018 (1,621,000 and 2,354,000 chlamydial infections in men and women, respectively;[15] 697,000 and 853,000 gonococcal infections in men and women, respectively;[15] and 121,000 and 25,000 syphilitic infections in men and women, respectively),[16] the estimated lifetime productivity costs of these STIs acquired in 2018 was $795 million ($528 million for chlamydia, $207 million for gonorrhea, and $60 million for syphilis).

Discussion

Our study provides updated estimates of the average lifetime productivity cost of STIs, per infection. To our knowledge, the most recent prior estimates of the productivity costs for STIs (per infection) were published in 2008.[9] These prior estimates, when updated for inflation to 2023 dollars, are $14 for gonorrhea and chlamydia in men, $67 for gonorrhea and chlamydia in women, and $160 for syphilis in men and women. Our updated estimates are 2.0 to 3.2 times as high as these previous estimates of productivity costs. A main reason for this substantial difference is our inclusion of market (paid) and nonmarket (unpaid) productivity costs, whereas the estimates in the previous study were intended to reflect only market productivity costs.

An important methodological improvement in our updated study is that our approach estimates the productivity cost associated with possible outcomes of STIs, whereas productivity cost estimates in the previous study[9] were approximated primarily as a percentage of the estimated direct medical costs. Specifically, our analysis incorporated estimates of the productivity costs associated with medical visits to receive STI treatment and for care of STI-related sequelae. Some outcomes such as premature death due to syphilis might not impose substantial direct medical costs but can impose substantial productivity costs due to years of life lost. Thus, the productivity costs of such outcomes might not be fully accounted for when estimating productivity costs as a percentage of direct medical costs. Our inclusion of the rare but costly productivity costs of syphilis morbidity in adults is another important reason why our updated estimate of the productivity costs of syphilis is greater than the previous estimate. However, we note that we did not include congenital syphilis in our analysis, because of limited published estimates of the long-term impact of congenital syphilis on productivity. Our estimates of the productivity costs of syphilis would be even more substantial if the costs of congenital syphilis had been included.

To put our productivity costs into perspective, the lifetime direct medical cost of the STIs we examined were recently estimated as follows, per infection (updated to 2023 dollars): $51 and $290 for chlamydia in men and women, respectively, $86 and $281 for gonorrhea in men and women, respectively, and $1,316 for syphilis regardless of sex.[1,4,5] The lifetime

productivity costs that we estimated for these STIs are about 45% to 55% that of the direct medical costs for chlamydia and gonorrhea in men; about 70% to 75% that of the direct medical costs for chlamydia and gonorrhea in women; and about 30% of the direct medical costs for syphilis in women and men. Similarly, for chlamydia, gonorrhea, and syphilis combined, the estimated direct medical cost burden of these STIs acquired in 2018 was $1.3 billion (updated to 2023 dollars)[1] and $0.8 billion in productivity costs. Thus, although the estimated direct medical cost burden of these STI exceeds the estimated productivity cost burden, the productivity cost burden is still an important component of the overall burden of STIs. Further, we estimated the productivity costs of STIs per infection, not the productivity costs associated with STI prevention. For example, the cost of time spent for prevention activities such as STI screening is not reflected in our estimates.

Three main approaches to estimating productivity loss are the human capital method, the friction cost method, and the multiplier method.[22] In the human capital approach, wages (including fringe benefits) are used to estimate productivity losses.[22 23] The friction cost method estimates productivity losses based on the costs to an employer to replace an absent worker, and typically yields lower estimates of productivity losses than does the human capital approach.[22,23] The multiplier approach allows for productivity losses to be even greater than wages due to factors such as the effects on team productivity.[22] We used the human capital approach (1) because the available data on the productivity impacts of STIs are better suited for the human capital approach, (2) because of the logical appeal of using average wages to approximate productivity, and (3) to be consistent with the vast majority of health economic studies.[23]

Our results can help to quantify the total economic burden of STIs in the United States. Along with recent estimates of the direct medical costs of STIs in the United States,[4–8] our productivity cost estimates allow for a more comprehensive assessment of the total burden of chlamydia, gonorrhea, and syphilis. However, much more research is needed before the STI research community can quantify the full economic burden of STIs. We assessed the productivity costs of three STIs, and thus studies are needed to provide updated assessments of the productivity costs of other STIs, including viral STIs. The lifetime productivity cost of life years lost in 2003 due to human papillomavirus-associated cancer mortality was estimated at $5.7 billion (updated to 2023 dollars),[24] illustrating that the productivity costs of viral STIs are substantial. Additional research is also needed to develop appropriate methods to measure the “intangible” costs (e.g., pain and suffering) of STIs, which might exceed the combined direct medical costs and productivity costs of STIs.

Cost-effectiveness studies are often conducted from the healthcare system perspective (focusing on direct medical costs only) or the societal perspective (a broader scope that includes costs beyond just direct medical costs). A recent review of cost-effectiveness studies of STI and HIV prevention interventions geared towards younger people in OECD (Organisation for Economic Co-operation and Development) countries found that of the 26 studies that reported the perspective used, 13 applied a healthcare system perspective, 11 applied a societal perspective, and 2 provided results from multiple perspectives.[25] Current health economic guidelines recommend that cost-effectiveness studies conducted from the societal perspective include market and non-market productivity costs.[13] Our estimates can

therefore facilitate the incorporation of productivity losses into cost-effectiveness studies of chlamydia, gonorrhea, and syphilis prevention interventions.

A key challenge in estimating the productivity costs per STI is that most of the model inputs required to generate these estimates are not known with precision. In our decision tree models, there is considerable uncertainty not only in the productivity costs but also in the probabilities that we applied. To address these critical uncertainties in our analysis, we applied a range of plausible values for all model parameters in sensitivity analyses. For example, for the productivity cost of sequelae of chlamydia and gonorrhea that we included (PID and epididymitis), we relied on approximations based on older data regarding the patient time costs of these outcomes,[10,21] owing to a lack of current productivity cost estimates for these two outcomes. Care practices for PID and its sequelae may have evolved since the earlier estimates were developed, which would introduce additional uncertainty.[26] Because of the uncertainty in these estimates, we applied a wide range of productivity cost estimates for PID ($819–$4,499) and epididymitis ($268–$1,470) in sensitivity analyses. However, the lack of current data on the effects of STIs on productivity illustrates the need to collect primary data to address this important void in the literature.

Although the uncertainty in our model inputs is a key limitation of our study, the probabilistic sensitivity analyses that we conducted to address this uncertainty is a key strength of our study. By conducting probabilistic sensitivity analyses, we calculated plausible, evidence-based ranges for our estimates of the productivity costs of STIs, per infection. The previously published estimates applied an arbitrary range of plus or minus 50%,[9] and thus the ranges we generated are more reflective of the actual uncertainty in our model inputs.

In summary, our study provides updated base case estimates and ranges of the lifetime productivity costs of chlamydia, gonorrhea, and syphilis. These estimates can be useful to quantify the economic burden of STIs and to inform cost-effectiveness analyses of STI prevention programs. Our results also illustrate the importance of obtaining updated, more precise estimates of the productivity costs of STI sequelae such as PID and epididymitis. Although productivity costs of the three STIs we examined are lower in magnitude than their corresponding direct medical costs, these productivity costs are about $0.8 billion annually and represent an important component of the overall cost burden of STIs.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

Acknowledgments

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

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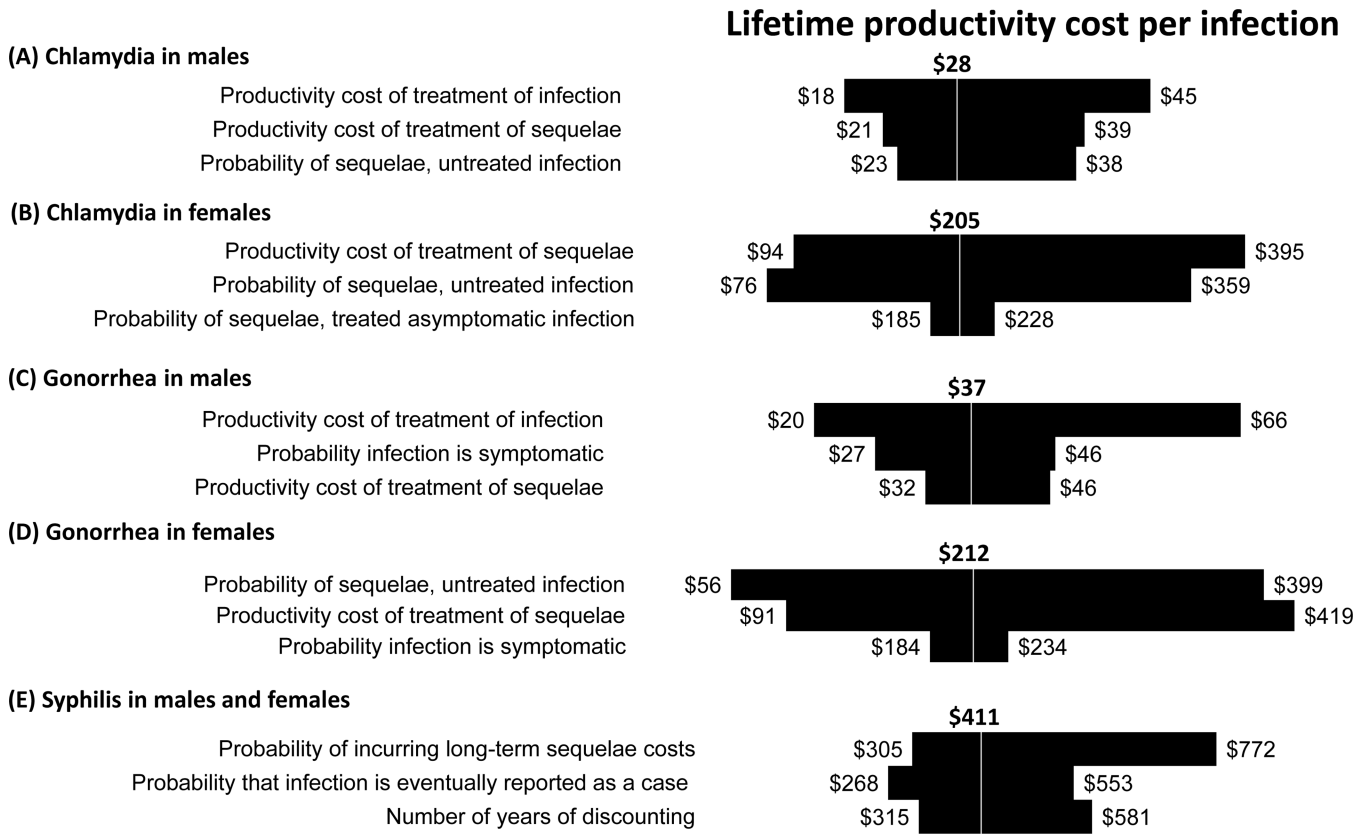

Figure 1.

Tornado diagrams showing results of the 1-way sensitivity analyses of the estimated lifetime productivity cost per infection, for (A) chlamydia in males, (B) chlamydia in females, (C) gonorrhea in males, (D) gonorrhea in females, and (E) syphilis in males and females. These diagrams show the estimated lifetime productivity cost per infection when a single parameter value was changed from its base case value to its lower or upper bound, for the most influential model parameters (see the Technical Appendix for the complete results of the one-way sensitivity analysis). The base case result is shown at the top of each diagram. For example, the lifetime productivity cost for chlamydia in males was $28 per infection in the base case. When we varied the productivity cost of receiving treatment for infection while holding all other parameters at their base case values, the lifetime productivity cost for chlamydia in males ranged from $18 to $45 when applying the lower bound and upper bound value of the productivity cost of treatment of infection, respectively. Costs are in 2023 U.S. dollars.

Table 1:

Productivity costs applied to outcomes of chlamydia, gonorrhea, and syphilis in the decision tree models

Outcome	Productivity cost per outcome	
	Base case (range)*	Distribution*†
Treatment of chlamydia or gonorrhea ‡	$66 (28 – 130)	Lognormal (4.11, 0.38)
Pelvic inflammatory disease (PID)§	$2,173 (819 – 4,499)	Lognormal (7.60, 0.41)
Epididymitis§	$710 (268 – 1,470)	Lognormal (6.48, 0.41)
Treatment of syphilis in P&S or early non-P&S syphilis stage‡	$148 (51–351)	Lognormal (4.88, 0.49)
Treatment of syphilis in late syphilis stage‡	$271 (93–643)	Lognormal (5.48, 0.49)
Early neurosyphilis/ocular syphilis§	$984 (431–2,076)	Lognormal (6.81, 0.41)
Late benign syphilis§	$328 (112–781)	Lognormal (5.67, 0.49)
Cardiovascular syphilis§	$412,945 (248,659–686,376)	Lognormal (12.90, 0.27)
Tabes dorsalis§	$413,742 (249,191–687,554)	Lognormal (12.90, 0.27)
Meningovascular syphilis§	$465,351 (280,611–772,388)	Lognormal (13.02, 0.26)
General paresis§	$822,847 (496,164–1,365,825)	Lognormal (13.59, 0.26)

P&S: primary and secondary.

These productivity cost estimates were based on a range of sources as described in the manuscript and the Technical Appendix. Costs are expressed in 2023 U.S. dollars.

*The middle column shows the range of values applied in the one-way sensitivity analyses, and the final column shows the distributions used in the probabilistic sensitivity analyses.

†The values in parentheses are the lognormal distribution mean and standard deviation parameters μ and σ.

‡These values show the lifetime costs discounted to the time treatment is received. Treatment for these outcomes was assumed to occur within the first year of infection except for the outcome “treatment of syphilis in late syphilis stage” which was assumed to occur one year after infection. Thus, the cost of “treatment of syphilis in late syphilis stage” was discounted one additional year (to the time of infection) in the decision tree model.

§These values show the lifetime costs discounted to the time the condition is diagnosed; in the decision tree model these costs are further discounted to the time of infection as described in the Technical Appendix.

Table 2.

Estimated lifetime productivity cost of chlamydia, gonorrhea, and syphilis, per infection, in men and women, in 2023 US dollars: Results of base case analyses and probabilistic sensitivity analyses

STI	Results of base case analyses		Results of probabilistic sensitivity analyses			
			25th–75th percentiles of estimates		2.5th–97.5th percentiles of estimates	
	Men	Women	Men	Women	Men	Women
Chlamydia	28	205	21 – 33	129 – 255	14 – 50	69 – 498
Gonorrhea	37	212	27 – 44	125 – 267	17 – 72	59 – 542
Syphilis	411	411	281 – 504	281 – 504	176 – 1,004	176 – 1,004

In estimating the average lifetime productivity cost per infection, future costs were discounted to the time of infection at a rate of 3% annually. The syphilis decision tree model was not stratified by sex.

Table 3.

Summary of results of decision tree analysis of productivity costs of chlamydia, gonorrhea, and syphilis: Components of lifetime productivity cost per infection

Outcome of infection	Percentage of infections in which outcome occurs*		Contribution of outcome to average cost per infection	
	Men	Women	Men	Women
Chlamydia				
Symptomatic infection, treated, no sequelae	14.8%	22.7%	$9.71	$14.91
Symptomatic infection, not treated, sequelae	0.0%	0.3%	$0.14	$7.02
Symptomatic infection, not treated, no sequelae	1.0%	2.4%	$0.00	$0.00
Asymptomatic infection, treated, sequelae	0.0%	1.1%	$0.00	$24.15
Asymptomatic infection, treated, no sequelae	11.5%	16.9%	$7.58	$11.10
Asymptomatic infection, not treated, sequelae	1.5%	6.8%	$10.32	$147.65
Asymptomatic infection, not treated, no sequelae	71.2%	49.8%	$0.00	$0.00
Total of all outcomes of chlamydial infection	100.0%	100.0%	$27.75	$204.83
Gonorrhea				
Symptomatic infection, treated, no sequelae	43.8%	23.6%	$28.78	$15.47
Symptomatic infection, not treated, sequelae	0.3%	0.9%	$2.14	$20.47
Symptomatic infection, not treated, no sequelae	14.8%	6.9%	$0.00	$0.00
Asymptomatic infection, treated, sequelae	0.0%	0.3%	$0.00	$6.27
Asymptomatic infection, treated, no sequelae	0.8%	4.4%	$0.54	$2.88
Asymptomatic infection, not treated, sequelae	0.8%	7.7%	$5.72	$166.72
Asymptomatic infection, not treated, no sequelae	39.5%	56.3%	$0.00	$0.00
Total of all outcomes of gonococcal infection	100.0%	100.0%	$37.18	$211.80
Syphilis				
Treated for P&S syphilis, no early neurosyphilis	48.8%	48.8%	$72.10	$72.10
Treated for P&S syphilis and early neurosyphilis	1.6%	1.6%	$17.78	$17.78
Treated for late syphilis, no early neurosyphilis	28.7%	28.7%	$75.28	$75.28
Treated for late syphilis and early neurosyphilis	0.9%	0.9%	$11.53	$11.53
Treated for syphilis but not reported as a case	14.5%	14.5%	$27.59	$27.59
Inadvertent treatment or unrelated death	4.8%	4.8%	$0.00	$0.00
Latent syphilis, untreated, no adverse outcomes	0.45%	0.45%	$0.00	$0.00

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Outcome of infection	Percentage of infections in which outcome occurs*		Contribution of outcome to average cost per infection	
	Men	Women	Men	Women
Treated for late benign syphilis	0.11%	0.11%	$0.14	$0.14
Treated for cardiovascular syphilis	0.06%	0.06%	$101.06	$101.06
Treated for tabes dorsalis	0.01%	0.01%	$22.50	$22.50
Treated for meningovascular syphilis	0.02%	0.02%	$37.96	$37.96
Treated for general paresis	0.01%	0.01%	$44.75	$44.75
Total for all outcomes of syphilis	100.0%	100.0%	$410.69	$410.69

P&S: Primary & secondary.

Costs are in 2023 US dollars. Probabilities are rounded to the nearest tenth of one percent, except for the long-term sequelae outcomes of syphilis which are rounded to the nearest one-hundredth of one percent.

*The values in the columns “Percentage of infections in which outcome occurs” have been previously published. For chlamydia and gonorrhea, because we used the same decision tree models and the same probabilities as applied in the medical cost study by Kumar and colleagues (2021),[4] our results regarding the percentage of infections in which the outcomes occur are the same as in that medical cost study. For syphilis, because we used the same decision tree model and the same probabilities as applied in the medical cost study by Chesson and Peterman (2021),[5] our results regarding the percentage of infections in which the outcomes occur are the same as in that medical cost study.

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