Appendix

Additional details of methods and results for the manuscript “The Estimated Lifetime Medical Cost of Chlamydia, Gonorrhea, and Trichomoniasis in the United States, 2018” by Sagar Kumar, Harrell Chesson, Ian H. Spicknall, Kristen Kreisel, and Thomas L. Gift.

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.

Appendix Part 1: Distributions used in probabilistic sensitivity analyses

In these tables, the values in parentheses for the beta distributions are the α and β shape parameters. Following methods described elsewhere,[1,2] we calculated α as $b*[(1-b)*b - SE^2]/SE^2$, where b is the parameter's base case value, SE is the parameter's standard error, and * denotes multiplication. We calculated β as $[1-b]*[(1-b)*b - SE^2]/SE^2$. We approximated the standard error as the absolute difference between the lower and upper bounds of the range, divided by 3.92.

The values in parentheses for the lognormal distributions are the mean and standard deviation parameters μ and σ. Following methods described elsewhere,[1,2] we calculated μ as $\ln(b) - 0.5*\ln(1+[SE^2/b^2])$, where b is the parameter's base case value, SE is the parameter's standard error, ln is the natural log function, * denotes multiplication, and SE was approximated as noted above. We calculated σ as the square root of $\ln(1+[SE^2/b^2])$.

Appendix Table A-1: Distributions used in chlamydia cost simulations

Parameter	Males	Females
Probability that infection is symptomatic	beta (9.81, 52.28)	beta (26.26, 77.14)
Probability of treatment, symptomatic infection	beta (156.40, 10.69)	beta (224.49, 26.62)
Probability of treatment, asymptomatic infection	beta (16.86, 106.23)	beta (146.26, 460.62)
Probability of sequelae, treated asymptomatic infection	not varied (always 0)	beta (4.24, 66.39)
Probability of sequelae, untreated infection	beta (6.67, 326.97)	beta (3.90, 28.62)
Treatment cost of acute infection, average across settings	lognormal (5.03, 0.08)	lognormal (5.01, 0.06)
Sequelae cost	lognormal (5.91, 0.19)	lognormal (7.79, 0.18)

Appendix Table A-2: Distributions used in gonorrhea cost simulations

Parameter	Males	Females
Probability that infection is symptomatic	beta (7.64, 5.33)	beta (7.93, 17.33)
Probability of treatment, symptomatic infection	beta (42.27, 14.54)	beta (46.00, 15.33)
Probability of treatment, asymptomatic infection	beta (12.43, 608.85)	beta (14.25, 195.36)
Probability of sequelae, treated asymptomatic infection	not varied (always 0)	beta (4.24, 66.39)
Probability of sequelae, untreated infection	beta (6.67, 326.97)	beta (3.90, 28.62)
Treatment cost of acute infection, average across settings	lognormal (5.06, 0.29)	lognormal (4.78, 0.31)
Sequelae cost	lognormal (5.91, 0.19)	lognormal (7.79, 0.18)

Appendix Table A-3: Distributions used in trichomoniasis cost simulations

Parameter	Males	Females
Probability that infection is symptomatic	beta (3.01, 34.20)	beta (10.19, 42.87)
Probability of treatment, symptomatic infection	beta (3.79, 5.54)	beta (10.22, 1.45)
Probability of treatment, asymptomatic infection	not varied (always 0)	not varied (always 0)
Probability of sequelae, treated asymptomatic infection	Not applicable	Not applicable
Probability of sequelae, untreated infection	Not applicable	Not applicable
Treatment cost of acute infection, average across settings	lognormal (5.02, 0.04)	lognormal (5.36, 0.03)
Sequelae cost	Not applicable	Not applicable

Appendix Part 2: Details of probabilities obtained from mathematical models of chlamydia, gonorrhea, and trichomoniasis published in this Special Issue

Appendix Table A-4. Values of selected probabilities used in our analysis, used in a previous analysis, and as reported in a 2003 study

Probability	Chlamydia		Gonorrhea		Trichomoniasis	
	Men	Women	Men	Women	Men	Women
Probability that infection is symptomatic						
Values applied in our analysis	0.158	0.254	0.589	0.314	0.081	0.192
Values applied in previous analysis[3*]	0.200	0.200	0.500	0.250	0.300	0.300
Values reported by Farley et al (2003)[4**]	0.110	0.300	0.660	0.440	NA	NA
Probability of treatment, symptomatic infection						
Values applied in our analysis	0.936	0.894	0.744	0.750	0.406	0.876
Values applied in previous analysis[3*]	0.890	0.890	0.890	0.890	0.850	0.850
Probability of treatment, asymptomatic infection						
Values applied in our analysis	0.137	0.241	0.020	0.068	0.000	0.000
Values applied in previous analysis[3*]	0.070	0.340	0.090	0.400	0.000	0.000

*The probabilities applied in the previous study[3] are included here for illustrative purposes. For the probability that the infection is symptomatic, the values we applied were generally similar (within 0.10 in absolute terms) to those applied in the previous cost study, except for trichomoniasis in men.

For the probability of treatment of symptomatic infections, the values we applied were generally similar (within 0.15 in absolute terms), except for trichomoniasis in men. For the probability of treatment of asymptomatic infections, the values we applied were generally similar (within 0.10 in absolute terms), except for gonorrhea in women.

**The study by Farley et al. (2003)[4] informed the models for chlamydia and gonorrhea[5] from which we obtained the probabilities for our analysis.

To obtain treatment probabilities from the chlamydia, gonorrhea, and trichomoniasis models in this Special Issue,[5,6] the probability of treatment for a symptomatic infection was calculated as $(\sigma + \tau)/(\sigma + \tau + \psi)$, where σ is the annual background screening rate, τ is the annual rate of treatment seeking among those with symptomatic infection, and ψ is the annual rate of natural clearance of infection. The probability of treatment for an asymptomatic infection was calculated as $(\sigma)/(\sigma + \psi)$. Details of these terms (σ, τ, and ψ) are provided elsewhere in this Special Issue.[5,6]

Appendix Part 3: Table of results of one-way sensitivity analyses

Appendix Table A-5. One-way sensitivity analysis results: Lifetime medical cost of chlamydia, gonorrhea, and trichomoniasis, per infection, when varying one model input at a time, 2019 US dollars

Input value varied in one-way sensitivity analysis	Lifetime medical cost per infection in men		Lifetime medical cost per infection in women	
	Lower bound value of input applied	Upper bound value of input applied	Lower bound value of input applied	Upper bound value of input applied
Chlamydia				
Probability that infection is symptomatic*	37	58	272	250
Probability of treatment, symptomatic infection	45	47	264	261
Probability of treatment, asymptomatic infection	40	55	262	262
Probability of sequelae, treated asymptomatic infection	46	46	240	289
Probability of sequelae, untreated infection	43	51	117	437
Cost of treatment of infection	39	52	255	269
Cost of sequelae	44	48	218	362
Gonorrhea				
Probability that infection is symptomatic	46	105	274	229
Probability of treatment, symptomatic infection	66	87	260	248

Input value varied in one-way sensitivity analysis	Lifetime medical cost per infection in men		Lifetime medical cost per infection in women	
	Lower bound value of input applied	Upper bound value of input applied	Lower bound value of input applied	Upper bound value of input applied
Probability of treatment, asymptomatic infection	77	79	254	253
Probability of sequelae, treated asymptomatic infection	78	78	248	260
Probability of sequelae, untreated infection	76	82	77	465
Cost of treatment of infection	48	135	239	283
Cost of sequelae	76	79	205	362
Trichomoniasis				
Probability that infection is symptomatic	3	14	22	61
Probability of treatment, symptomatic infection	2	9	24	39
Cost of treatment of infection	5	5	34	38

*This table shows how the estimated lifetime medical cost per infection changed when one model parameter value was varied at a time, and is included in addition to the figures shown in the main manuscript because it provides additional details (specifically, the results obtained when applying the lower bound values and the results obtained when applying the upper bound values). For example, the first row of results shows how the lifetime medical cost of chlamydia (per infection) changed when the "probability that infection is symptomatic" parameter was varied and all other parameters were kept at their base case values listed in Table 1. The cost per infection in males was $37 when applying the lower bound probability of symptomatic infection (0.082) and $58 when applying the upper bound value (0.262). The cost per infection in females was $272 when applying the lower bound probability of symptomatic infection (0.177) and $250 when applying the upper bound value (0.344). Symptomatic infections were more likely to be treated and thus were less likely to incur sequelae costs

than asymptomatic infections (except for trichomoniasis, for which the analysis did not assume sequelae costs). Thus, a higher probability of symptomatic infection led to an increase in costs of treating infections and a decrease in costs associated with treating sequelae. For males, the increase in treatment cost was greater than the decrease in sequelae cost, thus the average lifetime medical cost per infection was greater when a higher probability of symptomatic infection was applied. For females, the decrease in sequelae cost was greater than the increase in treatment cost, thus the average lifetime medical cost per infection was lower when a higher probability of symptomatic infection was applied.

Appendix References

1. Elbasha EH, Dasbach EJ. Impact of vaccinating boys and men against HPV in the United States. Vaccine 2010;28(42):6858-6867.
2. Wan X, Wang W, Liu J, Tong T. Estimating the sample mean and standard deviation from the sample size, median, range and/or interquartile range. BMC Med Res Methodol 2014;14:135.
3. Owusu-Edusei K, Jr., Chesson HW, Gift TL, et al. The estimated direct medical cost of selected sexually transmitted infections in the United States, 2008. Sex Transm Dis 2013;40(3):197-201.
4. Farley TA, Cohen DA, Elkins W. Asymptomatic sexually transmitted diseases: the case for screening. Prev Med 2003;36(4):502-509.
5. Kreisel KM, Weston EJ, St. Cyr SB, Spicknall IH. Estimates of the prevalence and incidence of chlamydia and gonorrhea among US men and women. Special Issue Sex Transm Dis 2021.
6. Lewis FM, Spicknall IH, Flagg EW, Et al. Estimates of the prevalence and incidence of trichomoniasis among US men and women. Special Issue Sex Transm Dis 2021.