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Estimating the Direct Medical Costs and Productivity Loss of Outpatient Chlamydia and Gonorrhea Treatment

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Abstract

We used 2016–2017 administrative claims data to calculate the direct medical cost and productivity loss per diagnosed case of chlamydia and gonorrhea treatment. In 2018 US dollars, the direct cost per diagnosed case was $151 for chlamydia (n = 9180) and $85 for gonorrhea (n = 3048); productivity loss was $206 (n = 31) and $246 (n = 7), respectively, among those missing work seeking care.

Chlamydia and gonorrhea are the most commonly reported sexually transmitted infections (STIs) in the United States. In 2018, 1,758,668 cases of chlamydia and 583,405 cases of gonorrhea were reported.[1] Left untreated, these infections can lead to adverse health outcomes including pelvic inflammatory disease, infertility, and ectopic pregnancy in women and epididymitis in men.[2,3]

In addition to this health burden, these infections impose a cost burden. Overall, chlamydia and gonorrhea are estimated to cost the United States almost $1 billion annually in direct medical costs, including costs of treating infections and sequelae costs of untreated or inadequately treated infections.[4] Previously reported treatment costs per acute infection were $142 for chlamydia and $210 for gonorrhea in 2007 US dollars.[5,6] Sexually transmitted infections also impose productivity loss. One study estimated that among those absent from work to seek treatment, the average losses in wages were $262 per chlamydia case and $197 per gonorrhea case in 2011 dollars.[7]

The available estimates of medical costs and productivity loss of outpatient treatment of chlamydia and gonorrhea are a decade old and do not reflect current STI treatment guidelines; for example, fluoroquinolones are no longer recommended to treat gonorrhea.[2,5–8] The objectives of this analysis were to develop updated US estimates of direct medical

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costs and productivity loss associated with treatment of chlamydia and gonorrhea. Our results can inform future health economic studies, including burden of disease studies, cost-effectiveness analyses, and resource allocation models.

METHODS

We used IBM Watson Health MarketScan Outpatient Commercial Database for patients enrolled in 2016 and 2017.[9] Databases captured person-specific enrollment and medical service information such as outpatient visits, dates of service, diagnosis codes, prescription drug use, and other billing information. We also used the IBM MarketScan Health and Productivity Management (HPM) Database, containing workplace absence data including dates of absence, type of absence (i.e., “sick” or “leave”), and number of hours of absence. MarketScan data consisted of deidentified patients with distinct enrollee IDs, making all databases linkable. Human subjects review at the Centers for Disease Control and Prevention (CDC) determined that the use of the data was exempt from the institutional review board.

Patients with chlamydia or gonorrhea at any anatomical site including unspecified sites were identified from the MarketScan outpatient services claims database using *International Classification of Diseases, Tenth Revision* (*ICD-10*) codes for chlamydia (A56.0, A56.1, A56.2, A56.3, A56.4, A56.8, A74.0, A74.8, A74.9, K67.0) or gonorrhea (A54.0, A54.1, A54.2, A54.4, A54.5, A54.6, A54.8, A54.9, K67.1).[10] We assumed that all visits occurring within 30 days of the initial visit were part of the same case. This 30-day window was based on previous studies, and including longer windows of 45 to 60 days affected <1% of all cases.[5,6,11]

Using CDC sexually transmitted disease (STD) treatment guidelines, we identified recommended drugs for treatment of chlamydia and gonorrhea, listed by generic name.[2] Generic drug names for chlamydia treatment were listed as follows: azithromycin, amoxicillin, doxycycline, erythromycin, erythromycin ethylsuccinate, levofloxacin, and ofloxacin. Generic drug names for gonorrhea treatment were listed as follows: ceftriaxone or cefixime in addition to a prescription for azithromycin. Treatment guidelines from the CDC recommend a 250-mg injection of ceftriaxone for treatment, as this is a treatment that is a procedure; we identified it using Healthcare Common Procedure Coding System “J0696.” We linked claims from outpatient visits to prescription drug claims data using the patient’s enrollee ID.

We used National Drug Codes to identify those diagnosed with chlamydia or gonorrhea with appropriate drug claims.[12] We included prescription drugs received 7 days before to 30 days after the first case-related visit. To ensure costs unrelated to chlamydia and gonorrhea were not included, we included only costs of outpatient claims where a patient received a single diagnosis (i.e., chlamydia or gonorrhea diagnosis with no other *ICD-10* codes). Costs were calculated per diagnosed case and stratified into the outpatient visit, drug costs, and total cost, which was the sum these 2 components; we further segregated costs by sex. All costs were adjusted to 2018 dollars using the medical care component of the Consumer Price Index for All Urban Consumers.[13] We also conducted additional analyses to ensure our

methods were consistent with those previous studies (Appendix, http://links.lww.com/OLQ/A522).[5,6]

To estimate productivity loss, we linked enrollee IDs to the HPM Database as in a previous analysis.[7] Our analysis of productivity loss was limited to those linked to the HPM database and documented as "sick" or "absent." Thus, our final data included those whose absence from work was on the same day(s) as their outpatient claims for STI treatment. Finally, among those with records of absence from work, we estimated the average number of hours absent per diagnosed case of gonorrhea or chlamydia and multiplied this by the average US hourly compensation rate ($27.30/h in 2018 US dollars, including wages and benefits).[14] All analyses were conducted using SAS 9.4 (SAS Institute, Cary, NC).

RESULTS

In 2016 and 2017, there were 60,810 unique patients with 76,953 visits related to chlamydia and 19,062 patients with 23,254 visits related to gonorrhea in the MarketScan data (Tables 1 and 2). Among them, 25,582 (42.1%) patients with drug claims had treatment of chlamydia and 9057 (47.5%) patients with drug claims had treatment of gonorrhea within 7 days before and 30 days after the initial chlamydia or gonorrhea diagnosis date (results not shown). Of these patients, there were 9618 and 4068 patients with a sole chlamydia or gonorrhea diagnosis, respectively, with 9180 and 3028 first cases of chlamydia and gonorrhea, respectively. The direct medical treatment cost per chlamydia case was $151 (n = 9180). The direct medical treatment cost per gonorrhea case was $85 (n = 3028).

Among the total patients with a chlamydia or gonorrhea diagnosis (n = 79,872), few patients (n = 8020) were linked to the HPM Database; 38 (<1%) patients were linked to a chlamydiaor gonorrhea-specific case. Among those with records of work absences and a chlamydia case (n = 31), the average absence from work was 7.6 hours, which corresponded to a productivity loss, or lost wages, of $206 per case. Among those with work absences and a gonorrhea case, the average absence from work was9.0 hours, which corresponded to productivity loss of $246 per case (n = 7).

DISCUSSION

We estimated medical treatment costs of $151 for chlamydia and $85 for gonorrhea. These estimates can be interpreted as the average cost of diagnosis and treatment of outpatient chlamydia and gonorrhea, respectively, in commercially insured patients. Higher outpatient costs among men may be attributable to testing of multiple anatomical sites, as recommended for men who have sex with men.[2]

Our cost estimates were lower than previous estimates obtained from 2003–2007 data of $196 and $290, respectively, when updated to 2018 US dollars.[5,6] The notable difference of $205 between our $85 cost estimate for gonorrhea and the previous $290 estimate is likely not attributable to differences in study design (see the Appendix, http://links.lww.com/OLQ/A522 for a description of a supplemental analysis we conducted in which we repeated our methodology using 2003–2007 data and obtained results consistent with the previous studies). The lower drug costs in our analysis could be due to more frequent use of generic

drugs and reductions in the costs of generic drugs.[15] Moreover, changes in drug regimens due to changes in STD treatment guidelines likely contributed to differences in the studies, as fluoroquinolones made up 95% of treatment of gonorrhea in the previous cost study but 0% of treatment of gonorrhea in our study.[2,6,16,17] In addition, our drug costs are similar to an analysis conducted at an STI clinic in Rhode Island.[18]

Among those missing work to seek treatment, we estimated that the average productivity loss was $206 per case of chlamydia and $246 per case gonorrhea. These costs were lower than previous estimates of $292 and $331, respectively, when updated to 2018 US dollars. The difference was partially attributable to the lower US hourly compensation rate we applied ($29.72/h in the previous analysis compared with $27.30/h in our analysis).[7] The small total number of patients (n = 38) linked to productivity losses likely is attributable to (1) patients seeking care outside of work hours, if employed, and (2) smaller enrollment in the HPM data set than in the outpatient data set (500,000 patients annually vs. ~17 million patients annually). Because of our small sample sizes and wide confidence intervals, the productivity loss estimates should be interpreted cautiously.

This analysis was subject to limitations associated with using medical claims data to estimate the cost of STIs as discussed in previous studies.[5,6] For example, our methods to identify chlamydia and gonorrhea cases were not perfectly sensitive and specific, owing to factors such as provider use of more ambiguous *ICD* codes for STIs than the ones we included, miscoded data due to inaccurate reporting, and data entry errors.[19,20] Another example is lack of laboratory results in the data set, making it difficult to identify positive cases of chlamydia or gonorrhea. To address the lack of laboratory results, we limited the analysis to those diagnosed with chlamydia or gonorrhea and with appropriate drug claims; costs may differ for patients receiving nonguideline adherent treatments. In this analysis, fewer than 50% of those with a diagnosis were linked to appropriate treatment. A previous study reported that among identified STI cases using laboratory results, 65% of chlamydia patients and 35% of gonorrhea patients were linked to recommended treatment.[21] However, even diagnoses with treatment are presumptive because treatment can be prescribed in advance of test results. To address data limitations, we focused specifically on those with only a chlamydia diagnosis or only a gonorrhea diagnosis; this focus may have introduced unintended bias in our estimates because of factors such as coinfection with both STDs and lower marginal costs associated with testing for and treating a second STD. Finally, the commercially insured patients in our data set are not representative of all commercially insured patients nationwide, other populations that may have other forms of insurance, and uninsured populations. In the future, updates of our cost estimates would be more robust if limitations of the claims data were resolved, or if researchers develop improved methods for addressing these limitations.

Our estimates represent costs of treatment of chlamydia and gonorrhea, but these do not include other potential costs of infection, such as costs associated with treatment of sequelae and provision of partner services including expedited partner therapy.[4,22] Despite limitations of this analysis, our study presents an updated estimate of treatment and productivity costs per episode of chlamydia and gonorrhea under current STD treatment guidelines. The cost estimates presented for chlamydia and gonorrhea can be used in cost-effectiveness studies of

STI prevention interventions and inform studies of expected lifetime costs per infection, which account for the possibility of treatment of infection and the possibility of sequelae among those with untreated or inadequately treated infections.[4]

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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TABLE 1.

Costs of Chlamydia (CT)

	Male		Female		Total	
Patients diagnosed with CT diagnosis code						
No. patients with a CT diagnosis	16,329		44,481		60,810	
Patients diagnosed with ONLY CT diagnosis code and no other code	7,144	43.8%	20,114	45.2%	27,258	44.8%
No. outpatient visits with a CT diagnosis	8030		22,986		31,016	
Avg. no. CT visits per patient	1.12		1.14		1.14	
No. patients with prescription drug coverage	6569	40.2%	18,547	41.7%	25,116	41.3%
No. patients with coverage having drug claims	4755	29.1%	14,086	31.7%	18,841	31.0%
No. patients with appropriate CT treatment linked to CT diagnosis	3546	21.7%	10,874	24.4%	14,420	23.7%
No. patients with treatment within 1 mo of DX	2706	16.6%	6912	15.5%	9618	15.8%
No. first cases of chlamydia without other diagnoses	2611	16.0%	6569	14.8%	9180	15.1%
Direct medical treatment costs *						
No. cases	2611		6569		9180	
Outpatient cost (95% CI)	$147.85	($140.92–$154.78)	$140.04	($136.92–$154.78)	$142.26	($138.89–$145.64)
Drug cost (95% CI)	$9.08	($8.07– $10.09)	$9.01	($8.50– $9.51)	$9.03	($8.07–$9.49)
Total cost (95% CI)	$156.93	($149.88–$163.98)	$149.05	($145.14–$152.95)	$151.29	($147.85–$154.73)
Productivity loss per CT case †						
No. claims in HPM database linked to patients with a CT diagnosis including non STI-visits	3650	22.4%	2940	6.6%	6590	10.8%
No. claims specific to CT visit	18	0.1%	13	0.03%	31	0.05%
Mean hours absent per CT case (95% CI)	9.33	(7.32–11.36)	5.11	(3.87–6.35)	7.56	(6.11–9.01)
Mean productivity loss per CT case (95% CI) ‡	$254.80	($199.70–$309.90)	$139.44	($105.56–$173.32)	$206.42	($166.98–$245.87)

The average productivity cost per chlamydia and gonorrhea case (n = 38) was 7.82 (95% CI, 6.28–9.36) hours absent and $213.53 (95% CI, 171.51–255.55) in lost wages.

*All costs are adjusted to 2018 US dollars using the Consumer Price Index for All urban consumers.

†The productivity loss per case was calculated assuming an average US hourly compensation rate of $27.30/h in 2018 US dollars, the 95% CI for the productivity loss reflects the 95% CI for the mean number of hours absent multiplied by $27.30. Applying a different hourly compensation rate would affect the estimated productivity loss per case in a proportional manner; for example, if the hourly rate were increased by 10%, the productivity cost estimates would be increased by 10% as well.

‡These are the average costs per case among those who were linked to the HPM Database and missed work for their outpatient visit. The average productivity loss per case across all cases (including those who did not miss work for treatment) is expected to be lower.

CI indicates confidence interval; DX, diagnosis.

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TABLE 2.

Costs of Gonorrhea (GC)

	Male		Female		Total	
Patients diagnosed with GC diagnosis code						
No. patients with a GC diagnosis	8766		10,296		19,062	
Patients diagnosed with ONLY GC diagnosis code and no other code	4683	53.4%	4976	48.3%	9659	50.7%
No. outpatient visits with a GC diagnosis	5274		5738		11,012	
Avg. no. GC visits per patient	1.13		1.15		1.14	
No. patients with prescription drug coverage	4410	50.3%	4559	44.3%	8969	47.1%
No. patients with coverage having drug claims	3654	41.7%	3909	38.0%	7563	39.7%
No. patients with appropriate GC treatment linked to GC diagnosis	2493	28.5%	2681	26.0%	5174	27.1%
No. patients with treatment within 1 mo of DX	1985	22.6%	2083	20.2%	4068	21.3%
No. first cases of GC without other diagnoses	1487	17.0%	1561	15.2%	3048	16.0%
Direct Medical treatment costs*						
No. cases	1487		1561		3048	
Outpatient costs (95% CI)	$92.35	($85.49–$99.22)	$63.12	($58.08–$68.15)	$77.38	($73.13–$81.64)
Drug cost (95% CI)	$7.75	($6.83–$8.67)	$7.39	($6.89–$7.90)	$7.57	($7.05–$8.09)
Total cost (95% CI)	$100.10	($93.10–$107.10)	$70.51	($65.41–$75.62)	$84.95	($80.62–89.28)
Productivity loss per GC case†						
No. claims in HPM database linked to patients with a GC diagnosis including non STI-visits	835	9.5%	595	5.8%	1430	7.5%
No. claims specific to GC visit	5	0.06%	2	0.02%	7	0.04%
Mean hours absent per GC case (95% CI)	11.2	(2.3–20.1)	3.5	(<1–9.9)	9.0	(2.6–15.4)
Mean productivity loss per GC case (95% CI)‡	$305.76	($63.21-$548.31)	$95.55	(<$1-$268.99)	$245.70	($70.17-$421.23)

The average productivity cost per chlamydia and gonorrhea case (n = 38) was 7.82 (95% CI, 6.28–9.36) hours absent and $213.53 (95% CI, 171.51–255.55) in lost wages.

*All costs are adjusted to 2018 dollars using the Consumer Price Index for all urban consumers.

†The productivity loss per case was calculated assuming an average US hourly compensation rate of $27.30/h in 2018 US dollars, the 95% CI for the productivity loss reflects the 95% CI for the mean number of hours absent multiplied by $27.30. Applying a different hourly compensation rate would affect the estimated productivity loss per case in a proportional manner; for example, if the hourly rate were increased by 10%, the productivity cost estimates would be increased by 10% as well.

‡These are the average costs per case among those who were linked to the HPM Database and missed work for their outpatient visit. The average productivity loss per case across all cases (including those who did not miss work for treatment) is expected to be lower.

CI indicates confidence interval; DX, diagnosis.