Impact of the COVID-19 Pandemic on Chlamydia and Gonorrhea Tests Performed by a Large National Laboratory—United States, 2019 to 2020

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Background: During the COVID-19 pandemic, disruptions were anticipated in the US health care system for routine preventive and other nonemergency care, including sexually transmitted infection care.

Methods: Using a large national laboratory data set, we assessed the impact of the COVID-19 pandemic on the weekly numbers and percent positivity of chlamydia and gonorrhea tests ordered from the 5th week of 2019 to the 52nd week of 2020 in the United States. We compared weekly 2020 values for test volume, percent positive, and number of positives with the same week in 2019. We also examined the potential impact of stay-at-home orders for the month of April 2020.

Results: Immediately after the declaration of a national emergency for COVID-19 (week 11, 2020), the weekly number of gonorrhea and chlamydia tests steeply decreased. Tests then rebounded toward the 2019 pre–COVID-19 level beginning the 15th week of 2020. The weekly percent positive of chlamydia and gonorrhea remained consistently higher in 2020. In April 2020, the overall number of chlamydia tests was reduced by 53.0% (54.1% in states with stay-at-home orders vs. 45.5% in states without stay-at-home orders), whereas the percent positive of chlamydia and gonorrhea tests increased by 23.5% and 79.1%, respectively.

Conclusions: To limit the impact of the pandemic on control of chlamydia and gonorrhea, public health officials and health care providers can assess measures put in place during the pandemic and develop new interventions to enable care for sexually transmitted infections to be delivered under pandemic and other emergency conditions. The assessment like this study is continuously needed.

The United States declared a national emergency in response to the COVID-19 pandemic on March 13, 2020, and many states and localities issued shelter-in-place or stay-at-home orders to limit movement outside the home to essential activities, followed by reopening with several types of restrictions.[1,2] For example, mobility patterns as the measure of individual's movement had dropped by 35% to 63% after the COVID-19 pandemic.[3] Disruptions were anticipated in the US health care system for routine preventive and other nonemergency care, and 2 studies have shown a reduction in sexually transmitted infections (STI) testing during the pandemic.[4,5] Using data from an additional large clinical laboratory with test locations throughout the United States, we assessed the impact of the pandemic on chlamydia and gonorrhea testing from 2019 to the end of 2020 with additional areas that have previously not been addressed: status of stay-at-home orders in April of 2020 and clinical setting and provider specialty.

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METHODS

Data were originally from a large commercial US laboratory that health care providers use it for laboratory tests in all 50 states and the District of Columbia and were transferred to Centers for Disease Control and Prevention's (CDC's) National Syndromic Surveillance Program. These data arrive at the National Syndromic Surveillance Program via Health Level Seven (refers to a set of international standards for transfer of clinical and administrative data between software applications used by various health care providers) message every 10 minutes; at the time, a provider orders the test from the laboratory company. The result of the test is then updated when available. These data are available from week 5 of 2019 to week 52 of 2020 to assess the impact of the COVID-19 pandemic on chlamydia and gonorrhea testing in the United States.

Because most chlamydia and gonorrhea cases were reported from persons aged 15 to 60 years, chlamydia and gonorrhea tests were included if specimens were from patients aged 15 to 60 years who resided in the United States and had results that were either positive or negative. Tests with other results, such as test not performed or inconclusive, were excluded. Data were available from February 3, 2019, to January 2, 2021.[6] Analyses were stratified by patient sex (male and female), age group (15–24, 25–34, 35–44, and 45–60 years), and US Census region (Northeast, Midwest, South, and West). In addition, analyses were also stratified by clinical setting and provider specialty: primary care providers (family practice, general practice, and internal medicine), obstetrics and gynecology, infectious disease, multiple specialty group, hospital, public health, pediatrician, and emergency department in 2020. The dates of chlamydia and gonorrhea tests were based on the dates the tests were ordered. Because no patient identifiers are available with these data, the unit of analysis was chlamydia or gonorrhea tests. Percent positive was defined as the total number of test results that were positive divided by the total number of test results that were either positive or negative.

For comparison between 2019 and 2020, numbers of chlamydia and gonorrhea tests were grouped by week. Chlamydia and gonorrhea tests ordered in January 1 to 4, 2020, were grouped into the 52nd week of 2019. Therefore, the 5th to 52nd weeks of 2019 represented days from February 3, 2019, to January 4, 2020. Similarly, chlamydia and gonorrhea tests ordered in January 1 to 2, 2021, were grouped into the 52nd week of 2020. As a result, the 1st to 52nd weeks of 2020 represented days from January 5, 2020, to January 2, 2021.

To assess the overall impact of COVID-19 on chlamydia and gonorrhea testing, we compared the number of total chlamydia and gonorrhea tests, positive test results, and percent positive from weeks 5 to 52 in 2019 (February 3, 2019–January 4, 2020) and weeks 5 to 52 in 2020 (February 2, 2020–January 2, 2021).

To investigate the potential impact of stay-at-home orders on testing, we then calculated the following 3 metrics during the 4 weeks of April in 2019 (March 31–April 27, 2019) to April 2020 (March 29–April 25, 2020).

1. The percent change in the number of tests, as follows:

$$\frac{(\text{number of tests in 2020} - \text{number of tests in 2019})}{\text{number of tests in 2019}}$$

2. The percent change in the number of positive test results, as follows:

$$\frac{(\text{number of positive test results in 2020} - \text{number of positive test results in 2019})}{\text{number of positive test results in 2019}}$$

3. The percent change in percent positive, as follows:

$$\frac{(\text{percent positive in 2020} - \text{percent positive in 2019})}{\text{percent positive in 2019}}$$

We finally stratified these 3 metrics by stay-at-home order status. Many states and localities issued shelter-in-place or stay-at-home orders in response to the COVID-19 pandemic in March 2020 and reopened in April or May of 2020.[2] Stay-at-home orders were classified into 5 categories (mandatory for all persons, mandatory only for persons in certain areas of the jurisdiction, mandatory only for persons at increased risk in the jurisdiction, mandatory only for persons at increased risk in certain areas of the jurisdiction, or advisory or recommendation), and some states might change their categories in a given time. States with no stay-at-home orders or advisory stay-at-home orders any time during the month of April 2020 were grouped as states without a stay-at-home order (Arkansas, Connecticut, Iowa, Kentucky, Massachusetts, Nebraska, New Mexico, North Dakota, South Dakota, Texas, Utah, and Wyoming); the remaining states were categorized as states with stay-at-home orders.[2]

SAS (version 9.4; SAS Institute) was used for analyses. A χ^2 test was used to test the statistical significance between number of tests in a given period between 2019 and 2020 by the patient's characteristics, such as sex, age group, region, and state status on stay-at-home orders in April of 2020.

This activity was reviewed by the CDC and was conducted consistent with applicable federal law and CDC policy (45 CFR part 46; 21 CFR part 56; 42 USC §241(d), 5 USC §552a, 44 USC §3501 et seq).

RESULTS

The weekly numbers of chlamydia tests among patients aged 15 to 60 years between 2019 (from the 5th week [February 3–February 9, 2019] to the 52nd week [December 29, 2019–January 4, 2020]) and 2020 (from the 1st week [January 5–January 11, 2020] to the 52nd week 52 [December 27, 2020–January 2, 2021]) are presented in Figure 1. Because the weekly number of gonorrhea tests was close to that of chlamydia tests, the weekly number of gonorrhea tests is not shown in Figure 1. A dip in the weekly number of tests for chlamydia and gonorrhea can be seen in the 10th week in 2020 (March 8–14) compared with 2019. This aligns with the national declaration of emergency for COVID-19. The number of gonorrhea and chlamydia tests rebounded toward the pre–COVID-19 level beginning the 15th week of 2020 (April 12–18). After the 37th week of 2020 (September 13–19), the weekly numbers of chlamydia and gonorrhea tests were similar to the 2019 weekly totals.

The weekly numbers of positive chlamydia test results and gonorrhea test results among patients aged 15 to 60 years between 2019 (weeks 5–52) and 2020 (weeks 1–52) are presented in Figure 2. The weekly number of positive chlamydia test results again declined steeply after the 10th week in 2020 (March 8–14) compared with 2019. After the 25th week of 2020 (June 21–27), the weekly number of positive chlamydia test results was similar to the 2019 weekly totals. The weekly number of positive gonorrhea test results also declined slightly after the 10th week in 2020 (March 8–14) compared with 2019. After the 19th week of 2020 (May 10–17), the weekly number of positive gonorrhea test results in 2020 exceeded levels observed in 2019.

The weekly percent positive of chlamydia and gonorrhea during the 5th to 10th weeks was similar between 2019 (weeks 5–52) and 2020 (weeks 1–52). Beginning the 11th week of 2020 (March 15–21), the weekly percent positive of chlamydia and gonorrhea remained consistently higher through the end of 2020 (Fig. 3).

Limiting to weeks 5 to 52 for both 2019 and 2020, we observed a 12.4% decrease in the number of chlamydia tests, a 12.3% decrease in the number of gonorrhea tests, a 5.6% decrease in the number of positive chlamydia test results, and a 19.3% increase in the number of positive gonorrhea test results. The percentage changes in the number of chlamydia tests, gonorrhea tests, positive

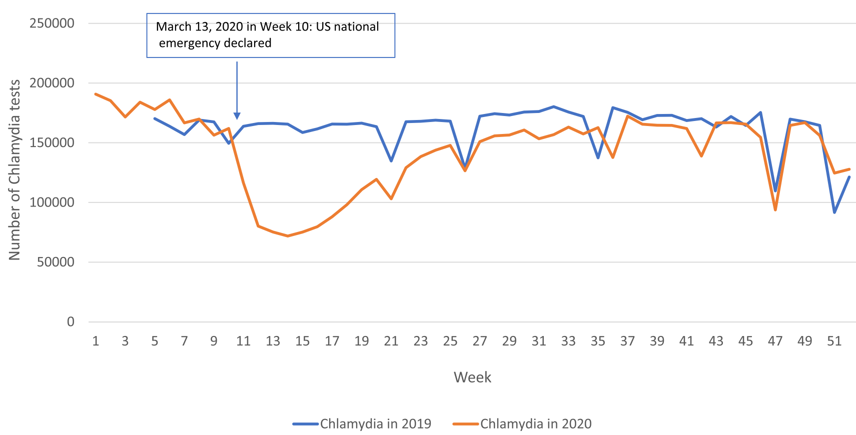

Figure 1. Weekly number of chlamydia tests among patients aged 15 to 60 years from the 5th week of 2019 to the 52nd week of 2020.

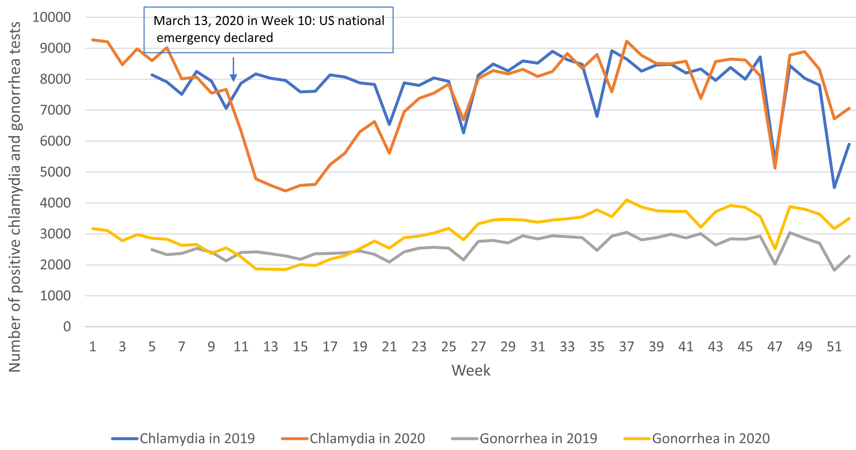

Figure 2. Number of positive chlamydia and gonorrhea test results among all people aged 15 to 60 years by week between 2019 (weeks 5–52) and 2020 (weeks 1–52).

chlamydia test results, and positive gonorrhea test results were significantly associated with the patient's sex, age group, and region (Table 1).

Comparing the 4 weeks of April, the percent changes in the total number of chlamydia tests, the total numbers of gonorrhea tests, the numbers of positive chlamydia test results, and the numbers of positive gonorrhea test results were −53.0%, −53.1%, −41.9%, and −16.1%, respectively (Table 2). In April 2020, the percent decline in states with stay-at-home orders was significantly greater than in states without stay-at-home for all chlamydia tests (−54.1% vs. −45.5%, respectively; $P < 0.05$), all gonorrhea tests (−54.2% vs. −45.7%, $P < 0.05$), positive chlamydia test results (−42.8% vs. −36.4%, $P < 0.05$), and positive gonorrhea test results (−18.5% vs. −1.8%, $P < 0.05$). The percent positive increased by 23.5% for chlamydia and 79.1% for gonorrhea in the 4 weeks of April between 2019 and 2020. No significant difference was observed in the percent positive in April based on stay-at-home order status.

Of the total number of chlamydia tests performed in 2020 (weeks 1–52), approximately 32.4% were ordered by obstetrics and gynecology, 31.2% by primary care providers, 7.8% by hospitals, 6.9% by infectious disease, 5.6% by multiple specialty group, 4.0% by public health, 2.8% by pediatrician, 1.7% by emergency department, and 7.6% by other. The pattern of weekly number of chlamydia tests among patients aged 15 to 60 years stratified by clinical setting and provider specialty in 2020 (weeks 1–52) was similar to that among overall patients aged 15 to 60 years (Fig. 4) with a few exceptions. The weekly number of chlamydia tests in hospitals increased and was much higher after the 27th week, compared with the weekly number before the pandemic in hospitals in 2020 (Fig. 4B). The weekly number of chlamydia tests ordered from public health did not rebound much toward the pre–COVID-19 level even at the end of 2020.

DISCUSSION

Chlamydia and gonorrhea are the 2 most common reported STIs in the United States. Continuously monitoring chlamydia and gonorrhea test volume is important for public health to control these infections and determine how changes in service delivery and test positivity may reflect and impact underlying changes in incidence and prevalence of chlamydia and gonorrhea. Previous work indicates that testing volume for these infections fell in the first half of 2020.[4,5] The substantial reduction in the number of chlamydia or gonorrhea tests performed in the laboratory system we analyzed suggests that patients may have avoided or delayed visits. It is also possible health care providers (especially for physician offices) may have seen fewer patients in their clinic practices than typical, or ordered fewer tests for chlamydia or gonorrhea.[2,7,8] The increased chlamydia and gonorrhea percent positive during the early COVID-19 pandemic period also suggests that testing during routine well visits was more likely to be affected

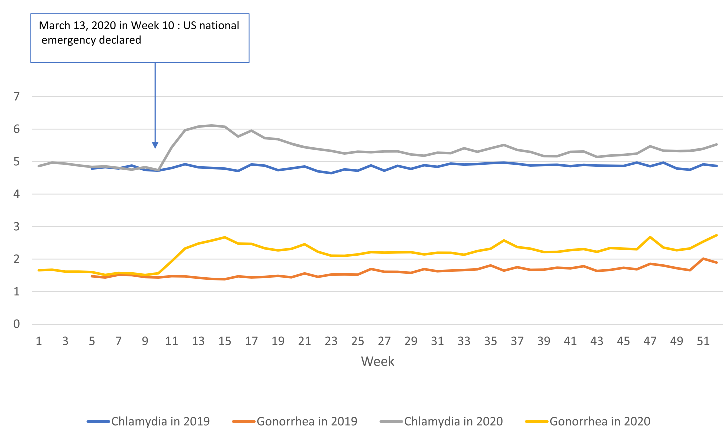

Figure 3. Percent positive (%) of chlamydia and gonorrhea tests among all people aged 15 to 60 years by week between 2019 (weeks 5–52) and 2020 (weeks 1–52).

TABLE 1. Changes in Number of Chlamydia Tests, Gonorrhea Tests, Chlamydia Positive Test Results, and Gonorrhea Positive Test Results Among Patients Aged 5 to 60 Years in the Period of 5th to 52nd Weeks Between 2019 (February 3, 2019–January 4, 2020) and 2020 (February 2, 2020–January 2, 2021)

	No. Chlamydia Tests			No. Gonorrhea Tests			No. Positive Chlamydia Test Results			No. Positive Gonorrhea Test Results		
	2019	2020	Percent Change Between 2019 and 2020	2019	2020	Percent Change Between 2019 and 2020	2019	2020	Percent Change Between 2019 and 2020	2019	2020	Percent Change Between 2019 and 2020
Total	7,681,723	6,731,899	−12.4	7,718,041	6,766,456	−12.3	377,597	356,493	−5.6	123,866	147,772	19.3
Region												
Northeast	1,321,327	1,133,830	−14.2	1,326,534	1,140,360	−14.0*	46,181	41,385	−10.4*	12,497	14,917	19.4*
Midwest	815,967	775,361	−5.0	818,375	779,969	−4.7	45,131	46,632	3.3	14,200	19,988	40.8
South	4,007,369	3,539,186	−11.7	4,025,114	3,551,281	−11.8	219,099	207,988	−5.1	73,572	88,491	20.3
West	1,537,060	1,283,522	−16.5	1,548,018	1,294,846	−16.4	67,186	60,488	−10.0	23,597	24,376	3.3
			$\chi^2 = 4618$			$\chi^2 = 4656$			$\chi^2 = 321$			$\chi^2 = 479$
			$P < 0.0001$			$P < 0.0001$			$P < 0.0001$			$P < 0.0001$
Age, yr												
15–24	2,412,119	2,204,939	−8.6	2,403,152	2,198,318	−8.5*	223,151	218,946	−1.9*	49,072	63,498	29.4*
25–34	2,809,280	2,472,121	−12.0	2,827,492	2,486,308	−12.1	112,640	102,152	−9.3	46,734	54,171	15.9
35–44	1,476,058	1,265,947	−14.2	1,491,523	1,283,778	−13.9	29,630	25,664	−13.4	18,208	20,299	11.5
45–60	984,266	788,892	−19.8	995,874	798,052	−19.9	12,176	9731	−20.1	9852	9804	−0.5
			$\chi^2 = 5876$			$\chi^2 = 5899$			$\chi^2 = 503$			$\chi^2 = 410$
			$P < 0.0001$			$P < 0.0001$			$P < 0.0001$			$P < 0.0001$
Sex												
Female	5,604,162	5,024,666	−10.3	5,614,624	5,034,777	−10.3*	247,270	237,942	−3.8*	49,085	62,690	27.7*
Male	2,077,561	1,707,233	−17.8	2,103,417	1,731,679	−17.7	130,327	118,551	−9.0	74,781	85,082	13.8
			$\chi^2 = 5259$			$\chi^2 = 5108$			$\chi^2 = 130$			$\chi^2 = 218$
			$P < 0.0001$			$P < 0.0001$			$P < 0.0001$			$P < 0.0001$
States with stay-at-home orders in April 2020												
No	964,488	844,045	−12.5	965,855	845,913	−12.4	55,585	52,144	−6.2	19,154	22,929	19.7
Yes	6,717,235	5,887,854	−12.3	6,752,186	5,920,543	−12.3	322,012	304,349	−5.5	104,712	124,843	19.2
			$\chi^2 = 0.4$			$\chi^2 = 1.9$			$\chi^2 = 3.0$			$\chi^2 < 0.1$
			$P = 0.5275$			$P = 0.1729$			$P = 0.0852$			$P = 0.8684$

Change between 2019 and 2020 was defined by (number of tests in 2020 − number of tests in 2019)/number of tests in 2019.

TABLE 2. Changes in Number of Chlamydia Tests, Gonorrhea Tests, Chlamydia Positive Test Results, and Gonorrhea Positive Test Results Among Patients Aged 15 to 60 Years in the 4 Weeks of April Between 2019 (March 31–April 27, 2019) and 2020 (March 29–April 25, 2020), Specifically by State Status of Stay-at-Home Orders in April 2020

	No. Chlamydia Tests			No. Gonorrhea Tests			No. Positive Chlamydia Test Results			No. Positive Gonorrhea Test Results		
	2019	2020	Percent Change Between 2019 and 2020	2019	2020	Percent Change Between 2019 and 2020	2019	2020	Percent Change Between 2019 and 2020	2019	2020	Percent Change Between 2019 and 2020
Total	641,838	301,931	−53.0	645,585	302,571	−53.1	31,186	18,128	−41.9	9181	7706	−16.1
Region												
Northeast	109,796	32,158	−70.7	11,0309	32,229	−70.8	3705	1393	−62.5	902	527	−41.1
Midwest	68,870	33,921	−50.7	69,094	33,981	−50.8	3702	2331	−37.0	1045	1068	2.9
South	333,966	173,636	−48.0	335,737	173,644	−48.3	18,131	11,093	−38.8	5529	4781	−13.6
West	129,206	62,216	−51.8	130,445	62,717	−51.9	5648	3311	−41.4	1705	1330	−21.8
			$\chi^2 = 6905$			$\chi^2 = 6867$			$\chi^2 = 223$			$\chi^2 = 71$
			$P < 0.0001$			$P < 0.0001$			$P < 0.0001$			$P < 0.0001$
Age, y												
15–24	190,240	100,315	−47.3	189,794	99,980	−47.3	18,045	11,262	−37.6	3579	3433	−4.2
25–34	239,133	119,819	−49.9	240,707	120,023	−50.1	9594	5213	−45.7	3558	2709	−23.9
35–44	126,859	53,326	−58.0	128,354	53,722	−58.1	2529	1221	−51.8	1305	1059	−19.1
45–60	85,606	28,471	−66.7	86,730	28,846	−66.7	1018	432	−57.8	739	505	−31.1
			$\chi^2 = 4245$			$\chi^2 = 4260$			$\chi^2 = 109$			$\chi^2 = 59$
			$P < 0.0001$			$P < 0.0001$			$P < 0.0001$			$P < 0.0001$
Sex												
Female	471,534	233,474	−50.5	472,954	233,441	−50.6	20,612	12,275	−40.5	3778	3197	−15.3
Male	170,304	68,457	−59.8	172,631	69,130	−60.0	10,574	5853	−44.7	5403	4509	−16.5
			$\chi^2 = 1620$			$\chi^2 = 1643$			$\chi^2 = 14$			$\chi^2 = 0.2$
			$P < 0.0001$			$P < 0.0001$			$P = 0.0002$			$P = 0.6578$
States with stay-at-home orders in April 2020												
No	83,220	45,314	−45.5	83,408	45,329	−45.7	4682	2978	−36.4	1322	1298	−1.8
Yes	558,618	256,617	−54.1	562,177	257,242	−54.2	26,504	15,150	−42.8	7859	6408	−18.5
			$\chi^2 = 728$			$\chi^2 = 746$			$\chi^2 = 17$			$\chi^2 = 19$
			$P < 0.0001$			$P < 0.0001$			$P < 0.0001$			$P < 0.0001$

Change between 2019 and 2020 was defined by (number of tests in 2020 − number of tests in 2019)/number of tests in 2019.

Overall percent positive increased was 23.5% for chlamydial (18,128/301,931 − 31,186/641,838)/(31,186/641,838) and 79.1% for gonorrhea.

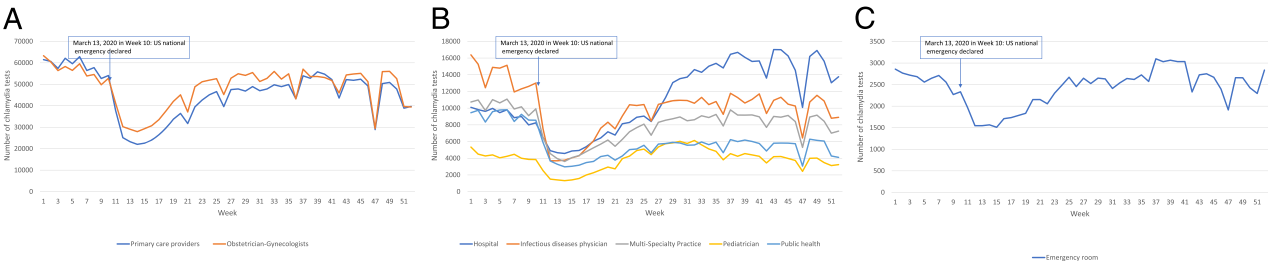

Figure 4. Number of chlamydia tests among all people aged 15 to 60 years by week in 2020, by clinical setting, and by provider specialty. A, Primary care providers, obstetrician-gynecologists. B, Hospital, infectious disease physicians, mutispecialty practices, pediatricians, public health. C, Emergency room. Primary care providers: family practice, general practice, and internal medicine.

than testing during STI-related visits. Both test volume and percent positive began to return to pre–COVID-19 levels after weeks 14 to 20, suggesting that clinics may have begun to accept more patients, patients may have been more willing to visit providers, or providers were able to order testing through telemedicine.

Weekly percent positive remained elevated through the remainder of 2020 compared with 2019, particularly for gonorrhea. When comparing weeks 5 to 52 of 2020 with that of 2019, we observed a decrease in the number of positive chlamydia test results but an increase in the number of positive gonorrhea test results, even though total testing volume for gonorrhea decreased by 12.3%. This finding was confirmed by a recent case report study, which showed that the 2020 cumulative totals from week 1 to week 50 compared with 2019 from week 1 to week 50 were 14.0% lower for chlamydia and 7.1% higher for gonorrhea.[9] The reason for the increase in the number of positive gonorrhea tests might partially be due to that gonorrhea-recommended injection treatment has to be in provider office; as a result, patients were not treated at all or possibly receiving treatment with a delay during the COVID-19 pandemic. Further studies are needed to assess all reasons for the increase in the number of positive gonorrhea test results after the COVID-19 pandemic.

Our stratified data analyses also indicated that the magnitude of 2020 difference varied by subpopulations. For example, during the 4 weeks of April, the states with stay-at-home orders had a greater reduction in relative volume compared with states without stay-at-home-orders. We also observed stronger declines in the volume of testing among specimens from male patients, patients aged 45 to 60 years, and patients who resided in the Northeast. All states in the Northeastern United States had stay-at-home orders in April, except for Massachusetts. Other studies have found that males are less likely to seek health care, especially for preventive care visits.[9]

A recent study has shown that chlamydia and gonorrhea testing volume fell in 2020 using data from a large commercial laboratory.[4] In addition to these findings, our study adds the following results: (1) chlamydia and gonorrhea testing volume not only fell the first half in 2020 but also remained lower in the second half of 2020; (2) in April 2020, the number of gonorrhea and chlamydia tests was reduced more among states with stay-at-home orders; and (3) the pattern of the weekly number of chlamydia tests among overall patients was similar to that among patients stratified by clinic setting and provider specialty with a few of exceptions.

Our study may have several implications for public health. First, the fact that testing volume declined suggests that patients with STIs were not tested and diagnosed at the same rate that would be expected given pre–COVID-19 levels. This could have led to patients not being treated at all or possibly receiving treatment with a delay. Delayed treatment or testing facilitates more STI transmission and a greater potential for serious sequelae to develop in untreated patients. Specific interventions for promote STI testing could be considered for those with the most pronounced declines in testing, such as males and people under stay-at-home orders. With increased use of rapid COVID-19 tests for home-based testing and high acceptable rates of home-based STI testing, public health may promote home-based STI testing among adolescents and young adults, because the broad use of rapid COVID-19 tests for home-based testing might be the trigger or opportunity for home-based STI testing in the United States.[10–12] Second, it is possible that COVID-19 disruptions may have led to more syndromic management and presumptive treatment in the absence of testing, thus obscuring the changes in chlamydia and gonorrhea suggested by these data. Third, with disruptions for routine preventive and other nonemergency care in the US health care system, the COVID-19 pandemic may also have an impact on STI surveillance in terms of the number of cases, reporting completeness, and reporting timeliness. Finally, the COVID-19 pandemic may change many people's sexual behaviors, which may affect STI transmission around the individuals' sexual networks.[13–15]

There are limitations to this analysis. We analyzed testing data from just 1 large independent clinical laboratory. Although the data had laboratory tests in all 50 states and the District of Columbia, the data might not be a national representative sample because of different market shares by state and by type of health insurances. The study was unable to determine the extent to which the changes in clinical setting and provider specialties might be due to changes in laboratory market share or other factors. In addition, because we do not have patient identifiers, some patients might have chlamydia tests and gonorrhea tests counted multiple times on the same date if anal, oral, or genital specimens were collected separately, or might be tested repeatedly across time. We are not able to deduplicate at the patient level. Also, because the ordered chlamydia and gonorrhea tests had almost 100% with missing values on clinical setting and provider specialty before August of 2019, we were not able to assess percentage decline in numbers of chlamydia and gonorrhea tests by clinical setting and provider specialty between 2019 and 2020. Finally, although our data showed an association between number of chlamydia and gonorrhea tests and stay-at-home order status in April between 2019 and 2020, we cannot determine from these data whether stay-at-home orders caused the declines in testing, or assess the relative importance of policy, provider, and patient decisions.

To limit the impact of the pandemic on control of chlamydia and gonorrhea, public health officials at the local, state, and federal levels can study measures put in place during the pandemic and develop new interventions to enable care for STIs to be delivered under long-term emergency conditions. Measures to coordinate with health care providers to provide rapid catch-up chlamydia or gonorrhea tests and to routinely monitor chlamydia or gonorrhea testing practices are also needed.

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