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COVID-19 Pandemic Impact on Sexually Transmitted Infection Testing in a College Setting

Impacto de la pandemia de COVID-19 en las pruebas de infecciones de transmisión sexual en un entorno universitario

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Abstract

Introduction: COVID-19 pandemic has had a great impact on health systems. Many non-urgent visits were done virtually to limit exposure risks. **Objective:** Assess the impact of the pandemic on STI (sexually transmitted infections) testing in a college health setting. **Material and methods:** Quantitative assessment of the number of STI tests done, positive rates and percentage of "compliance to follow-up" for diagnosed STI from March to December 2020 and its comparison with historical data (2015-2019) at the University Health Services, UW-Madison. Measurement: Observed (2020) vs expected (2015-2019) number of STI tests, positive rates and compliance to follow-up testing for STIs. **Results:** The 2020 period showed a significant decrease in the number of tests done and an increase of positive rate when compared to historical data for total sample and per sex. There was a decrease in the percentage of follow-up for the entire sample and for females and an increase for males. **Conclusions:** In accordance with national data, our analysis shows significant declines in STI testing and follow-up during 2020 compared to previous years and an increase in positivity rate. A higher positivity with lower number of tests is likely due to triaging patients, facilitating testing for those at highest risk.

Keywords: Sexually Transmitted Infections; student health services, COVID-19 Pandemic. (Source: DeCS, Bireme).

Resumen

Introducción: La pandemia de COVID-19 ha tenido un gran impacto en los sistemas de salud. Muchas citas no urgentes se hicieron virtualmente para limitar riesgos de exposición. **Objetivo:** Evaluar el impacto de la pandemia en las pruebas para infecciones de transmisión sexual en servicios de salud universitarios. **Materiales y métodos:** Estudio cuantitativo del número de pruebas de infecciones de transmisión sexual realizadas, tasas de positividad y porcentaje de "cumplimiento de seguimiento" en el diagnóstico, desde marzo a diciembre del 2020 y su comparación con datos históricos (2015-2019) en los Servicios de Salud de UW-Madison. **Resultados:** Se encontró una reducción significativa en el número de pruebas realizadas y aumento de la tasa positiva, comparado con datos históricos para la muestra total y por sexo. Hubo disminución en el porcentaje de seguimiento para toda la muestra y para mujeres, y un incremento para hombres. **Conclusiones:** El análisis muestra reducciones significativas en pruebas para infecciones de transmisión sexual y seguimiento durante 2020, comparado con años anteriores y un incremento en la tasa de positividad. El hallazgo de una mayor positividad con un bajo número de pruebas se debe probablemente a la clasificación de los pacientes, facilitando así pruebas en aquellos con mayor riesgo.

Palabras clave: Infecciones de transmisión sexual; servicios de salud estudiantil; pandemia por COVID-19. (Fuente: DeCS, Bireme).

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Introduction

The COVID-19 pandemic has had a huge impact on global health and health systems. It has challenged local, regional, national, and global capacities to prepare and respond[1]. The implications significantly altered aspects of daily life and access to health care, including routine health services[2].

Health systems across the world needed to quickly adapt to the pandemic[3]. Due to concerns about hospital capacity and limited intensive care resources, efforts were focused primarily on protecting access to critical care services. Preventive services were reduced, and many preventive and non-urgent visits were delayed by months or changed to virtual platforms to limit the need for personal protective equipment use and to limit patients' and clinical staff's exposure risks. Many people delayed or avoided seeking routine and even urgent health care services, including nearly 60% of young adults aged 18-24 as shown in one large survey[4]. This has been shown in literature, demonstrating decreased outpatient visits provided in 2020, especially during the period of March- May 2020[5]. As it became evident that the pandemic would last longer than a few weeks or months, it was clear that primary health care, including sexual health services, could not be indefinitely delayed without risking harm.

Millions of new sexually transmitted infections (STIs) are reported every year in the United States; in 2019 there were 1,808,703 cases of chlamydia and 616,392 cases of gonorrhea, which were all time high values. More than half of these infections were among teens and young adults ages 15-24[6]. Sexually transmitted infection rates are high in college settings, which traditionally serve the young adult population. A study examining chlamydia positivity at college health centers found that college students were not any less likely than their peers to experience high rates of chlamydia diagnosis, with rates comparable to those seen in family planning programs and prenatal clinics[7]. The long-term consequences of chlamydia and gonorrhea are frequently underrecognized and include a higher risk of human immunodeficiency virus (HIV) infection pelvic inflammatory disease (PID), infertility, and ectopic pregnancy. Screening for chlamydia has demonstrated reduced rates of PID among women[8]. Lockdown mandates to socially distance and self-quarantine were implemented to limit the spread of COVID-19 throughout the world; while these behavior changes should have similarly limited spread of STIs, it was unknown to what extent people were following the recommendations as it pertained to sexual activity[9]. For some young people, social distancing and stay-at-home guidelines have likely reduced partnered sexual activity[10,11]. In contrast, other studies found that sexual activity level stayed the same or increased, including with new partners or sex outside of one's home[12].

Early during the pandemic, US clinical data showed a significant decrease in the rates of STI visits and treatments[13]. In addition to this, some surveillance systems, like in Madrid, Spain, showed a decrease in the reported rate of STIs when compared to historical data[14], whereas other settings found that despite lockdown orders, rates of STI diagnosis were similar or unchanged[15]. Given the known prevalence of infection and potential for serious consequences of untreated infection, access to high quality sexual health services is a key focus of our student health center. While the changes to health center access were dynamic, particularly during the early days of the pandemic, making STI testing and treatment accessible to students was a top priority for UHS.

The University of Wisconsin-Madison (UW) is a large public research university in the Midwest United States with a total fall 2020 enrollment of 45,540, including undergraduate, master's and doctoral degree programs[16]. In 2020, 69.5% of enrolled students were undergraduates, 52.2% were female, 12.9% were international students, and 65% were white[17].

University Health Services (UHS) is a college health clinic that includes mental health and medical services for UW-Madison students. There are multiple departments within medical services, including Gynecology, Sexual Health, and Primary Care. As the primary patients served are young adults, UHS has had a strong focus on sexually transmitted infection (STI) diagnosis and treatment in all of these departments. In 2017, a group of nurses specialized in sexual health and an epidemiologist developed a protocol to assess compliance to follow up STI testing throughout UHS, showing significant differences within studied groups[18].

Early in the pandemic, it became apparent that the clinic needed to find a balance between the risks of undetected sexually transmitted infections for individuals as well as the importance of limiting risks to staff, patients, and the community associated with having traditional in-person visits during a pandemic. Limited self-testing appointments offered by nursing protocol and requiring only a lab visit have been available to students since 2017. These were initially limited to women due to limitations with the electronic health record and workflows to be sure to support the needs of extragenital site testing; extragenital testing is a routine recommendation for males with male partners (MSM), in whom only performing genital site testing may miss half or more of infections[19,20,21]. This is particularly worrisome as up to 10% of HIV infections are linked to chlamydia and gonorrhea infections[22]. A team at UHS had been looking at means of expanding this and removing gendered language to be inclusive but had not yet implemented this before April 2020.

Up until March 13, 2020, clinical access at UHS was normal. After that, web-booking, the primary means by which patients schedule appointments, was paused in order to utilize telephone visits as a means of triage by a nurse or advanced practice provider. While the CDC offered guidance for STI management with limited clinical interactions in their April 6th, 2020 Dear Colleague Letter[23], it was quickly noted by clinicians that there was an urgency to establish a safe means of testing our patients; this became a priority for the clinic. Testing for STIs was deemed appropriate for in-person care again by late March, particularly for individuals deemed to have higher risk and those with symptoms, but this process still required a telephone assessment by a nurse or advanced practice provider first. This was time-consuming and an additional step to accessing cares. The informatics team, interim deputy medical director, and sexual health clinicians teamed up to expand web-booking of STI testing for chlamydia and gonorrhea through a brief lab visit in order to increase self-test access to patients of any gender. This was released on April 10, 2020. This was complemented by ongoing phone triage for people who were experiencing symptoms or were recommended to complete extragenital screening or blood testing for HIV and syphilis.

Life on campus was dramatically different during this time period. Students were advised to move out of dorms during spring break and classes were moved to virtual only upon return from spring break, effective March 23, 2020. Classes remained online only through summer with a mix of online and in-person classes during the majority of fall semester. Classes returned to online only for the final weeks of fall semester 2020.

According to unpublished internal campus data, it is estimated that between 16,457 and 19,751 students remained on campus or the surrounding areas and were potential users of UHS services during this time. Historically, over 45,000 students are enrolled per year at UW-Madison and eligible to utilize UHS. Per state guidelines, as well as for internal quality improvement initiatives, positive tests for chlamydia and gonorrhea are routinely tracked. Given all of the changes to lifestyle and clinical access, we wished to compare the rates of infection for 2020 following declaration of the global pandemic in March to preceding years.

The goal of the present study is to assess the impact of the pandemic on STI testing in a college health setting. To do this we assessed:

1. Number of STI tests done during pandemic months in 2020 compared to historical data and
2. Positive rates for STI during pandemic months, and compared them with historical data and
3. Percentage of compliance to STI follow up during pandemic months and compared them with historical data.

Materials and methods

We developed an exploratory quantitative analysis of the number of STI tests done, positive rate for STI tests and of the percentage of "compliance to follow up to STI" for Primary Care, Sexual Health and Gynecology visits from March to December 2020 and its comparison with historical data (2015-2019) in college students at the University Health Services (UHS), UW-Madison. For the design and statistical comparison, we adapted the World Health Organization (WHO) recommendations for rapid mortality surveillance and epidemic response for a morbidity event like STI[24]. For the analysis we used total numbers of STI tests, the positive rate for STI and the percentage of compliance to follow up for the total period and per month and in the same

period in the past 5 years (2015-2019). We compared the observed 2020 number of STI tests done, positive rate for STI and percentages of compliance to STI follow up for the current period with the expected number of STI tests done, positive rate for STI and percentage of compliance to STI follow up from historical data. We checked the relative change (X- Xhistorical/Xhistorical) as percentage above or below baseline and the higher limit of the 95% confidence interval (CI 95%) derived from the historical number of STI tests done, positive rate for STI and percentage of compliance from five years of historical data. We reported total data for number of STI tests done, positive rate for STI and percentage of compliance and we then assessed female and male reports separately for all three outcomes. If a certain month in 2020 had three or less registers, we took a conservative approach and selected the historical worst follow up scenario for the same month.

To measure number of tests done, positive rate, and compliance to follow up testing for STIs during the COVID-19 pandemic, we used:

1. Expected number of STI tests, positive rate, compliance to follow up testing for STIs to have occurred on a monthly basis in the same period in the past 5 years (based on historical data 2015- 2019), and
2. Number of STI tests, positive rate, compliance to follow up testing for STIs that have occurred/observed in the analyzed period (2020)

Definitions

Sexually Transmitted Infection (STI). For this analysis we will utilize the most commonly diagnosed infections, chlamydia and gonorrhea, as the total STI. We excluded other diagnoses, including HIV, HSV, HPV, and syphilis.

Positive rate STI. Total positive STI tests/total STI tests done in a period of time.

Compliance to follow up testing for STIs. Is defined as repeating a test after 4 to 26 weeks of first treatment. This is based upon CDC guidance to repeat testing 3 months after treatment, with opportunistic screening when that person next presents for care[8]. The compliance to follow up is related to tests and not to individuals as people can test positive for chlamydia or gonorrhea several times a year. It is measured as a percentage.

Ethical considerations

The Minimal Risk (MR) Institutional Review Board (IRB) conducted a review of the above referenced initial application. The study (ID numbers 2021-0070 and 2021-0202) was determined to meet the criteria for exempt human subjects' research in accordance with the following category(ies) as defined under 45 CFR 46:

(4) Secondary research on data or specimens (no consent required).

Results

Table 1 shows the number of STI tests done between March and December 2020 and its comparison with historical data analyzed. The number of STI tests done in the studied period was 5501. This is a significant decrease of 51.2% when compared to the 11280 average tests from 2015-2019. There is a significant decrease when comparing 2020 number of tests with the historical upper Confidence Interval 95% for the total period (-58.1%). All analyzed months show a significant decrease in the number of tests when compared to historical baseline average with the worst scenario being April (-89%), May (-75.8%) and September (-53.4%). The comparisons to the upper Confidence Interval 95% were also significant for all 10 months analyzed. When stratifying by sex, both females and males have a similar significant decrease in the total period of -51.9% and -51.6% respectively as well as a significant decrease when comparing with historical upper Confidence Interval 95% (-58.7% for females and -57.9% for males). All months had a significant decrease in the number of tests both for females and males.

Table 1. STI tests done during Covid-19 Pandemic and historical comparison. Total and stratified by per sex and months. UHS. UW- Madison, March-December 2020

	Month	2015-2019 Average monthly tests (95% CI)	2020 tests done (n)	% Below baseline	% Below threshold
Total	March	1219 (1060-1378)	1048	-14.0	-23.9
	April	1374 (1081-1668)	151	-89.0	-90.9
	May	1008 (855-1160)	244	-75.8	-79.0
	June	514 (466-562)	269	-47.6	-52.1
	July	591 (524-658)	300	-49.2	-54.4
	August	775 (653-898)	434	-44.0	-51.7
	September	1624 (1313-1935)	757	-53.4	-60.9
	October	1617 (1248-1985)	865	-46.5	-56.4
	November	1347 (1038-1385)	857	-36.4	-45.3
	December	1211 (1038-1385)	576	-52.5	-58.4
	Total	11280 (9437-13123)	5501	-51.2	-58.1
Female	March	752 (674-829)	638	-15.1	-23.1
	April	876 (692-1061)	90	-89.7	-91.5
	May	578 (469-688)	145	-74.9	-78.9
	June	283 (258-308)	146	-48.4	-52.6
	July	333 (281-384)	181	-45.6	-52.9
	August	459 (379-539)	244	-46.9	-54.8
	September	1032 (812-1252)	446	-56.8	-64.4
	October	1045 (806-1283)	606	-42.0	-52.8
	November	879 (741-1017)	524	-40.4	-48.5
	December	743 (652-834)	338	-54.5	-59.5
	Total	6981 (5822-8140)	3358	-51.9	-58.7
Male	March	460 (380-540)	394	-14.3	-27.0
	April	486 (380-592)	59	-87.9	-90.0
	May	423 (370-477)	96	-77.3	-79.9
	June	228 (194-262)	123	-46.0	-53.0
	July	257 (231-282)	116	-54.8	-58.9
	August	309 (272-346)	177	-42.7	-48.8
	September	576 (484-668)	299	-48.1	-55.2
	October	558 (434-681)	241	-56.8	-64.6
	November	455 (379-531)	294	-35.4	-44.7
	December	453 (378-529)	234	-48.4	-55.7
	Total	4205 (3581-4828)	2033	-51.6	-57.9

Table 2 shows the positive rate of STI tests done in the analyzed period and its comparison with historical data. For the whole 2020 period, the positive rate for the STI tests done was 4.2%, while the historical positive rate was 3.2%. This 30.8% increase was significant when comparing it to baseline and when compared to the historical upper Confidence Interval 95% (18.5%). When stratified by sex, both females and males have a similar positive rate, 4.2% and 4.5% respectively. Both are significant increases in positive rate from baseline (46.1% and 18.5%). There is also a significant increase when comparing positive rate with historical upper Confidence Interval 95% for the total period (28.5% and 7.1% respectively). When analyzing data per month, female students have a significant increase in positive rate for STI in April, May, July, September and November and a significant decrease in July, October and December. In male students, April, May, September, November and December were significantly above historical positive rate and June, August and October were significantly below historical positive rate.

Table 2. STI tests positive rates during Covid-19 Pandemic and historical comparison. Total and stratified by per sex and months. UHS

	Month	2015-2019 Monthly average (95% CI)	2020 percentage of positivity x 100	% above/below baseline	% above/below threshold
Total	March	3 (2.4-3.4)	3.2	9.0	-8.4
	April	3 (2.2-3.8)	6.0	96.4	55.0
	May	2.8 (2.5-3.2)	4.1	44.5	28.6
	June	3.7 (2.9-4.4)	4.5	22.0	1.7
	July	3.5 (2.5-4.5)	3.7	3.0	-19.9
	August	3.3 (2.3-4.3)	3.0	-9.0	-30.0
	September	3.1 (2.6-3.6)	4.6	48.1	27.5
	October	3.4 (2.6-4.1)	2.7	-22.0	-36.3
	November	3(2.3-3.7)	5.8	94.7	57.3
	December	3.1 (3-3.3)	4.3	38.8	33.4
	Total	3.2 (2.9-3.5)	4.2	30.8	18.5
Female	March	2.5 (1.8-3.1)	2.7	8.1	-14.4
	April	2.9 (2.1-3.6)	6.7	132.7	85.1
	May	2.6 (2.0-3.6)	4.1	61.5	31.3
	June	2.8 (1.8-3.7)	5.5	97.0	46.6
	July	3.3 (2.1-4.5)	3.3	-0.9	-27.1
	August	3.1 (2.0-3.5)	4.1	33.2	-2.2
	September	3.0 (2.5-3.4)	4.3	43.8	25.2
	October	2.8 (2.0-3.5)	2.6	-4.8	-25.4
	November	2.9 (2.3-3.5)	6.1	111.0	74.7
	December	3.1 (2.5-3.6)	2.7	-13.0	-25.9
	Total	2.9 (2.5-3.3)	4.2	46.1	28.5
Male	March	3.9 (3.3-4.5)	4.3%	10.7	-3.8
	April	3.4 (2.2-4.6)	5.1	49.9	10.7
	May	3.2 (2.6-3.8)	4.2	30.6	9.6
	June	4.8 (4.4-5.3)	3.3	-32.9	-38.6
	July	3.9 (2.3-5.4)	4.3	10.9	-20.5
	August	3.7 (2.8-4.6)	2.3	-38.4	-50.5
	September	3.5 (2.6-4.3)	5.4	53.9	24.1
	October	4.7 (3.7-5.6)	2.9	-37.9	-48.5
	November	3.3 (2.1-4.4)	6.1	86.7	38.3
	December	3.3 (2.7-4.0)	6.8	104.8	73.0
	Total	3.8 (3.4-4.2)	4.5	18.5	7.1

Table 3, and Figure 1 shows the analyzed data for compliance to follow up for the whole sample per month and for females and males per month. Percentage compliance for March- December 2020 was 53%, whereas historical percentage compliance was 58.8%. There was a decrease in the percentage of follow up for the whole period compared to 2015-2019 of -4.7% with a significant decrease when compared to the historical upper Confidence Interval 95% (-9.5%). In the analysis per month, we observe a significant decrease of the percentage of follow up in March, April, May, July and November.

On the other hand, we observe significant increase in compliance to follow up in October and December. Percentage compliance for March- December 2020 for females was 54%, whereas the historical percentage of compliance for the whole period in females was 62%.

There was a decrease in the percentage of follow up for the whole period compared to 2015-2019 of -

11.5% with a significant decrease when compared to the historical upper Confidence Interval 95% (-16%). In the analysis per month for females' compliance, we observe a significant decrease of the percentage of follow up in March, April, June, July, November and December. On the other hand, we observe no significant increase or decrease in compliance to follow up for the rest of the months. When analyzing percentage compliance for March-December 2020 for males, we obtain 53.7%, whereas the historical percentage of compliance for the whole period in males was 48.3%. There was an increase in the percentage of follow up for the whole period compared to 2015-2019 of 11.2% with a significant increase when compared to the historical upper Confidence Interval 95% (2.2%). In the analysis per month, we observe a significant increase of the percentage of follow up for males in March, April, October and December. On the other hand, males' compliance to follow up significantly decreased in May, July and August.

Table 3. STI tests percentage of follow up during Covid-19 Pandemic and historical comparison. Total and stratified by per sex and months. UHS.

Sex	Month	2015-2019 Monthly percentage follow up (95% CI)	2020 percentage follow up (%)	% above/below baseline	% above/below threshold
Total	March	46.7 (35.9-57.6)	36.4	-22.2	-36.9
	April	48.1 (37.3-58.9)	44.4	-7.6	-24.5
	May	40.8 (33.4-48.2)	33.3	-18.3	-30.9
	June	61.6 (55.5-67.7)	63.6	3.3	-6.0
	July	59.3 (47.5-71.2)	36.4	-38.7	-48.9
	August	62.1 (53.2-71.0)	64.3	3.5	-9.5
	September	62.6 (54.6-70.6)	62.9	0.4	-11.0
	October	57.6 (53.3-61.9)	63.6	10.5	2.8
	November	61.0 (49.1-72.9)	56.5	-7.3	-22.5
	December	56.0 (52.1-60)	68.4	22.1	14.0
	Total	55.6 (52.7-58.5)	53.0	-4.7	-9.5
Female	March	51.0 (34.5-67.4)	23.5	-53.9	-65.1
	April	54.5 (44.8-64.3)	33.3	-38.9	-48.2
	May	42.4 (29.7-55.1)	50.0	17.9	-9.3
	June	73.3 (57.2-89.5)	62.5	-14.8	-30.1
	July	57.5 (31.7-83.4)	50.0	-13.1	-40.1
	August	67.4 (55.4-79.4)	70.0	3.9	-11.9
	September	70.3 (63.7-76.8)	73.7	4.9	-4.0
	October	61.6 (53.9-69.4)	62.5	1.4	-9.9
	November	68.4 (55.1-81.6)	58.6	-14.2	-28.2
	December	63.5 (55.5-71.5)	55.6	-12.5	-22.3
	Total	62.0 (57.7-64.3)	54.0	-11.5	-16.0
Male	March	41.2 (34.1-48.3)	50.0	21.4	3.5
	April	38.4 (23.6-53.1)	66.6	73.8	25.6
	May	37.9 (33.8-41.9)	33.3	-12.0	-20.6
	June	54.7 (40.8-68.7)	66.6	21.8	-2.9
	July	62.2 (52.3-72.1)	20.0	-67.8	-72.3
	August	56.4 (43.3-69.6)	50.0	-11.4	-28.2
	September	49.5 (32.2-66.8)	50.0	1.0	-25.1
	October	50.0 (37.7-62.3)	66.6	33.4	7.1
	November	48.9 (30.8-67.1)	53.3	9.0	-20.5
	December	43.5 (27.6-59.3)	80.0	84.0	34.9
	Total	48.3 (44.0-52.5)	53.7	11.2	2.2

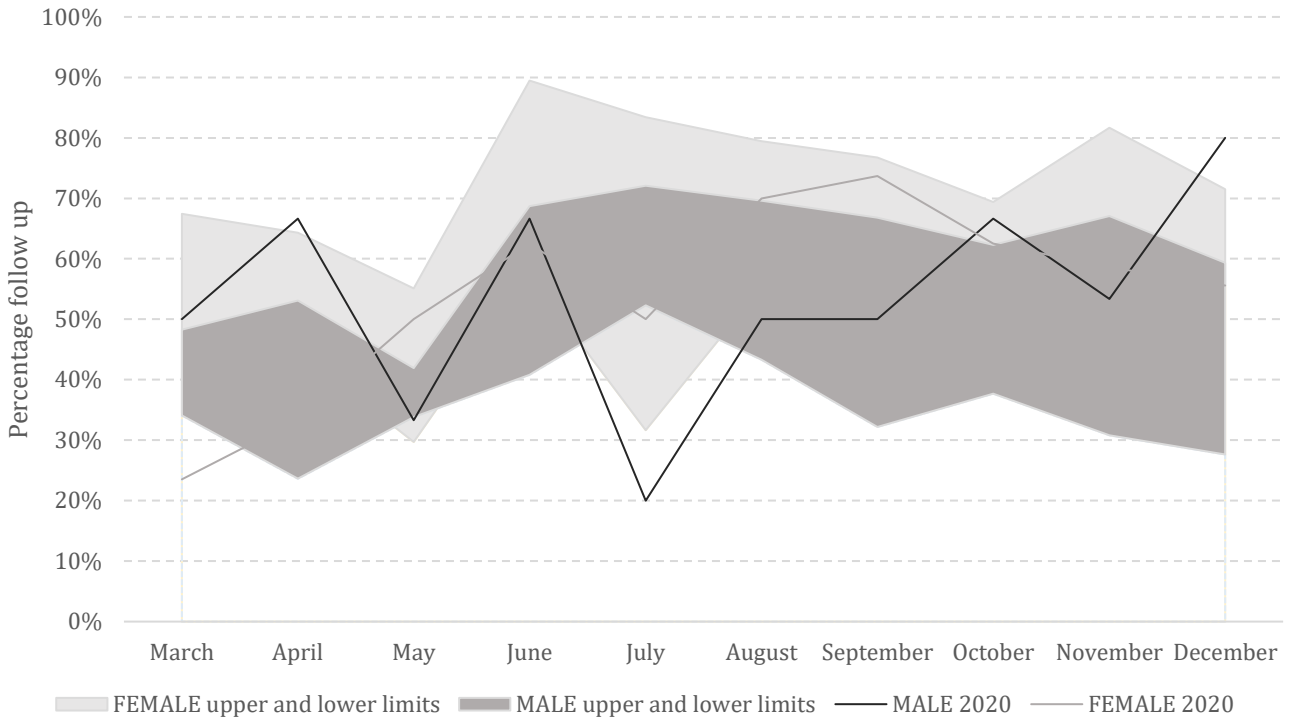

Figure 1. Percentage of STI follow up by sex and March-December 2020 compared to the upper and lower limits of historical licenses (95%CI). Medical Services UHS, UW-Madison

Discussion

Considering the three outcomes assessed, we do observe an impact in STI testing during the pandemic. The impact of the safety measures implemented to adapt to the new reality show consequences in the number of visits. In concordance with European and national data, our analysis shows significant declines in chlamydia and gonorrhea testing during 2020 compared to values from the previous five years[25,26]. The total number of chlamydia and gonorrhea tests from March to December 2020 significantly decreased when compared to historical data for the total period and in each analyzed month. (Table and Figure 1). Unpublished UHS data shows that from March to December 2020, the total number of visits for Primary Care, Sexual Health and Gynecology decreased 39% during 2020 compared to historical data. Clinical access tightened up to limit in-person visits during times of increased COVID-19 activity on campus, which may have impacted follow-up rates. While it is beyond the scope of this study, a comparison of follow up rates vs COVID-19 activity level on campus may further our understanding of monthly differences[27].

Overall, given the changes in access to routine clinical health services based on clinic limitations as well as studies demonstrating hesitancy on behalf of patients related to COVID-19, the finding of reduced testing is expected.

Positive STI rates increased for both males and females[23]. When analyzed by sex, historical data shows the percentage of positivity was higher in male students, consistent with males more often testing because of symptoms[28]. Additionally, the finding of higher positivity with lower number of tests overall is likely due to triaging of patients and recommendation and facilitation of testing for those at highest risk of infection, including those with symptoms, known contact, or sexual behaviors associated with higher risk for infections. While appearing that we had a more efficient means of testing given the increased positivity rate in setting of reduced testing overall, it is likely that by adhering to the triaging, which was in line with CDC guidance at the time, many asymptomatic infections were missed.

Many of these screens often occur during the context of wellness visits, which were primarily completed

through telehealth at UHS during this time period. These asymptomatic infections are especially common in women, as well as typical of extragenital site infections, which make up the majority of chlamydia and gonorrhea infections in MSM[8]. These infections can be associated with serious outcomes, such as PID and infertility in women and an increased risk of HIV acquisition, in particular for rectal infections, in MSM[8]. While CDC guidance supported empiric treatment of symptomatic illnesses suggestive of STIs, there was little guidance for identifying the common asymptomatic infections that make up the bulk of infections[29,8]. UHS prioritized ongoing care for patients utilizing HIV pre-exposure prophylaxis (PrEP) services throughout the pandemic, including access to chlamydia and gonorrhea screening. The use of PrEP is advised for people at higher risk for HIV acquisition, and thus more likely to acquire chlamydia and gonorrhea as well, so this may have additionally impacted the positivity rate. The majority of people who use PrEP at UHS are males, which could have particularly impacted the male positivity rate[8].

Finally, there was a minimal decrease in follow up for the whole sample in the 2020 months analyzed when compared to historical data. Historical UHS analysis shows male students tend to be less compliant to STI follow up than female students (39.6% vs 60.4%)[15]. Although our analysis shows a slightly lower compliance to follow up for male students in 2020 when compared to females (53.7 % vs 54%), male students show an increase in compliance to follow up when compared to male historical data. While a past UHS analysis demonstrated that males with partners of a different sex have lower STI follow up rates than females, this wasn't true of males with partners of the same sex or males with partners of same and different sex partners[15], so the triaging and maintenance of PrEP care during the pandemic may have contributed to a higher rate of follow up in males observed in 2020. This analysis did not include sex of partners for comparison. Our prior analysis did not include symptomatic compared to asymptomatic at time of diagnosis; by favoring detection of symptomatic cases during 2020, it's possible that this experience may impact the likelihood of STI follow up, though to what degree clinical factors impact repeat testing is unclear from the literature.

Conclusions

Despite many perceived barriers to developing new access opportunities, when the urgency was apparent, UHS brought together a team to expedite a process change to meet the needs of patients and clinicians that was also mindful of community safety and resources. The process allowed us to diagnose and treat many STIs in a significantly altered environment. New follow-up analyses will be needed to check for negative health consequences of missed screening opportunities in the college population. However, multiple options for accessing care may allow people to feel more able to access needed services in a confidential way. Living situations changed greatly during the pandemic and more young adults were once again living with family members[30], so we have maintained multiple access options to meet various needs.

The possibility of using at-home testing kits would help further facilitate routine testing in settings of health crises and offers another access point for people who have schedule limitations or prefer testing in their own private space. A successful pilot program for mail-order kits was demonstrated in a diverse population in New York during the pandemic that could serve as a model for other centers, including UHS. They identified many asymptomatic infections, which remains a key concern for quality sexual health services given the importance of timely treatment for individual health benefits and community transmission impacts[31].

This is an ecological study, therefore no directionality or association can be established. Our sample includes only college students, so it may not be generalizable to non-college populations. The study only includes tests, follow up visits/testing done in our clinic. Follow up testing done elsewhere is unknown to us and therefore not included. We were limited to binary sex analysis by sourcing through registrar data. Although we have an estimation of students that could potentially have used UHS during the pandemic, we don't know exactly how many students remained on campus or surrounding areas per month. The clinic does not have a consistent system for follow up reminders, thus, there are differences in whether or not patients are reminded to return to the clinic for repeat testing, which may influence our results.

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