Open Forum Infectious Diseases

BRIEF REPORT

Concurrent Sexually Transmitted Infection Testing Among Patients Tested for Mpox at a Tertiary Healthcare System

Ahmad Mourad, Naseem Alavian, Edwin W. Woodhouse, Emily Niehaus, Hayley Cunningham, Sofia Zavala, Patricia Kohler, Steven Pappas, Michael Yarrington, Nwora Lance Okeke, Cameron R. Wolfe, Gary M. Cox, Kristen V. Dicks, and Jason E. Stout

Division of Infectious Diseases, Department of Medicine, Duke University Medical Center, Durham, North Carolina, USA

Coinfection with sexually transmitted infections (STIs) and mpox is common. We evaluated concurrent STI testing among Duke Health patients tested for mpox. We found that most patients tested for mpox were not comprehensively tested for STIs, despite concurrent STIs being diagnosed in 15% of patients when testing was performed.

Keywords. HIV; mpox; sexually transmitted infections.

The worldwide mpox outbreak, unlike endemic mpox in the past, has been predominantly fueled by human-to-human transmission. The epidemiology and clinical presentation in outbreak cases most closely resembles a sexually transmitted infection (STI) [1–4]. Among the first 2891 cases of mpox reported to the Centers for Disease Control and Prevention (CDC) in the United States (US) as of July 2022, 337 of 357 (94%) of men with data on sexual behavior reported male-to-male sexual or close intimate contact during the 3 weeks prior to symptom onset [2]. Additionally, high prevalence of human immunodeficiency virus (HIV) and other STIs among patients with mpox has also been reported. Approximately 40% of mpox cases in the US occurred in people with HIV, and in a study of 8 US jurisdictions, 41% of patients with mpox also had at least 1 diagnosis of another STI in the past year (gonorrhea, 28%; chlamydia, 25%; and syphilis, 8%) [1–3, 5].

Received 06 June 2023; editorial decision 30 June 2023; accepted 14 July 2023; published online 17 July 2023

Presented in part: Conference on Retroviruses and Opportunistic Infections, Seattle, Washington, 19–22 February 2023, Poster 1035.

Correspondence: Jason E. Stout, MD, MHS, Department of Medicine, Division of Infectious Diseases, Duke University Medical Center, Box 102359-DUMC, Durham, NC 27710 (jason.stout@duke.edu).

Open Forum Infectious Diseases®

https://doi.org/10.1093/ofid/ofad381

While the CDC and World Health Organization have recommended that persons evaluated for mpox should also be screened for HIV and other STIs, data addressing frequency and setting of concurrent STI testing during the outbreak are limited [6, 7]. Data prior to the mpox outbreak suggest that when patients present for STI testing, concurrent STIs are commonly diagnosed [8]. Furthermore, while rates of extragenital gonorrhea and chlamydia can approach 10%, patients screened for gonorrhea and chlamydia are inconsistently tested for extragenital infection [9–12]. Understanding patterns of concurrent STI testing may identify barriers to comprehensive testing in routine care as well as highlight opportunities to strengthen coordinated and standardized STI testing efforts across different healthcare settings during future outbreaks.

We sought to evaluate patterns of concurrent STI and mpox testing, as well as the setting in which patients were tested within our health system in the southeastern US. We hypothesized that the frequency of concurrent STI testing in patients tested for mpox would differ by the type of healthcare setting to which the patients presented—specifically, that patients presenting to higher clinical volume locations with competing clinical priorities, such as urgent care centers or emergency departments, would less often receive appropriate concurrent testing than patients presenting to other outpatient clinics.

METHODS

Patient Consent Statement

The study was approved by the Duke University Medical Center Institutional Review Board, with a waiver of informed consent, in accordance with 45 Code of Federal Regulations part 46.

Data and Patient Selection

We performed a retrospective cross-sectional study of all patients tested for mpox in the Duke University Health System between 1 July and 30 November 2022. The Duke Enterprise Data Unified Content Explorer, a self-service interface to clinical data for all Duke University Health System patients [13], was used to identify those patients tested for mpox with non-variola orthopoxvirus polymerase chain reaction.

Variables and Outcomes

The healthcare setting in which patients were tested for mpox was categorized into the following groups: urgent care centers, emergency departments, primary care clinics, or other locations (including infectious diseases clinics). Results of prior as well as concurrent STI testing at the time of mpox testing were collected, including *Neisseria gonorrhoeae* and *Chlamydia trachomatis* nucleic acid amplification test (NAAT), *Treponema pallidum* serology (TP immunoglobulin G [IgG]), and rapid plasma reagin

(RPR; which reflexed for testing if the TP IgG was reactive, or if ordered separately from TP IgG), as well as HIV testing. For *C trachomatis* and *N gonorrhoeae* NAATs, the anatomical sites tested were also collected. For patients with positive TP IgG or RPR, patient records were reviewed to determine if this represented incident syphilis, that is, newly positive TP IgG or 4-fold increase in RPR from prior testing in patients with a history of syphilis. Prior HIV status as well as demographic data including age, sex at birth, self-identified race, and ethnicity were collected.

Statistical Analysis

Categorical variables were assessed with a χ^2 test and continuous variables with Student *t* test. The χ^2 test was used to examine whether the frequency of concurrent STI testing differed by healthcare setting. R version 4.0.0 software (R Core Team, Vienna, Austria) using the RStudio interface was used for data analysis.

RESULTS

We identified 225 patients tested for mpox, of whom 52 of 225 (23.1%) tested positive (Table 1). Of all those tested, 159 of 225 (70.7%) were male, 182 of 225 (80.9%) were non-Hispanic, 95 of 225 (42.2%) were Black, and 34 of 225 (15.1%) had a known prior diagnosis of HIV. Only 138 of 225 (61.3%) of all patients tested for mpox were also tested for concurrent STI: 71 of 225 (31.6%) were tested for gonorrhea and chlamydia, 123 of 225 (54.7%) were tested for syphilis, and 63 of 191 (33%) of those not known to have HIV were tested for HIV (Figure 1*A*). When chlamydia and gonorrhea testing was done, 47 of 71 (66.2%) patients only had urine specimen testing and only 2 of 71 patients (2.8%) had concurrent urine, rectal, and pharyngeal specimen testing (Figure 1*B*). Stratification of testing as well as anatomic testing sites for gonorrhea and chlamydia by sex are detailed in Supplementary Figures 1 and 2. Of those tested for concurrent STIs, 21 of 138 (15.2%) were diagnosed with an STI. Among all testing negative for mpox, 10 of 173 (5.8%) were diagnosed with a concurrent STI: 1 chlamydia, 7 syphilis, 1 newly diagnosed HIV, and 1 both chlamydia and syphilis. Among those testing positive for mpox, 11 of 52 (21.2%) were diagnosed with a concurrent STI: 2 gonorrhea, 1 chlamydia, 5 syphilis, 1 newly diagnosed HIV, 1 gonorrhea and chlamydia, and 1 syphilis and newly diagnosed HIV.

Importantly, of all patients presenting for mpox testing, 162 of 225 (72%) had been tested for at least 1 STI (syphilis, gonorrhea, or chlamydia) in our healthcare system between 1 January 2020 and before presenting for mpox testing. Fifty-six (25%) had been tested for gonorrhea and chlamydia and 161 (71.6%) had been tested for syphilis. Of these 162 patients, 32 (19.8%) had at least 1 prior STI diagnosis in that period. Patients testing positive for mpox were more likely to have had a documented prior STI (20/52 [38.5%]) than patients testing negative for mpox (12/173 [6.9%]) ($P < .001$).

Gonorrhea/chlamydia testing was performed in 32 of 114 (28.1%) patients presenting to urgent care facilities, 26 of 62 (41.9%) presenting to emergency departments, 10 of 34 (29.4%) presenting to primary care facilities, and 3 of 15 (20%) presenting to other sites (which included 10 patients tested in infectious diseases clinics) ($P = .21$). Syphilis testing was performed in 66 of 114 (57.9%) patients presenting to urgent care facilities, 37 of 62 (59.7%) presenting to emergency departments, 15 of 34 (44.1%) presenting to primary care facilities, and 5 of 15 (33.3%) presenting to other sites ($P = .15$). HIV testing was performed in 31 of 108 (28.7%) patients

Table 1. Patient Characteristics and Concurrent Sexually Transmitted Infection Testing and Results Among Patients Tested for Mpox

Characteristic	Mpox Test Result		*P* Value
	Negative (n = 173)	Positive (n = 52)	
Male sex at birth	110/173 (63.6)	49/52 (94.2)	<.001
Age, y, mean (SD)	38.1 (17.6)	35.6 (9.6)	.323
Ethnicity			.486
Non-Hispanic	137/173 (79.2)	45/52 (86.5)	
Hispanic	24/173 (13.9)	5/52 (9.6)	
Unknown	12/173 (6.9)	2/52 (3.8)	
Race			<.001
Black or African American	58/173 (33.5)	37/52 (71.2)	
White	81/173 (46.8)	8/52 (15.4)	
Other	17/173 (9.8)	5/52 (9.6)	
Asian	8/173 (4.6)	1/52 (1.9)	
Not reported/declined	9/173 (5.2)	5/52 (9.6)	
Known HIV positive	15/173 (8.7)	19/52 (36.5)	<.001
Documented prior STI diagnosis[a]	12/173 (6.9)	20/52 (38.5)	<.001
Concurrent STI testing performed			
Gonorrhea	48/173 (27.7)	23/52 (44.2)	.038
Chlamydia	48/173 (27.7)	23/52 (44.2)	.038
Syphilis	91/173 (52.6)	32/52 (61.5)	.329
HIV	52/158 (32.9)	11/33 (33.3)	1.000
Positive for concurrent STI			
Gonorrhea	0/48 (0)	2/23 (8.7)	
Chlamydia	1/48 (2.1)	1/23 (4.3)	
Syphilis	7/91 (7.7)	5/32 (15.6)	
HIV	1/52 (1.9)	1/11 (9.1)	
Gonorrhea and chlamydia	0/48 (0)	1/23 (4.3)	
Chlamydia and syphilis	1/139 (0.7)	0/55	
Syphilis and HIV	0/143 (0)	1/43 (2.3)	
Testing location			.059
Urgent care	91/173 (52.6)	23/52 (44.2)	
Emergency department	43/173 (24.9)	19/52 (36.5)	
Primary care	30/173 (17.3)	4/52 (7.7)	
Infectious diseases clinic	5/173 (2.9)	5/52 (9.6)	
Other	4/173 (2.3)	1/52 (1.9)	

Data are presented as No. (%) unless otherwise indicated.

Abbreviations: HIV, human immunodeficiency virus; SD, standard deviation; STI, sexually transmitted infection.

[a]Documented positive result for either gonorrhea, chlamydia, or syphilis between 1 January 2020 and before presenting for mpox testing.

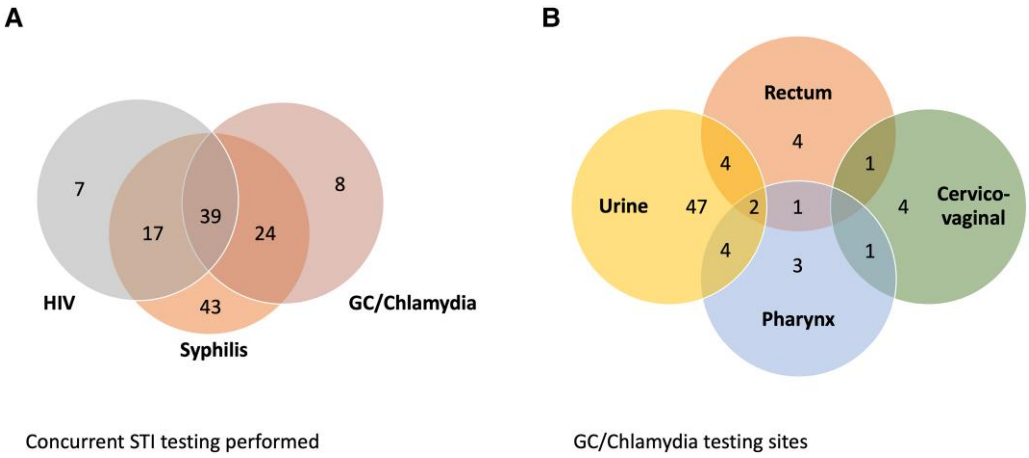

Figure 1. *A*, Frequency of concurrent testing performed on persons presenting for mpox testing. *B*, Frequency of anatomical sites tested for gonorrhea and chlamydia in persons presenting for mpox testing. Abbreviations: GC, gonorrhea; HIV, human immunodeficiency virus; STI, sexually transmitted infection.

presenting to urgent care facilities, 25 of 46 (54.3%) presenting to emergency departments, 7 of 29 (24.1%) presenting to primary care facilities, and 0 of 8 (0%) presenting to other sites ($P = .002$).

DISCUSSION

In our study evaluating concurrent STI testing among patients tested for mpox across varying healthcare settings in our southeastern US tertiary healthcare system, we identified 3 key findings: (1) concurrent STI testing was not consistently or comprehensively performed among those tested for mpox; (2) among those tested, approximately 15% of patients were diagnosed with a concurrent STI; and (3) concurrent STI testing did not vary significantly across healthcare settings. These findings highlight missed opportunities for appropriate concurrent STI and mpox screening.

Following recognition of the mpox outbreak, available data demonstrated that mpox acquisition shared many similar risk factors as acquisition of other STIs [1–3, 5, 14, 15]. Less than two-thirds of patients in our cohort were tested for concurrent STIs. Additionally, when chlamydia and gonorrhea testing was done, approximately two-thirds of patients only had urine testing, and <3% had comprehensive concurrent urine, rectal, and pharyngeal testing. Considering the rate of positive concurrent STIs, both the frequency and extent of testing were inadequate. With new clusters of mpox cases being reported in France and the US, it is important to ensure that concurrent STI testing is consistently and comprehensively performed in the future [16, 17]. Additionally, almost two-thirds of patients presenting for mpox testing were tested for other STIs in the years prior to presentation, and approximately 20% of these patients had been diagnosed with a prior STI. This underscores the importance of long-term preventive strategies to lower rates of newly acquired STIs. Strategies such as postexposure doxycycline should be strongly considered in this patient population [18].

Importantly, 2 patients were diagnosed with newly acquired HIV in our cohort. Knowing that poor outcomes with mpox have primarily occurred among patients with HIV [19], making these diagnoses and ensuring adequate disease control are crucial for mitigating future infections and subsequent outcomes.

Most patients tested for mpox in our cohort (176/225 [78.2%]) were seen in the outpatient acute care setting (either urgent care centers or emergency departments). Contrary to our hypothesis, apart from HIV testing, we did not encounter a difference in rates of concurrent testing by healthcare setting. Although outpatient acute care settings may have been overrepresented in our study, recent studies have highlighted the importance of these healthcare settings in STI testing [20, 21]. These locations serve as the front line for such testing, and a better understanding of why testing rates were relatively low will help inform where future interventions to mitigate shortcomings in screening can be implemented.

Development of an automated electronic medical record (EMR)–based alert system has shown success in increasing adequate HIV and STI screening in various healthcare settings [22–28]. Implementing best-practice alerts or other EMR-based solutions, such as prespecified testing panels, could improve rates of comprehensive STI screening in these patients. Additionally, ensuring availability of patient self-collection of relevant clinical samples, such as rectal, cervicovaginal, or oral swabs for *N gonorrhoeae* and *C trachomatis*, may relieve the burden on healthcare providers in these settings [29]. Finally, integrating sexual wellness initiatives into emergency departments can provide at-risk patients with mechanisms for comprehensive evaluation, access to treatment, and appropriate follow-up [30].

While our study is one of the first to evaluate the extent of concurrent and comprehensive STI screening in patients presenting for mpox testing, it did have several limitations. Our sample size was small and may have limited our ability to detect a difference in testing across healthcare settings. Additionally, we did not collect individual patient-level data on signs/symptoms of presentation for mpox testing, nor on sexual history/exposure history, which may have additionally informed the appropriateness of concurrent STI screening. Nevertheless, our data clearly demonstrate that concurrent testing was underperformed.

In conclusion, although concurrent STIs were common when testing was performed, most patients tested for mpox in our health system were not comprehensively tested for STIs. Strategies to promote concurrent testing are needed.

Supplementary Data

Supplementary materials are available at *Open Forum Infectious Diseases* online. Consisting of data provided by the authors to benefit the reader, the posted materials are not copyedited and are the sole responsibility of the authors, so questions or comments should be addressed to the corresponding author.

Notes

Author contributions. Conception and design: All authors. Data collection: A. M., M. Y., and J. E. S. Analysis and interpretation of results: All authors. Writing–original draft: A. M. Writing–review and editing: A. M., J. E. S., N. A., E. W. W., M. Y., C. R. W., K. V. D., and P. K. All authors reviewed the results and approved the final version of the manuscript.

Financial support. This project was funded by a grant from the Duke Center for AIDS Research (grant number 5P30AI064518).

Potential conflicts of interest. All authors: No potential conflicts.

References

1. Thornhill JP, Barkati S, Walmsley S, et al. Monkeypox virus infection in humans across 16 countries—April–June 2022. N Engl J Med **2022**; 387:679–91.
2. Philpott D, Hughes CM, Alroy KA, et al. Epidemiologic and clinical characteristics of monkeypox cases—United States, May 17–July 22, 2022. MMWR Morb Mortal Wkly Rep **2022**; 71:1018–22.
3. Curran KG, Eberly K, Russell OO, et al. HIV and sexually transmitted infections among persons with monkeypox—eight U.S. jurisdictions, May 17–July 22, 2022. MMWR Morb Mortal Wkly Rep **2022**; 71:1141–7.
4. Allan-Blitz LT, Gandhi M, Adamson P, Park I, Bolan G, Klausner JD. A position statement on mpox as a sexually transmitted disease. Clin Infect Dis **2023**;76: 1508–12.
5. O'Shea J, Filardo TD, Morris SB, Weiser J, Petersen B, Brooks JT. Interim guidance for prevention and treatment of monkeypox in persons with HIV infection—United States, August 2022. MMWR Morb Mortal Wkly Rep **2022**; 71:1023–8.
6. Centers for Disease Control and Prevention. Evaluating patients with suspected mpox. **2023**. Available at: https://www.cdc.gov/poxvirus/mpox/clinicians/clinical-guidance-quick-reference.html. Accessed 26 March 2023.
7. Institutional Repository for Information Sharing, Pan American Health Organization.. Guidance on clinical suspicion and differential diagnosis of monkeypox. **2022**. Available at: https://iris.paho.org/handle/10665.2/56218. Accessed 26 March 2023.
8. Choudhry S, Ramachandran VG, Das S, Bhattacharya SN, Mogha NS. Characterization of patients with multiple sexually transmitted infections: a hospital-based survey. Indian J Sex Transm Dis AIDS **2010**; 31:87–91.
9. Bamberger DM, Graham G, Dennis L, Gerkovich MM. Extragenital gonorrhea and chlamydia among men and women according to type of sexual exposure. Sex Transm Dis **2019**; 46:329–34.
10. Geba MC, Powers S, Williams B, Dort KR, Rogawski McQuade ET, McManus KA. A missed opportunity: extragenital screening for gonorrhea and chlamydia sexually transmitted infections in people with HIV in a southeastern Ryan White HIV/AIDS program clinic setting. Open Forum Infect Dis **2022**; 9:ofac322.
11. Friedman DS, O'Byrne P. Extragenital testing increases case detection of gonorrhea and chlamydia: the impact of implementing nucleic acid amplification testing. Can Commun Dis Rep **2020**; 46:285–91.
12. Abara WE, Llata EL, Schumacher C, et al. Extragenital gonorrhea and chlamydia positivity and the potential for missed extragenital gonorrhea with concurrent urethral chlamydia among men who have sex with men attending sexually transmitted disease clinics—Sexually Transmitted Disease Surveillance Network, 2015–2019. Sex Transm Dis **2020**; 47:361–8.
13. Horvath MM, Rusincovitch SA, Brinson S, Shang HC, Evans S, Ferranti JM. Modular design, application architecture, and usage of a self-service model for enterprise data delivery: the Duke Enterprise Data Unified Content Explorer (DEDUCE). J Biomed Inform **2014**; 52:231–42.
14. UK Health Security Agency. Investigation into monkeypox outbreak in England: technical briefing 3. **2022**. Available at: https://www.gov.uk/government/publications/monkeypox-outbreak-technical-briefings/investigation-into-monkeypox-outbreak-in-england-technical-briefing-3. Accessed 26 March 2023.
15. Girometti N, Byrne R, Bracchi M, et al. Demographic and clinical characteristics of confirmed human monkeypox virus cases in individuals attending a sexual health centre in London, UK: an observational analysis. Lancet Infect Dis **2022**; 22:1321–8.
16. City of Chicago Health Alert Network. Resurgence of mpox—provider update: May 9, 2023. **2023**. Available at: https://www.chicagohan.org/alert-detail/-/alert-details/46678186. Accessed 26 June 2023.
17. Jamard S, Handala L, Faussat C, et al. Resurgence of symptomatic mpox among vaccinated patients: first clues from a new-onset local cluster. Infect Dis Now **2023**; 53:104714.
18. Luetkemeyer AF, Donnell D, Dombrowski JC, et al. Postexposure doxycycline to prevent bacterial sexually transmitted infections. N Engl J Med **2023**; 388: 1296–306.
19. Riser AP, Hanley A, Cima M, et al. Epidemiologic and clinical features of mpox-associated deaths—United States, May 10, 2022–March 7, 2023. MMWR Morb Mortal Wkly Rep **2023**; 72:404–10.
20. Barnes A, Jetelina KK, Betts AC, Mendoza T, Sreeramoju P, Tiro JA. Emergency department testing patterns for sexually transmitted diseases in north Texas. Sex Transm Dis **2019**; 46:434–9.
21. Stanford KA, Mason JA, Friedman EE. Trends in STI testing and diagnosis rates during the COVID-19 pandemic at a large urban tertiary care center, and the role of the emergency department in STI care. Front Reprod Health **2023**; 5:1082429.
22. Sha BE, Kniuksta R, Exner K, et al. Evolution of an electronic health record based-human immunodeficiency virus (HIV) screening program in an urban emergency department for diagnosing acute and chronic HIV infection. J Emerg Med **2019**; 57:732–9.
23. McGuire R, Moore E. Using a configurable EMR and decision support tools to promote process integration for routine HIV screening in the emergency department. J Am Med Inform Assoc **2016**; 23:396–401.
24. Naito T, Endo K, Fukushima S, et al. A preliminary analysis of the performance of a targeted HIV electronic medical records alert system: a single hospital experience. J Infect Chemother **2021**; 27:123–5.
25. Lin J, Mauntel-Medici C, Heinert S, Baghikar S. Harnessing the power of the electronic medical record to facilitate an opt-out HIV screening program in an urban academic emergency department. J Public Health Manag Pract **2017**; 23:264–8.
26. Hughes MS, Apostolou A, Reilley B, Leston J, McCollum J, Iralu J. Electronic health record reminders for chlamydia screening in an American Indian population. Public Health Rep **2021**; 136:320–6.
27. Willis SJ, Elder H, Cocoros NM, Callahan M, Hsu KK, Klompas M. Impact of an electronic medical record best practice alert on expedited partner therapy for chlamydia infection and reinfection. Open Forum Infect Dis **2022**; 9:ofab574.
28. Ontario HIV Treatment Network. The use of electronic medical records to prompt HIV testing. **2022**. Available at: https://www.ohtn.on.ca/rapid-response-the-use-of-electronic-medical-records-to-prompt-hiv-testing/. Accessed 5 April 2023.
29. Lunny C, Taylor D, Hoang L, et al. Self-collected versus clinician-collected sampling for chlamydia and gonorrhea screening: a systemic review and meta-analysis. PLoS One **2015**; 10:e0132776.
30. Hazra A, Stanford K, Schneider J, Davis A. Introducing a sexual wellness clinic to an at-risk population through the emergency department. Acad Med **2023**; 98: S60–2.