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Low STI screening and presumptive treatment and high STI positivity among U.S. females visiting the emergency department after sexual assault

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Abstract

Objective: The CDC STI treatment guidelines state that the decision to provide STI/HIV testing and presumptive treatment after sexual assault (SA) should be made on an individual basis to minimize re-traumatization of the patient. However, little is known about STI screening, presumptive treatment, and positivity in the emergency department (ED) setting. The objective of this study is to evaluate STI testing rates and positivity, presumptive gonorrhea and chlamydia treatment, pregnancy testing, and emergency contraception offered to SA survivors in the ED in the US.

Methods: The Premier Healthcare Database, a national administrative data set containing healthcare information from inpatient and hospital-based outpatient encounters, was used. Approximately 30% of encounters have available lab test results. ED visits for SA (identified by ICD-10-CM codes) among female patients aged 15–44 years between 2019–2023 were included. For patients presenting multiple times to the ED, only the first ED visit after SA was included.

Results: Of 49,047 total visits where females ages 15–44 years presented to the ED for SA, chlamydia, gonorrhea, syphilis, and HIV tests were conducted in 18.6%, 18.6%, 13.4%, and 16.9%, respectively, and pregnancy tests in 33.1% of visits. Presumptive gonorrhea and chlamydia treatment was provided in 53.7% and 52.2%, respectively, and emergency contraception in 27.2% of visits. Approximately 40% of patients were neither tested nor treated for either chlamydia or gonorrhea. Of patients with available lab test results, chlamydia, gonorrhea, and syphilis positivity were 10.0%, 3.8%, and 1.0%, respectively.

Conclusion: Low STI testing and treatment rates and high STI positivity identified in this study suggest an important opportunity exists for improving STI screening and presumptive treatment for female patients presenting to the ED after SA.

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Keywords

sexual assault; STI/HIV testing; presumptive STI treatment; STI positivity; emergency department

INTRODUCTION

Numbers of sexually transmitted infections (STIs), especially gonorrhea, syphilis, and congenital syphilis, are increasing rapidly across the US¹ Strategies to address this epidemic must including screening and treatment in high priority populations disproportionately affected by STIs.² While limited data suggest that females experiencing sexual assault (SA) may have elevated rates of STIs and HIV^{3,4}, existing guidelines recommend that the decision to provide STI/HIV testing and presumptive treatment should be made on an individual basis.{Workowski, 2021 #105} This approach may introduce bias as to whom should be tested and treated, and it risks leaving SA survivors without consistent, appropriate testing and treatment. While identification of an STI immediately after SA likely represents an infection acquired before the assault, this medical visit still represents an important opportunity for testing and treatment in this population, who may have limited follow-up visits or limited contact with the healthcare system outside of the initial SA visit. {Workowski, 2021 #105} Furthermore, baseline serology is important for those individuals receiving HIV post-exposure prophylaxis (PEP) and follow up syphilis testing at one month, as it can establish the absence of an infection at the time of the assault. At the time of the initial examination, clinicians may offer the nucleic acid amplification testing (NAAT) for chlamydia and gonorrhea at the sites of penetration or attempted penetration, HIV and syphilis serologic testing, empiric prophylactic antimicrobial treatment for gonorrhea and chlamydia, HIV PEP, pregnancy testing, emergency contraception, and many other services. {Workowski, 2021 #105;, 2019 #137;ACEP, #207}

Existing data examining practices around STI and contraception care for SA survivors are limited and largely out of date, but have shown variable rates of STI/HIV testing and presumptive treatment, and high STI prevalence among patients with healthcare visits for SA.^{3,4,8–10} One recent study with a large sample of 55,113 Medicaid patients showed that during initial SA visits in 2019, fewer than 20% were tested for HIV or STIs; and presumptive gonorrhea and chlamydia treatment rates were 9.7% and 3.4%, respectively.{Tao, 2023 #197} Another recent study with standardized protocols for SA services in the emergency department (ED) showed that among 182 adult ED encounters for SA during 2019–2022, more than 90% were offered HIV and STI testing, HIV PEP and STI presumptive treatment, and pregnancy testing and emergency contraception. {Hollender, 2023 #206} An older study with 389 SA patients during 1995–1997 found that standard treatments at the initial SA visit included emergency contraception and antibiotic prophylaxis against gonorrhea, chlamydia, and syphilis (note that all patients were assumed to receive those services in the study); emergency contraception was provided in 73% of cases at the initial visit.{Holmes, 1998 #158} Early studies found a high prevalence of STIs among females with healthcare visits for SA, including gonorrhea (3%–6%), chlamydia (10%–17%), trichomonas (15%–20%), syphilis (1%) and HIV (1%).^{3,4} These rates are higher than the nationally reported prevalence among females.{CDC, 2022 #199}

Previous studies have shown that EDs are common locations (21%–60%) for survivors to seek care after SA, and ED visits for SA have been increasing, with a 1533.0% increase from 2006 to 2019.^{8,11,12} With limited and outdated information on STI prevalence, testing and presumptive treatment rates in this population, combined with guidelines that allow for clinician discretion to inform these practices on a case by case basis, our study aimed to assess STI rates among SA survivors, as well as current practices around STI testing and presumptive treatment, pregnancy testing, and emergency contraception provided during ED visits for SA, using recent data from an US large hospital database.

METHODS

We used the Premier Healthcare Data (PHD) COVID-19 Special Release database in this study. The PHD COVID-19 Special Release database is an all-payer, administrative database that includes more than 900 geographically diverse, non-profit, non-governmental, community and teaching hospitals and health systems from rural and urban areas across the US, represents about 25% of hospital admissions, and includes hospitals from all nine mainland US Census divisions. The database contains more than one billion encounters from individual ambulatory, ED, and inpatient settings from 2019 to 2023. The database is routinely updated every two weeks, with a data lag of four to six weeks.

The database contains de-identified patient-level (by MEDREC_KEY) and encounter-level (by PAT_KEY) data from hospital information systems, including patient demographics, diagnoses, procedures, medications, laboratory tests, and time-stamped billed items. In the data system, each patient had a unique MEDREC_KEY, each visit (based on MEDREC_KEY and date of discharge) might generate multiple encounters if multiple clinicians were involved in medical services at the given visit, and each encounter had its unique PAT_KEY. Data reporting from outpatient settings or laboratories to the PHD database is voluntary, and general and microbiology laboratory results were only available for approximately 30% of included encounters.

The database was searched for all ED encounters from January 2019 through December 2023 involving females aged 15–44 years whose visit was associated with a diagnosis code for SA (ICD-10 T74. 21XA, T74.22XA, or Z04.41). Data included legal sex only, as no information was available on gender identity. These criteria were selected because previous studies⁸ and CDC data¹ have shown that most SA survivors are females aged 15–44. The first ED encounter for SA identified during the study period was defined as the index SA visit. For patients presenting multiple times with an included diagnosis code, only the first ED visit after SA was included. For each index visit, clinical data were extracted, including testing for HIV, syphilis, gonorrhea, chlamydia, and pregnancy, any available results of STI/HIV or pregnancy testing, antibiotics administered or prescribed for presumptive treatment, and emergency contraception. Presumptive treatment for chlamydia and gonorrhea was defined as patients who were treated for chlamydia and gonorrhea without chlamydia and gonorrhea testing or prior to results from laboratory tests. STI/HIV and pregnancy tests were identified by Current Procedural Terminology (CPT) codes in the procedure file, medications were identified by National Drug Code (NDC) in the medication file, and syphilis lab test results were identified in the laboratory file (Supplementary Table).

Of the index SA visits with laboratory chlamydia, gonorrhea, syphilis, and HIV tests identified in the laboratory file, positivity was calculated with valid results (either positive or negative). Because no clinical history was available, positivity for syphilis was defined as any cases in which both treponemal (e.g., antibody) and non-treponemal (e.g., RPR or VDRL) tests were positive among all cases in which both treponemal and non-treponemal tests had valid results.

Our analysis was stratified by demographic, social, and other visit-related factors. These factors included age groups, race/ethnicity, insurance type, ED census region (region was based on ED location rather than patient's residence), and ED rural-urban status. Based on race and ethnicity categories, if a person was coded as Hispanic with ethnicity category, then the person was defined as Hispanic; if a person was coded as non-Hispanic with ethnicity category and was coded as White with race category, then the person was defined as non-Hispanic White; if a person was coded as non-Hispanic with ethnicity category and was coded as Black with race category, then the person was defined as non-Hispanic Black. All remaining persons were defined as Other.

All data were stored and analyzed in Microsoft Azure's Databricks system housed inside Centers for Disease Control and Prevention (CDC) Datahub, a web-based platform for machine learning and other data science use cases. Although the original database is routinely updated every two weeks with a data lag of four to six weeks, the data stored in CDC's Datahub are updated several times per year. Structured Query Language (SQL) was used for data preparation. Statistical tests were performed with SAS (version 9.4; SAS Institute). A chi-square (χ^2) test was used to test the statistical significance ($p < 0.05$) between any of the following: STI/HIV testing, STI presumptive treatment, pregnancy testing, and emergency contraception use, and patient demographics, including ED census region. Because the sample sizes for STI/HIV testing, STI presumptive treatment, pregnancy testing, and emergency contraception use were very large in this study, even small differences in any measure between groups would be detected as being statistically significant, but this might not mean that the findings were clinically significant.¹³ Due to large sample size concerns, we selectively report differences in STI/HIV testing, STI presumptive treatment, pregnancy testing, and emergency contraception use between groups. Because the number of STI positive tests were much smaller than the number of STI tests, Chi-square tests with 95% confidence intervals (CI) were used to test the association of STI positivity with any categorical variable. If $p < 0.05$ in χ^2 tests or two 95% CIs without overlap for STI positivity estimates, the association was considered statistically significant. Any cell with ≤ 10 observations was considered unreliable and thus was reported as unreliable estimate in this study.

This study 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). Because the PHD COVID-19 Special Release database used in this study consisted of de-identified data with distinct patient identifiers (MEDREC_KEY), it was determined to be non-human subject research.

RESULTS

The database included ED visits for 49,047 females ages 15–44 years presenting for SA over the five-year study period. Of these, 18.6% were tested for both chlamydia and gonorrhea, and 52.2% and 53.7% were presumptively treated for chlamydia and gonorrhea, respectively. Overall, 12.6% were tested and treated for gonorrhea, 6.0% were tested and not treated for gonorrhea, 41.2% were treated and not tested for gonorrhea, and 40.2% were neither tested nor treated for gonorrhea (Table 1). Patients in the West were significantly more likely to be neither tested nor treated for gonorrhea than those in the Northeast (49.2% vs. 34.9%, $p<.0001$). Similarly, 12.1% were tested and treated for chlamydia, 6.5% were tested and not treated for chlamydia, 40.1% were treated presumptively but not tested for chlamydia, and 41.3% were neither tested nor treated for chlamydia. The frequency of patients with chlamydia tests and presumptive treatment by patient age, race/ethnicity, insurance type, and residence variables were similar to that in Table 1 for patients with gonorrhea tests and treatment.

Of these 49,047 females ages 15–44 years presenting for SA in the ED, 13.4% and 16.9% were tested for syphilis and HIV, respectively; 33.1% were tested for pregnancy; and 27.2% were provided emergency contraception (Table 2). Patients in the West were significantly more likely to be tested for pregnancy than those in the Northeast (41.6% vs. 26.3%, $p<.0001$), while patients in the West were significantly less likely to receive emergency contraception than those in the Northeast (21.0% vs. 35.8%, $p<.0001$). In addition, patients aged 15–19 years were significantly more likely to receive emergency contraception than those aged 40–44 years (32.4% vs. 15.1%, $p<.0001$).

Of all 5,123 index SA encounters with any chlamydia, gonorrhea, syphilis, or HIV lab testing identified in the laboratory file, there were 2,881 (98.2%) valid results from 2,934 chlamydia tests, 2,826 (98.5%) valid results from 2,868 gonorrhea tests, 2,167 (99.6%) valid results from 2,176 syphilis tests, and 3,543 (99.9%) valid results from 3,547 HIV tests. Of those encounters with valid chlamydia test results, 10% (95%CI: 8.9%–11.1%) were positive. Positivity was significantly ($p<0.05$) higher among the youngest age groups: 15.6% (95%CI: 13.1%–18.2%) among females aged 15–19 years and 11.8% (95%CI: 9.5%–14.1%) among females aged 20–24 years, compared to 6.5% (95%CI: 4.3%–8.7%) among females aged 25–29 years (Figure 1); and significantly ($p<0.05$) higher among non-Hispanic black females: 12.9% (95%CI: 10.5%–15.2%), compared to 8.4% (95%CI: 7.0%–9.8%) among non-Hispanic white females (Figure 2). Of those encounters with valid gonorrhea test results, 3.8% (95%CI: 3.1%–4.5%) were positive. There was no significant association identified between gonorrhea test positivity and age, race or ethnicity. Overall, 1.0% (95%CI: 0.6%–1.4%) of syphilis tests were positive with both non-treponemal and treponemal tests, and 0.3% (95%CI: 0.1%–0.5%, unreliable) of HIV tests were positive.

DISCUSSION

There is limited recent published data regarding STI positivity or prevalence among females visiting the ED after SA in the United States. Although STIs identified at the initial SA visits might be more likely to represent an infection acquired before the assault, this study

found that this population may have high rates of STIs. Despite this, 40% of females with SA received neither STI screening nor presumptive treatment, with this proportion increasing with age. There were additionally some racial and ethnic disparities in testing and treatment, with non-Hispanic Black patients more likely to be tested and treated for STIs than other groups. These findings suggest that SA survivors would benefit from more consistent screening and treatment practices and more robust systems of follow up to reach this priority population for appropriate care and prevention. Further research is needed to understand and address disparities in care observed in this study. The syphilis positivity (1%) estimated from this study has alarming implications for public health, particularly in light of the congenital syphilis epidemic, as the study population is comprised entirely of females of reproductive age. Compared to the current syphilis surveillance report in the US, the syphilis positivity in this study was much higher than that mentioned in the national surveillance report (1% for females in this study vs. 0.05% for both males and females nationally).¹ A recent study also showed that syphilis positivity was about 2.3% among males and females and 1.2% among females who visited the ED in a hospital system with routine syphilis screening.^{14, {Stanford, 2024 #215}} Considering the elevated syphilis rates from ED visits for SA in the present study as well as from undifferentiated ED visits in the earlier study, routine ED syphilis screening in high-prevalence communities or special populations such as SA survivors could be critical to address the syphilis epidemic.¹⁴ In the present study, only 13.4% of SA visits included syphilis testing. This suggests a major opportunity for syphilis detection and case control in this population. In one ED that utilizes a standard template for SA visits that includes HIV, syphilis, and other STI testing and treatment for all SA patients, 94.9% of SA patients were offered STI testing and 93.1% offered presumptive treatment, and 91.6% and 83.9% of these accepted STI testing and presumptive treatment, respectively. In addition, sexual assault nurse examiners (SANE) were more likely to offer the recommended services than other providers. This suggests that with a standardized approach increased screening would be feasible, even more so by including SANEs.¹⁰

In this study, testing or presumptive treatment for gonorrhea and chlamydia were almost always performed together. The pattern of gonorrhea and chlamydia testing together in this study was similar to that in the previous study.⁸ Overall high chlamydia and gonorrhea positivity (10.0% and 3.8%) estimated from this study suggest that routine chlamydia and gonorrhea testing among females with SA may be useful. Although around half of females were presumptively treated for chlamydia and gonorrhea, only 18.6% were tested, and more than 40% were neither tested nor treated for chlamydia or gonorrhea when they visited the ED for medical care related to SA. Presumptive treatment rates in this study were considerably higher than in a previous study, which showed 3.4% and 9.7% presumptive treatment rates for chlamydia and gonorrhea.⁸ This may reflect practice differences in the ED, as the earlier study examined visits in all clinical locations, not just the ED, or it may in part be due to missing inpatient pharmacy data in administrative datasets utilized in the previous study. Regardless, high STI rates among those tested indicate the need for strategies to increase screening for chlamydia and gonorrhea among SA survivors in the ED, which could include additional guidelines and policy, including standardized national testing and treatment recommendations and legal protections for those testing positive at the index visit, reimbursement incentives, technical infrastructure to support systematic ordering of

tests, or local standardized protocols for testing and treatment, as were described in recent studies.^{10,15}

Given approximately 3 million females in the US experienced SA-related pregnancy during their lifetime¹⁶, it is important to assess pregnancy status among reproductive-aged female survivors and offer emergency contraception when indicated.^{5-7,17} The finding that only about a third of visits included pregnancy testing or emergency contraception, and furthermore the provision of these decreased by age in this study suggests the need for more consistent pregnancy testing and emergency contraception counseling and use, especially given increasing risk of pregnancy related morbidity and mortality with age. An earlier study showed that 64% of females offered emergency contraception in the ED after SA accepted it.^{Hollender, 2023 #206} While our study is not able to examine the reasons for low rates of emergency contraception prescription in particular if these rates are related to healthcare provider bias, patient preference, or other barriers, further studies will be helpful to understand these patterns and improve access to pregnancy testing and emergency contraception after SA.

There were several limitations in this study. First, because only 30% of encounters had laboratory test results in the database, estimates of STI positivity might be biased. Additionally, less than 20% of females were tested for chlamydia and gonorrhea, and it is unknown if there was selection bias as to which females were tested or if there were different protocols in different EDs for STI testing. Some of the patients may have refused testing, although one previous study suggests that most women offered testing do accept it.¹⁰ Future studies with complete testing data will be needed to examine un-biased STI positivity among SA visits in the ED. Second, administrative data has inherent limitations, as reporting is voluntary and may not be complete. Third, because the dataset used in this study had incomplete outpatient encounters, the follow-up SA visits could not be assessed. Fourth, this study relied on ICD10-CM codes to identify SA cases, and codes for “suspected” SA were not included because they were not confirmed, thus some SA cases may have been inadvertently excluded from the study. Finally, additional clinical factors unavailable in an administrative dataset could have affected the likelihood of or need for testing or treatment, including the length of time between the SA and the ED visit, previous testing or treatment at an outpatient appointment, patient preferences, the nature of the assault or the assailant, other acute or life threatening conditions requiring treatment, or presence of SANE.¹⁰

This study presents empiric evidence on the current STI and reproductive health-related services provided during initial SA visits in the ED across the US, showing low rates of testing and presumptive treatment for STIs, inconsistent testing and treatment practices across race, ethnicity and age groups, and high positivity rates among those tested. STI rates among SA survivors in the ED were higher than nationally reported rates. In the context of the current epidemics of syphilis and other STIs, this suggests that increased and standardized testing and treatment in this population may be useful. Combined with other interventions such as expanded SANE programs and use of automated reminders and clinical protocols in the electronic medical record, this represents an important opportunity to improve STI care and reproductive health for people who are at increased risk for

STI/HIV infection as well as help to combat the national epidemics of STIs and congenital syphilis.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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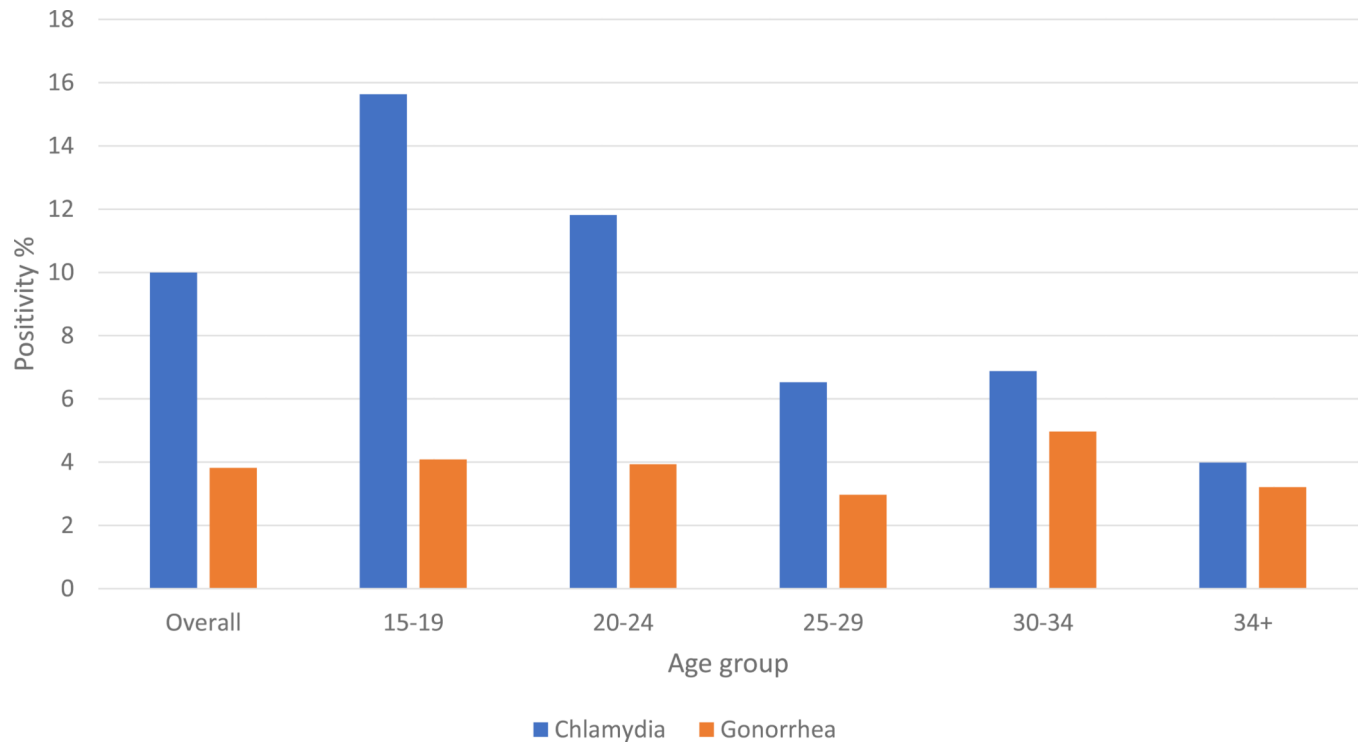


Figure 1.

Positivity for chlamydia and gonorrhea by age category during their initial visits with sexual assault diagnosis for female patients aged 15–44 years at emergency departments, 2019–2023

Footnote: Of 5123 patients who were tested for any STI, 5112 (99.8%) had at least one valid result.

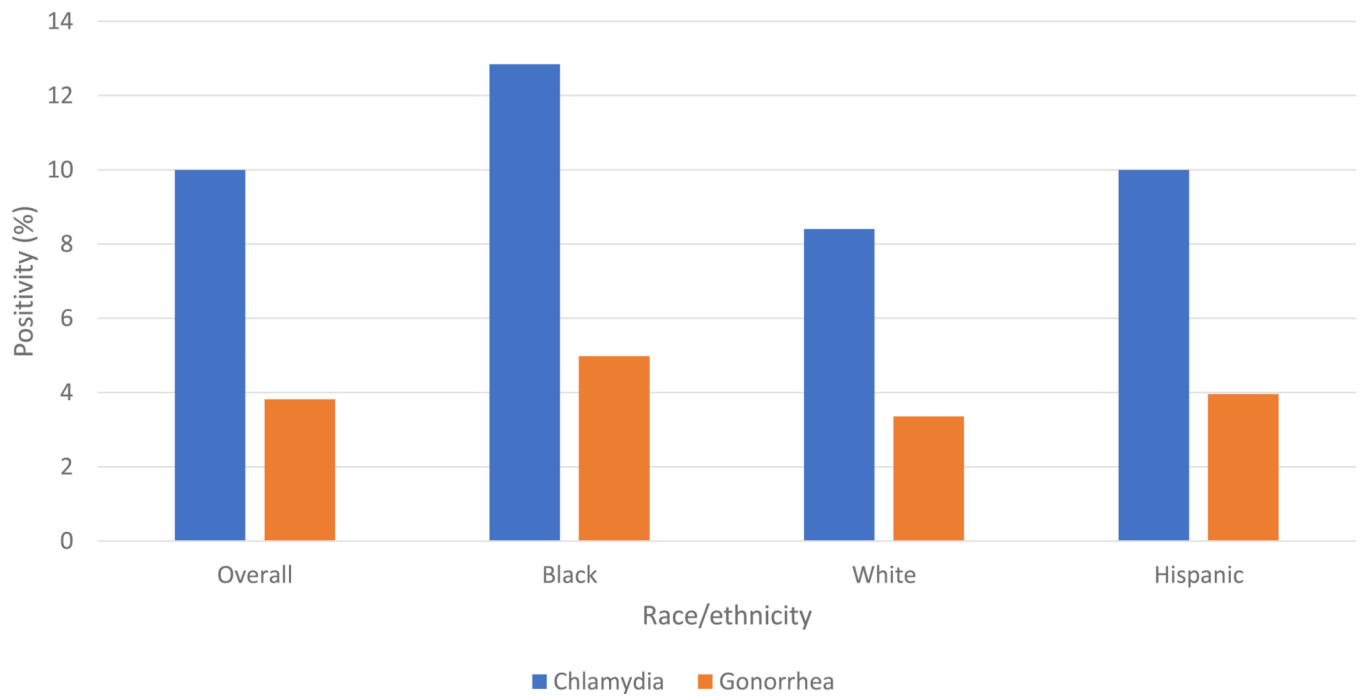


Figure 2.

Positivity for chlamydia and gonorrhea by race/ethnicity category during their initial visits with sexual assault diagnosis for female patients aged 15–44 years at emergency departments, 2019–2023

Footnote: Of 5123 patients who were tested for any STI, 5112 (99.8%) had at least one valid result.

Table 1.

Gonorrhea testing and presumptive treatment rate among patients who were identified with sexual assault diagnosis at their initial visit in emergency department (ED) during 2019–2023, Premier Healthcare Database

Demographics	Total number of patients N (col %)	Both tested and treated N (%)	Tested but not treated N (%)	Treated but not tested N (%)	Neither tested nor treated N (%)
Overall	49,047	6,160 (12.6)	2,955 (6.0)	20,195 (41.2)	19,737 (40.2)
Age groups in years					
15–19	12,553 (25.6)	1,657 (13.2)	918 (7.3)	5,175 (41.2)	4,803 (38.3) *
20–24	12,953 (26.4)	1,648 (12.7)	699 (5.4)	5,668 (43.8)	4,938 (38.1)
25–29	8,280 (16.9)	1,042 (12.6)	449 (5.4)	3,495 (42.2)	3,294 (39.8)
30–34	6,534 (13.3)	798 (12.2)	370 (5.7)	2,550 (39.0)	2,816 (43.1)
35–39	5,105 (10.4)	554 (10.9)	301 (5.9)	1,990 (39.0)	2,260 (44.3)
40–44	3,622 (7.4)	461 (12.7)	218 (6.0)	1,317 (36.4)	1,626 (44.9)
Race/ethnicity					
Non-Hispanic White	27,049 (55.1)	3,338 (12.3)	1,702 (6.3)	11,037 (40.8)	10,972 (40.6) *
Non-Hispanic Black	10,834 (22.1)	1,473 (13.6)	591 (5.5)	4,616 (42.6)	4,154 (38.3)
Hispanic	6,559 (13.4)	803 (12.2)	385 (5.9)	2,712 (41.4)	2,659 (40.5)
Other	4,605 (9.4)	546 (11.9)	277 (6.0)	1,830 (39.7)	1,952 (42.4)
Insurance type					
Commercial (fee for service)	6,536 (13.3)	705 (10.8)	333 (5.1)	3,212 (49.1)	2,286 (35.0) *
Managed care	6,768 (13.8)	833 (12.3)	465 (6.9)	2,771 (40.9)	2,699 (39.9)
Medicare	1,581 (3.2)	168 (10.6)	115 (7.3)	499 (31.6)	799 (50.5)
Medicaid or other public programs	22,315 (45.5)	3,051 (13.7)	1,500 (6.7)	8,264 (37.0)	9,500 (42.6)
Self-pay	5,893 (12.0)	611 (10.4)	261 (4.4)	2,415 (41.0)	2,606 (44.2)
Others	5,954 (12.2)	792 (13.3)	281 (4.7)	3,034 (51.0)	1,847 (31.0)
ED census region [†]					
Midwest	13,218 (27.0)	1,250 (9.5)	601 (4.5)	5,859 (44.3)	5,508 (41.7) *
Northwest	6,513 (13.3)	761 (11.7)	324 (5.0)	3,155 (48.4)	2,273 (34.9)
South	20,870 (42.5)	2,925 (14.0)	1,344 (6.4)	8,796 (42.2)	7,805 (37.4)
West	8,446 (17.2)	1,224 (14.5)	686 (8.1)	2,385 (28.2)	4,151 (49.2)
ED rural-urban status [†]					
Urban	43,090 (87.8)	5,008 (11.6)	2,414 (5.6)	18,099 (42.0)	17,569 (40.8) *
Rural	5,957 (12.2)	1,152 (19.3)	541 (9.1)	2,096 (35.2)	2,168 (36.4)

* $p < 0.05$ for chi-square test for categorical data. For example, for the “age group in years”, the chi-square test is used to test the null hypothesis that testing and treatment status (both tested and treated, tested but not treated, treated but not tested, and neither tested nor treated) is independent of age group (15–19, 20–24, 25–29, 30–34, 35–39, 40–44 years). The $p < 0.05$ for the “age group in years” indicates that the distribution of the testing and treatment status outcomes varies significantly across age groups.

[†] ED census region and ED rural-urban status were based ED locations rather than patients’ residence.

Table 2.

Syphilis, HIV, and pregnancy testing, and emergency contraception use among patients who were identified with sexual assault diagnosis at their initial visit in emergency department (ED) during 2019–2023, Premier Healthcare Database

Demographics	Total number of patients N (col %)	Syphilis testing %	HIV testing %	Pregnancy testing %	Emergency contraception %
Overall	49,047	6,569 (13.4)	8,291 (16.9)	16,232 (33.1)	13,351 (27.2)
Age groups in years					
15–19	12,553 (25.6)	1,785 (14.2) *	2,198 (17.5) *	4,507 (35.9) *	4,066 (32.4) *
20–24	12,953 (26.4)	1,699 (13.1)	2,156 (16.6)	4,390 (33.9)	4,070 (31.4)
25–29	8,280 (16.9)	1,131 (13.7)	1,397 (16.9)	2,683 (32.4)	2,235 (27.0)
30–34	6,534 (13.3)	854 (13.1)	1,149 (17.6)	2,122 (32.5)	1,484 (22.7)
35–39	5,105 (10.4)	638 (12.5)	797 (15.6)	1,490 (29.2)	951 (18.6)
40–44	3,622 (7.4)	462 (12.8)	594 (16.4)	1,039 (28.7)	545 (15.1)
Race/ethnicity					
Non-Hispanic White	27,049 (55.1)	3,496 (12.9) *	4,488 (16.6) *	9,142 (33.8) *	7,187 (26.6) *
Non-Hispanic Black	10,834 (22.1)	1,628 (15.0)	1,930 (17.8)	3,533 (32.6)	3,127 (28.9)
Hispanic	6,559 (13.4)	888 (13.5)	1,138 (17.4)	2,096 (32.0)	1,728 (26.4)
Other	4,605 (9.4)	557 (12.1)	735 (16.0)	1,460 (31.7)	1,309 (28.4)
Insurance type					
Commercial (fee for service)	6,536 (13.3)	886 (13.6) *	987 (15.1) *	2,288 (35.0) *	2,015 (30.8) *
Managed care	6,768 (13.8)	839 (12.4)	1,012 (15.0)	2,051 (30.0)	1,896 (28.0)
Medicare	1,581 (3.2)	179 (11.3)	200 (12.7)	465 (29.4)	260 (16.5)
Medicaid or other public programs	22,315 (45.5)	3,027 (13.6)	3,990 (17.9)	7,861 (35.2)	5,735 (25.7)
Self-pay	5,893 (12.0)	537 (9.1)	712 (12.1)	1,693 (28.7)	1,292 (21.9)
Others	5,954 (12.2)	1,101 (18.5)	1,390 (23.4)	1,873 (31.5)	2,153 (36.2)
ED census region [†]					
Midwest	13,218 (27.0)	1,332 (10.1) *	1,715 (13.0) *	3,887 (29.4) *	3,722 (28.2) *
Northwest	6,513 (13.3)	1,093 (16.8)	1,370 (21.0)	1,714 (26.3)	2,329 (35.8)
South	20,870 (42.5)	2,955 (14.2)	3,403 (16.3)	7,118 (34.1)	5,527 (26.5)
West	8,446 (17.2)	1,189 (14.1)	1,803 (21.4)	3,512 (41.6)	1,773 (21.0)
ED rural-urban status [†]					
Urban	43,090 (87.8)	5,692 (13.2) *	6,974 (16.2) *	13,838 (32.1) *	11,824 (27.4) *
Rural	5,957 (12.2)	877 (14.7)	1,317 (22.1)	2,393 (40.2)	1,527 (25.6)

* p <0.05 for chi-square test between the clinical measurement and demographic factors, such as between the proportion of syphilis test and age group.

[†] ED census region and ED rural-urban status were based ED locations rather than patients' residence.