HIV and Syphilis Screening Among Adolescents Diagnosed With Pelvic Inflammatory Disease

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abstract

BACKGROUND AND OBJECTIVES: Women with pelvic inflammatory disease (PID) are at an increased risk for syphilis and HIV, but screening rates among adolescents have been understudied. Our objective is to measure the frequency of HIV and syphilis screening among adolescents who are diagnosed with PID and identify patient- and hospital-level characteristics associated with screening.

METHODS: We performed a retrospective cohort study using the Pediatric Health Information System from 2010 to 2015. We included visits to the emergency department by female adolescents who were diagnosed with PID and determined the frequency of HIV and syphilis screening. We performed separate multivariable logistic regression analyses to identify factors associated with screening.

RESULTS: Of the 10 698 patients who were diagnosed with PID, 22.0% (95% confidence interval [CI] 21.2%–22.8%) underwent HIV screening, and 27.7% (95% CI 26.9%–28.6%) underwent syphilis screening. Screening rates varied by hospital (HIV: 2.6%–60.4%; syphilis: 2.9%–62.2%). HIV screening was more likely to occur in younger (adjusted odds ratio [aOR] 1.2; 95% CI 1.0–1.3), non-Hispanic African American (aOR 1.4; 95% CI 1.2–1.7), non–privately insured (publicly insured [aOR 1.3; 95% CI 1.1–1.5], uninsured [aOR 1.6; 95% CI 1.2–2.0]), and admitted patients (aOR 7.0; 95% CI 5.1–9.4) at smaller hospitals (aOR 1.4; 95% CI 1.0–1.8). Syphilis screening was more likely to occur in younger (aOR 1.1; 95% CI 1.0–1.3), non-Hispanic African American (aOR 1.8; 95% CI 1.2–2.8), non–privately insured (publicly insured [aOR 1.4; 95% CI 1.2–1.6], uninsured [aOR 1.6; 95% CI 1.2–1.9]), and admitted patients (aOR 4.6; 95% CI 3.3–6.4).

CONCLUSIONS: We found low rates of HIV and syphilis screening among adolescents who were diagnosed with PID, with wide variability across hospitals.

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Dr Jichlinski conceptualized and designed the study, drafted the initial manuscript, and reviewed and revised the manuscript; Ms Badolato and Mr Pastor designed the data collection instruments, collected data, conducted the initial analyses, and reviewed and revised the manuscript; Dr Goyal conceptualized and designed the study, coordinated and supervised data collection and analyses, and critically reviewed and revised the manuscript; and all authors approved the final manuscript as submitted and agree to be accountable for all aspects of the work.

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WHAT'S KNOWN ON THIS SUBJECT: Patients with pelvic inflammatory disease (PID) are at an increased risk for syphilis and HIV. Screening for these conditions is recommended when diagnosing PID.

WHAT THIS STUDY ADDS: When adolescents are diagnosed with PID, they are underscreened for HIV and syphilis, with a wide variability of screening rates across hospitals.

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Of the almost 1 million cases of pelvic inflammatory disease (PID) diagnosed annually, 20% occur in adolescents.[1,2] Although many bacteria can cause PID, *Neisseria gonorrhoeae* (GC) and *Chlamydia trachomatis* (CT) are often identified as causative organisms.[3] It is estimated that up to 22% of women who are diagnosed with PID are also infected with HIV.[4] This may be because HIV lowers host immune response, thereby increasing susceptibility for lower genital tract infections to spread into the pelvis and increasing the risk for PID.[3] Furthermore, inflammatory sexually transmitted infections (STIs), such as GC and CT, increase the risk of HIV acquisition.[5] Similarly, women diagnosed with PID are at a higher risk for syphilis infection.[6]

The Centers for Disease Control and Prevention (CDC) has recommended HIV screening for all women diagnosed with PID since 2006, and in 2010, the CDC recommended universal HIV screening for all individuals 13 to 64 years of age presenting to any health care facility.[7,8] Despite these CDC guidelines, women, and particularly adolescents, with STIs are frequently underscreened for HIV.[7–9] The authors of 1 study (published in 2004) on adolescents who were diagnosed in the emergency department (ED) with STIs or PID found HIV screening rates as low as 1%.[7] Although syphilis screening among those who are diagnosed with PID is not explicitly recommended by the CDC, the CDC sexually transmitted disease treatment guidelines recommend syphilis screening in those at a high risk for infection.[3] PID, often a complication of untreated or undertreated cervicitis, may constitute a condition that places individuals at a high risk for syphilis. However, rates of syphilis screening among women who are diagnosed with PID have been under-studied. One previous study that was conducted in a general ED revealed syphilis screening rates of 31% among those tested for GC or CT.[10]

The majority of adolescent cases of PID are diagnosed in EDs rather than in primary care practices.[11] As a result, understanding ED practices of screening for STIs when diagnosing PID has the potential for tremendous public health impact. For this study, our goal was to measure rates of HIV and syphilis screening in adolescents who were diagnosed with PID in EDs of children's hospitals and to identify patient- and hospital-level characteristics associated with HIV and syphilis screening.

METHODS

Study Design

We performed a retrospective cohort study using the Pediatric Health Information System (PHIS) from 2010 to 2015. This study was approved by our institutional review board.

Data Source

The PHIS is an administrative database that contains inpatient-level, ED-level, ambulatory surgery–level, and observation encounter–level data from 48 children's hospitals in the United States that are affiliated with the Children's Hospital Association (Overland Park, KS).[12] Contributing hospitals are pediatric tertiary-care centers located in 27 states, including the District of Columbia. The PHIS contains deidentified administrative data (demographics, diagnosis codes, procedure codes) and billing data (clinical charges) on all hospital discharges. This data set does not contain information regarding the results of diagnostic testing or procedures.

Study Population

All visits for female patients between the ages of 12 and 21 with an *International Classification of Diseases, Ninth Revision* or *International Classification of Diseases, 10th Revision* diagnosis code of PID (see Supplemental Table 3) from 2010 to 2015 were included in this study.

Outcome Measures

The primary outcome was documentation of laboratory testing for HIV and/or syphilis. Clinical Transaction Classification codes (see Supplemental Table 4) were used to determine if testing was ordered. GC and CT testing was also abstracted for comparison with HIV and syphilis testing rates. Because STI testing results are not always immediately available and patients may return to the ED for STI treatment, we included any STI testing that was conducted on the index visit or during any visit within 7 days before the index visit.

Covariables of interest included both patient- and hospital-level factors. Patient-level factors included age, race and/or ethnicity, insurance status, ED disposition, and year of visit. Hospital-level factors included hospital size and geographic region. Race and ethnicity were categorized as non-Hispanic white, non-Hispanic African American, Hispanic, other, and unknown. For insurance status, patients were characterized as being publicly, privately, or uninsured. ED disposition status was defined as discharged from the hospital or hospital admission. Hospital size was categorized as ≤300 beds or >300 beds. Geographic region was characterized as Northeast, Midwest, South, or West.

Data Analysis

We used standard descriptive statistics to summarize the patient population with PID and measure the proportion of visits that included HIV or syphilis testing. We also calculated the proportion of visits that included GC or CT testing for comparison with HIV and syphilis testing rates.

TABLE 1 Descriptive Characteristics of Study Population

Variable	Population (N = 10 698), n (%)
Age, y	
12–16	5961 (55.7)
17–21	4737 (44.3)
Race and/or ethnicity	
White, non-Hispanic	2673 (25.0)
African American, non-Hispanic	5802 (54.2)
Hispanic	1460 (13.7)
Other, non-Hispanic	605 (5.7)
Unknown	158 (1.4)
Insurance status	
Public	7543 (70.5)
Private	2111 (19.7)
Uninsured	1044 (9.8)
Disposition	
Admission	4043 (37.8)
Discharge	6655 (62.2)
Geographic region	
Northeast	2276 (21.2)
South	3720 (34.8)
Midwest	3332 (31.2)
West	1370 (12.8)
Hospital size, beds	
≤300	3297 (30.8)
>300	7401 (69.2)

We performed separate bivariable analyses to identify covariables associated with HIV and syphilis testing. Covariables with P values <.2 were included in the multivariable logistic regression models in which generalized estimating equations were used to account for clustering by hospital. A correlation analysis was conducted to determine if HIV screening was associated with syphilis screening. An α of .05 was used to signify statistical significance, and adjusted odds ratios (aORs) with 95% confidence intervals (CIs) are reported. We used SAS Software version 9.3 (SAS Institute, Inc, Cary, NC) to perform all analyses.

RESULTS

Between 2010 and 2015, there were 10 698 cases of PID that met inclusion criteria. The mean age of the study population was 16.7 years (SD ±1.8). The majority of adolescents who were diagnosed with PID were publicly insured (70.5%), and approximately half were non-Hispanic African American (54.2%). A greater proportion of PID cases were diagnosed in larger-sized hospitals (69.2%). More than one-third of cases resulted in hospital admission (37.8%). The characteristics of the study population are further described in Table 1.

Of the 10 698 patients with PID, 22.0% (95% CI 21.2%–22.8%) underwent HIV screening, 27.7% (95% CI 26.9%–28.6%) underwent syphilis screening, and 18.4% (95% CI 17.6%–19.1%) of all patients underwent both HIV and syphilis screening. By contrast, 82.0% (95% CI 81.3%–82.7%) and 84.4% (95% CI 83.7%–85.1%) were tested for GC and CT, respectively. We identified 407 (3.8%) patients who also visited the ED within the 7 days before the visit in which they were diagnosed with PID (index visit). Of those patients, 7.6% were screened for HIV, and 13.3% were screened for syphilis during the previous visit. Of the remaining unscreened patients, 18.1% were screened for HIV, and 19.5% were screened for syphilis at the subsequent visit during which PID was diagnosed.

The rates of HIV and syphilis screening increased over time (Fig 1). HIV screening rates increased from 16.3% in 2010 to 26.1% in 2015 (P < .001). Similarly, there was an increase in the rates of syphilis screening from 22.9% in 2010 to 31.9% in 2015 (P < .001). Over the study period, HIV screening rates by hospital ranged from 2.6% to 60.4% and from 2.9% to 62.2% for syphilis (Fig 2). HIV screening rates were moderately correlated with screening rates for syphilis within hospitals (r^2 = 0.4; Fig 2).

In a multivariable model in which adjustments were made for age, race and/or ethnicity, insurance status, disposition, year, geographic region, and hospital size, HIV screening was more likely to occur in 12- to 16-year-olds compared with older adolescents (aOR 1.2; 95% CI 1.0–1.3), in non-Hispanic African American patients (aOR 1.4; 95% CI 1.2–1.7), in non–privately insured patients (publicly insured [aOR 1.3; 95% CI 1.1–1.5], uninsured [aOR 1.6; 95% CI 1.2–2.0]), during visits that resulted in hospital admission (aOR 7.0; 95% CI 5.1–9.4), and in smaller hospitals (≤300 beds [aOR 1.4; 95% CI 1.0–1.8]; Table 2). Similarly, the multivariable model for syphilis testing revealed that screening was also more likely to occur in 12- to 16-year-olds (aOR 1.1; 95% CI 1.0–1.3), in non-Hispanic African American patients (aOR 1.8; 95% CI 1.2–2.8), in non–privately insured patients (publicly insured [aOR 1.4; 95% CI 1.2–1.6], uninsured [aOR 1.6; 95% CI 1.2–1.9]), and during visits that resulted in hospital admission (aOR 4.6; 95% CI 3.3–6.4; Table 2).

DISCUSSION

In this multicenter study of almost 11 000 adolescents who were diagnosed with PID across 48 children's hospitals, we found low rates of HIV and syphilis screening despite an increased risk for infection

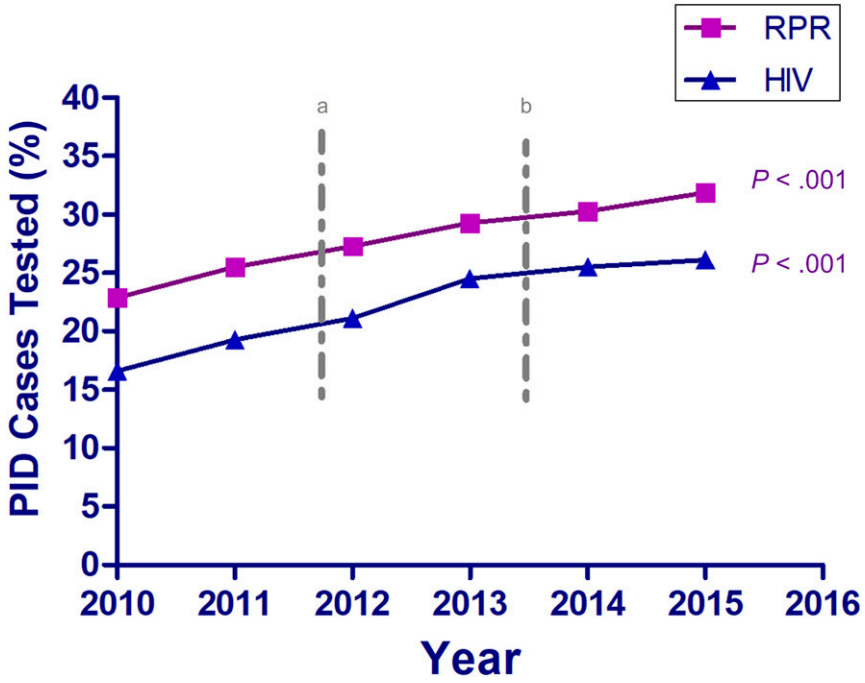

FIGURE 1
HIV and syphilis screening rates over time. [a] American Academy of Pediatrics HIV screening guidelines are published. [b] US Preventive Services Task Force HIV screening guidelines are published. RPR, rapid plasma reagin.

among this population.[5,7] Although screening rates increased somewhat from 2010 to 2015, rates overall remained low. Furthermore, we found wide variability by hospital, with rates of screening from 2% to >60%.

Our results are consistent with earlier research that has revealed low rates of HIV screening among adolescents and adults who are diagnosed with PID.[7–9] For instance, Beckmann et al[7] collected data from

TABLE 2 Patient- and Hospital-Level Factors Associated With HIV and Syphilis Screening

Variable	Screened for HIV		Screened for Syphilis	
	N (%)	aOR (95% CI)[a]	*N* (%)	aOR (95% CI)[a]
Age, y				
17–21	1150 (19.3)	Referent	1539 (25.8)	Referent
12–16	1205 (25.4)	1.2 (1.0–1.3)	1426 (30.1)	1.1 (1.0–1.3)
Race and/or ethnicity				
White, non-Hispanic	586 (21.9)	Referent	645 (24.1)	Referent
Hispanic	293 (20.1)	0.9 (0.7–1.1)	292 (20.0)	0.9 (0.6–1.3)
African American, non-Hispanic	1276 (22.0)	1.4 (1.2–1.7)	1831 (31.6)	1.8 (1.2–2.8)
Other, non-Hispanic	159 (26.3)	1.2 (0.9–1.5)	160 (26.5)	1.0 (0.6–1.7)
Unknown	41 (26.0)	1.2 (0.7–1.9)	37 (23.4)	1.0 (0.6–1.6)
Insurance status				
Private	463 (21.9)	Referent	535 (25.3)	Referent
Public	1685 (22.3)	1.3 (1.1–1.5)	2161 (28.7)	1.4 (1.2–1.6)
Uninsured	207 (19.8)	1.6 (1.2–2.0)	269 (25.8)	1.5 (1.2–1.9)
Disposition				
Discharge	655 (9.9)	Referent	1144 (17.2)	Referent
Admission	1700 (42.1)	7.0 (5.1–9.4)	1821 (45.0)	4.6 (3.3–6.4)
Hospital size, beds				
>300	1424 (19.2)	Referent	1992 (26.9)	Referent
≤300	931 (28.2)	1.4 (1.0–1.8)	973 (29.5)	1.1 (0.7–1.6)

[a] Adjusted for displayed variables, year of encounter, and geographic region.

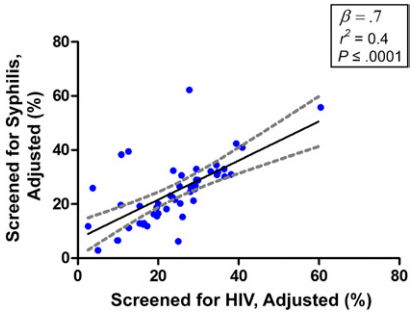

FIGURE 2
Variations in HIV and syphilis screening by hospital.

the National Hospital Ambulatory Medical Care Survey between 1992 and 1998 and found HIV screening rates of 1% among adolescents who were diagnosed with STIs or PID. Unfortunately, 12 years later, our results indicate that although HIV screening rates in adolescents with PID have increased, they still remain low. By comparison, in a study on Medicaid-enrolled adults presenting with STIs or PID, it was found that although they were underscreened, they received HIV testing at considerably higher rates (42.6%).[8] Adults may be screened at higher rates than adolescents because clinicians may be more hesitant to approach adolescents because of confidentiality concerns. For instance, there may be a concern that clinicians may be unable to confidentially notify patients of laboratory results after ED discharge or that parents or caregivers may become aware of STI testing when reviewing hospital or insurance bills.

Our results are also consistent with previous studies that reveal higher STI screening rates among minority, publicly insured patients.[13–15] This screening practice may reflect a bias among clinicians who associate STIs with minority populations. Similarly, previous authors have speculated that nonprivate insurance may act as a marker for socioeconomic status, and clinicians may associate STIs with patients of lower income, thus leading to a greater tendency

to screen this population.[13,14] Results from our study add to the body of evidence that there are unequal STI screening practices on the basis of race or socioeconomic status among the population of patients who are diagnosed with PID. Such discrepancies in screening can negatively impact quality of medical care, and further emphasize the need for the establishment of a standardized approach to STI screening.

We found that younger adolescents were more likely to undergo HIV and syphilis screening. These results are in contrast to those in studies in which the authors have found a greater tendency to screen older adolescents compared with younger adolescents for STIs in the ED.[13] Our results may be reflective of a concern for an even greater risk for coinfection with HIV and syphilis when clinicians are making a diagnosis of PID in younger adolescents.

We also found higher rates of screening among patients who are hospitalized. This may be because individuals with PID who meet CDC hospitalization criteria are often sicker than patients discharged from the hospital.[3] Therefore, clinicians may have a greater tendency to consider the risk of coinfection with HIV and syphilis in this population. Additionally, clinicians may be more likely to conduct HIV and syphilis testing in adolescents who are hospitalized because they are able to provide results notification in a confidential setting; syphilis testing is rarely performed as point-of-care, and not all hospitals perform point-of-care HIV testing.

Despite the link between syphilis infection and PID, neither adolescents nor women with PID are singled out as high-risk groups by the CDC.[3] Several factors indicate the need for broader screening practices. First, detailed sexual histories are often not obtained on adolescents, making any high-risk behavior harder to identify.[13,16] Second, syphilis rates have been rising after years of decline. Since 2001, syphilis rates have been steadily increasing almost every year, with the national rate of primary and secondary syphilis increasing by almost 18% from 2015 to 2016.[1] Finally, syphilis is now most prevalent in young adults.[1] These changing demographics indicate that a higher index of suspicion and broader screening measures for syphilis may be beneficial to adolescents.

Our study has several potential limitations that warrant consideration. Because of the limitations of the PHIS, we are unable to ascertain if any of the patients included in our cohort had previously been diagnosed with HIV because these patients should have been excluded from our study population. However, we believe this would include only a small group of patients and therefore, would likely have a minimal effect on our estimates. Another limitation is that the PHIS is based on administrative data and relies on accuracy of diagnosis and billing codes, which can result in misclassification bias because of coding errors. However, coding errors would be random, and the PHIS undergoes rigorous reliability and validity checks before data can be analyzed.[12] Because this database contains information from tertiary-care children's hospitals only, our results may not be generalizable to adolescents treated in nonpediatric hospitals. Finally, in our study, we were unable to account for any screening that took place at an outside facility. For example, if a patient received a diagnosis at a primary care center and was referred or transferred to the hospital, results of any screening performed at an outpatient facility would not be captured.

CONCLUSIONS

Our findings reveal low rates of HIV and syphilis screening among adolescents who are diagnosed with PID in a large sample of pediatric hospitals, with considerable variability by hospital. These results reveal that there is an opportunity to improve HIV and syphilis screening rates in this population. Further research exploring the differences in screening rates between pediatric and general EDs and investigating the prevalence of HIV and syphilis among adolescents who are diagnosed with PID is warranted. These data could help inform the development of innovative methods by which to improve screening among this high-risk population, including the implementation of electronic alerts, decision support, and clinical pathways through the electronic health record.

ABBREVIATIONS

aOR: adjusted odds ratio
CDC: Centers for Disease Control and Prevention
CI: confidence interval
CT: *Chlamydia trachomatis*
ED: emergency department
GC: *Neisseria gonorrhoeae*
PHIS: Pediatric Health Information System
PID: pelvic inflammatory disease
STI: sexually transmitted infection

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