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National Trends in Pelvic Inflammatory Disease among Adolescents in the Emergency Department

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Abstract

Objective—In 2002 the CDC broadened the pelvic inflammatory disease (PID) diagnostic criteria to increase detection and prevent serious sequelae of untreated PID. The impact of this change on PID detection is unknown. Our objective was to estimate trends in PID diagnosis among adolescent emergency department (ED) patients before and after the revised CDC definition and identify factors associated with PID diagnoses.

Methods—We performed a retrospective repeated cross-sectional study using the National Hospital Ambulatory Medical Care Survey from 2000–2009 of ED visits by 14 to 21 year old females. National estimates of PID rates were calculated. Multivariable logistic regression analyses and tests of trends were performed.

Results—During 2000–2009, of the 77 million female adolescent ED visits, there were an estimated 704,882 (95% CI 571,807, 837,957) cases of PID. Following the revised criteria, PID diagnosis declined from 5.4 cases per 1000 U.S. adolescent females to 3.9 cases per 1000 ($p=0.03$). In a multivariable model, age 17 years (OR 2.14, 95% CI 1.25, 3.64) and Black race (OR 2.04, 95% CI 1.36, 3.07) were associated with PID diagnosis.

Conclusions—Despite broadened CDC diagnostic criteria, PID diagnoses did not increase over time. This raises concern about awareness and incorporation of the new guidelines into clinical practice.

Keywords

Pelvic inflammatory disease; Adolescents; Trends

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INTRODUCTION

Of the almost 1 million annually diagnosed cases of pelvic inflammatory disease (PID), 20% are estimated to occur in adolescents.[1–3] Although PID is highly preventable with timely diagnosis and treatment of sexually transmitted infections (STI), it is associated with significant morbidity, including infertility, ectopic pregnancy, tubo-ovarian abscesses, pelvic adhesion, dyspareunia, and chronic pelvic pain.[2, 4, 5]

Adolescents with PID are more likely to present to emergency departments (ED) rather than primary care or obstetrics and gynecology clinics.[6] Because abdominal and genitourinary complaints are the most common reasons for ED visits among adolescent females,[7] it is critical that ED providers consider PID as a potential diagnosis when evaluating these patients. However, the diagnosis of PID can be difficult since the clinical presentation of PID may mimic other pelvic and abdominal processes including, but not limited to appendicitis, ovarian torsion, urinary tract infection, and constipation. Given the difficulty of diagnosis and the morbidity associated with disease, the Centers for Disease Control and Prevention (CDC) recommends that health-care providers maintain a low threshold for the diagnosis of PID. In fact, in 2002 the CDC broadened PID diagnostic criteria in an effort to increase diagnostic sensitivity after data suggested that the 1998 CDC criteria would miss more than 15% of true cases of upper genital infection.[8] With this change, the CDC began to recommend the empiric treatment for PID in sexually active women if experiencing lower abdominal pain and if they have cervical motion tenderness *or* uterine/adnexal tenderness, as opposed to having *both* present on exam per the prior recommendations.[9]

To our knowledge, there have been no studies that have specifically investigated the impact of the CDC diagnostic change in the ED diagnosis of PID. Therefore, we sought to estimate trends in PID diagnosis among adolescent ED patients before and after the 2002 revised CDC diagnostic guidelines. Our secondary objectives were to determine factors associated with PID diagnosis.

METHODS

Study Design

We conducted a retrospective repeated cross-sectional analysis of the National Hospital Ambulatory Medical Care Survey (NHAMCS) from 2000–2009. This study was considered exempt from formal review by our Institutional Review Board.

Data Source and Study Population

The NHAMCS is an annual, national probability sample survey of hospital EDs conducted by the National Center for Health Statistics (NCHS) branch of the CDC. The survey is conducted during a randomly assigned 4-week data period using a stratified and clustered design for selection of geographic primary sampling units, hospitals within primary sampling units, EDs within hospitals, and patient visits within EDs. Each visit represents a larger number of patients in the population. The NCHS provides probability weights which are equal to the inverse probability of any visit being sampled and allow for the generation of nationally representative estimates using data collected in the NHAMCS.

The eligible study population included all sampled ED visits by females between 14 and 21 years during 2000–2009.

Outcome Measures

Our outcome variable was diagnosis of PID. PID cases were captured by ICD-9 codes of 098.10, 098.16, 098.17, 098.19, 098.86, 099.56, 614.0, 614.2, 614.3, 614.5, 614.8, 614.9, 615.0, 615.9 (Appendix). Covariates of interest included year of ED visit, patient age, race and ethnicity, insurance status, disposition, and ED geographic location based on prior literature as well as authors' hypotheses that these covariates may be related to PID diagnosis. Patient race and ethnicity was categorized as: White (non-Hispanic), Black or African American (Non-Hispanic), Hispanic, or Other. Insurance status was categorized as private, public, or no insurance.

Data Analysis

We used descriptive statistics with survey weighting to perform all analyses. Annual census data was used as the denominator for all rate calculations. Non-parametric trend analysis was used to evaluate trends in PID diagnosis by year and also to compare trends in diagnosis before and after the CDC PID diagnostic criteria change. Finally, logistic regression modeling was performed to identify factors associated with PID diagnosis. For our multivariable model, we included all variables found to have a p-value <0.1 on bivariate analysis.

RESULTS

During 2000–2009, there were 22,866 sampled patient visits, representing 77.3 million female adolescent ED visits. Of these, there were an estimated 704,882 (95% CI 571,807, 837,957) diagnosed cases of PID. PID comprised 1.0% of all female adolescent ED diagnoses and 3.3% of diagnoses among those presenting with lower abdominal pain or genitourinary complaints.

Figure 1 illustrates the incidence of ED diagnosed cases of PID per 1000 persons per year over a United States population of adolescent females based on yearly census data. We found no change in PID diagnosis rates over time (p for trend=0.67). However, when we compared PID visit rates before and after introduction of the 2002 CDC diagnostic guideline change, we found a modest decline, from 5.4 (95% CI 2.7, 8.1) per 1000 persons in 2000–2002 to 3.9 (95% CI 1.5, 6.3) per 1000 persons in 2003–2009 (p=0.03).

Table 1 compares demographics of the total population with the population diagnosed with PID. Table 2 displays the unadjusted and adjusted models for factors associated with PID diagnosis. On bivariate analysis, geographic region was not found to have a statistically significant association with PID diagnosis (p=0.6), and therefore was not included in our final multivariable model. In a fully adjusted model, age 17–21 years (OR 2.14, 95% CI 1.25, 3.64) and Black race (OR 2.04, 95% CI 1.36, 3.07) remained significantly associated with PID diagnosis.

DISCUSSION

This analysis represents the first population-based assessment of trends in ED based PID diagnosis before and after broadening of the CDC diagnostic criteria in 2002. Despite the broadening of the CDC diagnostic criteria, we did not find an increase in PID diagnosis rates in adolescent ED patients.

There are multiple possible explanations for the decline in PID diagnosis rates we observed among adolescent ED females. One reason might be a decline in *Chlamydia trachomatis* rates, the organism most commonly associated with PID. However, recent studies have shown that although overall chlamydia prevalence has decreased, there has been no change

in the prevalence of chlamydia among females aged 14 to 25 years.[10] Second, perhaps with increased STI screening rates, patients may be treated in other outpatient settings prior to the development of adverse sequelae such as PID. Indeed, other studies have found declining rates of PID with concurrent increase in STI screening rates.[11, 12] However, while the chlamydia screening rates from 2000 to 2010 nearly doubled from 25% to 48% among young women, nonetheless, most are still not receiving screening.[13] Third, perhaps patients may be more likely to undergo PID diagnosis and management in other outpatient settings (e.g. physician offices) rather than EDs. However, Trent and colleagues recently reported that 70% of adolescent PID cases are diagnosed in the ED as compared to other outpatient settings.[6]

Another possible explanation for the decline in ED PID diagnosis rates is that providers are under-detecting PID. The diagnosis of PID can be challenging as the clinical presentation of PID may mimic other pelvic and abdominal processes. One study of pediatric ED providers found that less than 50% of nationally surveyed providers could currently diagnose PID.[14] Another study found that over 50% of adolescent patients diagnosed with cervicitis in the ED actually met diagnostic criteria for PID.[15] These were among patients who actually had pelvic exams performed. As almost 40% of pediatric EM providers report discomfort with the performance of pelvic exams on adolescent females,[14] it is possible that many adolescents with PID are missed due to lack of an appropriate clinical exam. Therefore, despite rates of adolescents reporting sexual experience remaining steady,[16] adolescent STI rates remaining relatively constant, STI screening rates remaining low, and adolescent ED use for sexual health complaints remaining high, it is concerning that ED PID diagnosis rates have declined over the last ten years and may be a result of under-detection. This may have substantial public health consequences as decreased detection and under-treatment of PID will lead to significant morbidity.

We found certain patient demographics to be associated with PID diagnosis. For instance, older patient age was found to be associated with PID diagnosis. This finding is consistent with others that have found older adolescent age to be associated with PID diagnosis.[17] Furthermore, Black race was found to be significantly associated with PID diagnosis. Other studies have reported PID rates to be two to three times higher among black women than among white women.[18] These disparities are consistent with the marked racial disparities observed for the incidence of chlamydia and gonorrhea. However, because of the subjective methods by which PID is diagnosed, which may in itself be prone to racial and socioeconomic biases, racial disparity data should be interpreted with caution.[13, 18]

Several limitations to this study deserve mentioning. First, given that PID is largely a clinical diagnosis and we do not have access to physical exam data, we are unable to validate PID diagnosis. It is also possible that PID cases were under-diagnosed. A recent study found that 52% of adolescent ED patients who met criteria for PID were misdiagnosed as having cervicitis.[15] Additionally, it is possible that due to confidentiality issues, a provider may choose not to provide an ICD-9 diagnosis of PID although PID is clinically suspected and the patient is being treated for PID, and may provide a more vague diagnosis of abdominal pain. This clinical behavior would lead to an underestimation of PID rates. However, it is unlikely that these factors would have changed over time. Furthermore, it is possible that the decline in PID diagnosis rates may be attributable to other residual confounders (e.g. earlier detection and treatment of STIs, increasing outpatient treatment of PID) as well as unknown confounders that cannot be accounted for in this study.

In conclusion, we found a decline in PID diagnosis rates among adolescent ED patients over time despite the broadening of the CDC diagnostic criteria. Whether this result reflects changing epidemiology of PID or possible under-detection of PID should be the subject of

future studies. These findings suggest that there may be a need for improvement in the ED identification of adolescents with PID. Prior studies have found that providing brief written information about PID diagnosis and treatment resulted in improved performance in the identification of PID and its treatment. [14, 19] Future studies that evaluate the impact of such interventions and perhaps clinical pathways on a larger scale are warranted and may confer significant public health impact.

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Abbreviations

PID	Pelvic inflammatory disease
ED	Emergency department
STI	Sexually transmitted infections
CDC	Centers for Disease Control and Prevention
NHAMCS	National Hospital Ambulatory Medical Care Survey
NCHS	National Center for Health Statistics

References

- Centers for Disease Control and Prevention DoSP, National Center for HIV/AIDS, Viral Hepatitis, STD, and TB Prevention. [Accessed September 4, 2012.] Pelvic Inflammatory Disease (PID): CDC Fact Sheet. 2011. <http://www.cdc.gov/std/pid/STDFact-PID.htm>
- Shafer MA, Sweet RL. Pelvic Inflammatory Disease in Adolescent Females. *Adolesc Med*. 1990 Oct; 1(3):545–564. [PubMed: 10350730]
- Tarr ME, Gilliam ML. Sexually transmitted infections in adolescent women. *Clin Obstet Gynecol*. 2008 Jun; 51(2):306–318. [PubMed: 18463461]
- Gray-Swain MR, Peipert JF. Pelvic inflammatory disease in adolescents. *Curr Opin Obstet Gynecol*. 2006 Oct; 18(5):503–510. [PubMed: 16932044]
- Trent M, Haggerty CL, Jennings JM, et al. Adverse adolescent reproductive health outcomes after pelvic inflammatory disease. *Arch Pediatr Adolesc Med*. 2011; 165(1):49–54. [PubMed: 21199980]
- Trent M, Ellen JM, Frick KD. Estimating the direct costs of pelvic inflammatory disease in adolescents: a within-system analysis. *Sex Transm Dis*. 2011; 38(4):326–328. [PubMed: 21057380]
- Ziv A, Boulet JR, Slap GB. Emergency department utilization by adolescents in the United States. *Pediatrics*. 1998; 101(6):987–994. [PubMed: 9606224]
- Peipert JF, Ness RB, Blume J, et al. Clinical predictors of endometritis in women with symptoms and signs of pelvic inflammatory disease. *Am J Obstet Gynecol*. 2001; 184(5):856–863. discussion 863–854. [PubMed: 11303192]

9. Centers for Disease Control and Prevention. Sexually transmitted diseases treatment guidelines 2002. MMWR. 2002; 51(RR-6):48–52.
10. Datta SD, Torrone E, Kruszon-Moran D, et al. Chlamydia trachomatis trends in the United States among persons 14 to 39 years of age, 1999–2008. Sex Transm Dis. 2012; 39(2):92–96. [PubMed: 22249296]
11. Rekart ML, Gilbert M, Meza R, et al. Chlamydia public health programs and the epidemiology of pelvic inflammatory disease and ectopic pregnancy. J Infect Dis. 2013; 207(1):30–38. [PubMed: 23100568]
12. Scholes D, Satterwhite CL, Yu O, et al. Long-term trends in Chlamydia trachomatis infections and related outcomes in a U.S. managed care population. Sex Transm Dis. 2012; 39(2):81–88. [PubMed: 22249294]
13. Centers for Disease Control and Prevention. Sexually Transmitted Disease Surveillance 2009. Atlanta: Department of Health and Human Services; 2010.
14. Balamuth F, Zhao H, Mollen C. Toward improving the diagnosis and the treatment of adolescent pelvic inflammatory disease in emergency departments: results of a brief, educational intervention. Pediatr Emerg Care. 2010; 26(2):85–92. [PubMed: 20094001]
15. Woods JL, Bailey SL, Hensel DJ, et al. Cervicitis in adolescents: do clinicians understand diagnosis and treatment? J Pediatr Adolesc Gynecol. 2011; 24(6):359–364. [PubMed: 21872515]
16. Centers for Disease Control and Prevention. Youth Risk Behavior Surveillance - United States, 2011. MMWR. 2012; 61(4):24–29.
17. Kelly AM, Ireland M, Aughey D. Pelvic inflammatory disease in adolescents: high incidence and recurrence rates in an urban teen clinic. J Pediatr Adolesc Gynecol. 2004; 17(6):383–388. [PubMed: 15603980]
18. Sutton MY, Sternberg M, Zaidi A, et al. Trends in pelvic inflammatory disease hospital discharges and ambulatory visits, United States, 1985–2001. Sex Transm Dis. 2005; 32(12):778–784. [PubMed: 16314776]
19. Trent M, Judy SL, Ellen JM, et al. Use of an institutional intervention to improve quality of care for adolescents treated in pediatric ambulatory settings for pelvic inflammatory disease. J Adolesc Health. 2006; 39(1):50–56. [PubMed: 16781961]

Appendix: Table of ICD-9 codes and associated diagnoses

ICD-9 Code	Associated Diagnosis
098.10	Gonococcal infection (acute) of upper genitourinary tract, site unspecified
098.16	Gonococcal endometritis (acute)
098.17	Gonococcal salpingitis specified as acute
098.19	Other gonococcal infection (acute) of upper genitourinary tract
098.86	Gonococcal peritonitis
099.56	Other venereal diseases due to Chlamydia trachomatis, peritoneum
614.0	Acute salpingitis and oophoritis
614.2	Salpingitis and oophoritis not specified as acute, subacute, or chronic
614.3	Acute parametritis and pelvic cellulitis
614.5	Acute or unspecified pelvic peritonitis, female
614.8	Other specified inflammatory disease of female pelvic organs and tissues
614.9	Unspecified inflammatory disease of female pelvic organs and tissues
615.0	Acute inflammatory diseases of uterus, except cervix
615.9	Unspecified inflammatory disease of uterus

IMPLICATIONS AND CONTRIBUTION

This is the first study to evaluate the impact of the broadened CDC PID diagnostic criteria on adolescent PID diagnosis rates. Rather than finding an increase, we found a decrease in PID diagnoses. This raises concern about awareness and incorporation of the new guidelines into clinical practice.

Figure 1. Incidence of ED diagnosed PID cases per 1000 US adolescent females (ages 14–21) per year

*Bars along each data point reflect 95% Confidence Intervals

Table 1

Description of PID Diagnosed Adolescent Female Population in NHAMCS

Variable		PID Diagnosed Population
Number of visits		704,882
Mean Age (years)		18.7
Race/Ethnicity	White	48.2 %
	Black	42.1 %
	Hispanic	9.3 %
	Other	0.4 %
Payer	Private	27.2 %
	Public	33.6 %
	Self-pay/other	30.1 %
	Unknown	9.1 %
Geographic Region	Northeast	13.9 %
	Midwest	24.4 %
	South	49.7 %
	West	12.0 %
% Hospitalized		7.7 %

Table 2

Factors associated with PID Diagnosis

Variable		Unadjusted Odds (95% CI)	Adjusted Odds (95% CI)
Age Category	14–16	Ref	Ref
	17–21	2.26 (1.34, 3.83)	2.14 (1.25, 3.64)
Race/Ethnicity	Non-Black Race	Ref	Ref
	Black Race	2.18 (1.47, 3.24)	2.04 (1.36, 3.07)
Insurance Status	Private Insurance	Ref	Ref
	Non-Private Insurance	1.64 (1.07, 2.51)	1.39 (0.89, 2.18)
ED Disposition	Discharge	Ref	Ref
	Hospital Admission	1.90 (0.91, 3.99)	1.99 (0.95, 4.17)