# Can Case Reports Be Used to Identify Trends in Pelvic Inflammatory Disease? San Francisco, 2004–2009

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**Background:** Chlamydia screening programs have been shown to reduce the incidence of pelvic inflammatory disease (PID), which can lead to ectopic pregnancy, tubal infertility, and chronic pelvic pain. However, few reliable data exist on the population-level burden of PID and the utility of passive case-based surveillance of this important infertility-related outcome.

**Methods:** We conducted a descriptive analysis of all case reports of PID in San Francisco from 2004 to 2009 through our passive case reporting surveillance system. We examined demographics as well as sexually transmitted disease history. Pearson $\chi^2$ and Fisher exact tests were used to assess significance in the trend analysis.

**Results:** There were 245 case reports over the 6-year period examined. There were no statistically significant differences over this period based on demographics. However, an increasing proportion of cases were diagnosed at the municipal sexually transmitted disease clinic.

**Discussion:** PID is an important intermediary to assess the impact in reducing infertility in areas where chlamydia screening programs have been implemented. As the locus of PID care has shifted from inpatient to outpatient settings, passive PID surveillance has not adjusted. Efforts should be made to increase provider awareness that pelvic inflammatory disease is a notifiable condition and improve reporting among providers by devoting resources to either improving current passive surveillance or to the development of new innovative ways to conduct PID surveillance.

Prevention of sexually transmitted disease (STD)-related infertility has been an important national goal since the 1988 creation of the Infertility Prevention Project.[1] In 2009, the Centers for Disease Control and Prevention's (CDC) Division of Sexually Transmitted Disease Prevention designated reducing STD-related infertility as a high priority activity.[2] Because *Chlamydia trachomatis* causes a portion of infertility, chlamydia surveillance and prevalence monitoring data have been indicators used to assess the prevalence of and monitor trends in infertility.[3,4] However, using chlamydia trends among women to assess potential impact on infertility is challenging for a number of reasons, including the often asymptomatic nature of chlamydial infections[5] and the fact that increases in screening coverage often lead to increases in case finding.[3] Additionally, most women diagnosed with and treated for chlamydia will not likely develop infertility.[6–8] As a result, decreases in chlamydia morbidity may not necessarily translate into measurable reductions in STD-related infertility.

Pelvic inflammatory disease (PID) is a more proximal outcome associated with STD-related infertility, making it a more suitable marker in measuring successes in reducing infertility locally and nationally. PID is an infectious disorder of the upper genital tract caused by a wide spectrum of aerobic and anaerobic microbes that ascend from the cervix or vagina into the endometrium, fallopian tubes, or contiguous structures.[9] When left untreated, PID can cause serious sequelae, including chronic pelvic pain, tubal infertility, and ectopic pregnancy.[9] *Chlamydia trachomatis* and *Neisseria gonorrhoeae* are the 2 bacteria most often indicated in cases of pelvic inflammatory disease; however, up to 70% of PID cases are either of unknown etiology or associated with bacteria/conditions for which there are no screening guidelines or commercially available assays, e.g., bacterial vaginosis, *Mycoplasma genitalium.*[10]

Although 21 states and US territories list PID as a reportable condition (14 explicitly reportable in statutory/regulatory language, 7 implicitly reportable or commonly reported though not specifically listed in statutory/regulatory language),[11] few reliable data exist on the population-level burden of PID and the utility of passive case based surveillance of this important infertility-related condition. Sutton et al ascertained there were 769,589 cases of PID diagnosed annually between 1995 and 2001, using data from 3 national probability surveys.[12] In a study by Bohm et al, Medstat MarketScan Databases were used to describe the burden of disease and trends in PID among privately insured women from 2001 to 2005.[13] During this time period, the authors found that the annual PID diagnosis rates decreased but the proportion of women hospitalized for PID care remained relatively stable.[13] Similarly, the California Patient Discharge Database was used to describe trends in PID hospitalization and tuboovarian abscess, which showed a decrease in hospitalization rates from 1991 to 2001.[14] Using PID surveillance data, either in place of or in addition to, chlamydia and gonorrhea case reports and prevalence monitoring data may be a cost-effective means to assess the effectiveness in interventions in reducing infertility. Previously, Moss et al. examined PID case reports in San Francisco and found a 5.3% per year decline in PID cases.[15] However, other researchers have also noted that diagnoses have shifted from inpatient to outpatient settings[12]; as a result, passive surveillance systems

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designed for inpatient settings have not yet translated to outpatient settings. In an effort to examine the utility of provider-based PID reporting as a potential outcome measure of success in infertility prevention, we examined case reports of pelvic inflammatory disease in San Francisco through our passive case reporting surveillance system to identify trends over a 6-year period.

## MATERIALS AND METHODS

In California, all PID diagnoses are required to be reported to the local health jurisdiction under Title 17, CA Code of Regulations §2500, §2593, §2641 to 2643, and §2800 to 2812. Because PID is a clinical syndrome without a definitive laboratory test, all case reports come from clinical providers through submission of a confidential morbidity report (CMR) by phone, fax, or mail; the CMR collects standard data elements including age, race, provider, address, and gender of sex partners. On receipt, PID case reports are entered and maintained in an electronic surveillance database.

The clinical case definition of PID is based on an array of signs and symptoms. The 2006 CDC STD Treatment Guidelines recommend that treatment be initiated in sexually active young women or women at risk for sexually transmitted disease if they experience pelvic or lower abdominal pain and no other cause of illness can be determined, and if cervical motion tenderness, uterine tenderness or adnexal tenderness are present on pelvic examination.[16] In addition to those minimum criteria, the following findings can be used to support a diagnosis of PID: oral temperature >101°F, abnormal cervical or vaginal mucopurulent discharge, presence of abundant numbers of white blood cells on saline microscopy of vaginal secretions, elevated erythrocyte sedimentation rate, elevated C-reactive protein, and laboratory documentation of cervical infection with *N. gonorrhoeae* or *C. trachomatis.*[16]

The CDC surveillance case definition for PID differs from the clinical case definition. A female who has lower abdominal pain and who has not been diagnosed as having an established cause other than PID must have lower abdominal tenderness, tenderness with motion of the cervix, and adnexal tenderness to be considered a surveillance case of PID.[17] In addition to the previous 3 criteria, at least 1 of the following findings must also be present: meets the surveillance case definition of *C. trachomatis* infection or gonorrhea; temperature >100.4°F (>38.0°C); leukocytosis >10,000 white blood cells/mm$^3$; purulent material in the peritoneal cavity obtained by culdocentesis or laparoscopy; pelvic abscess or inflammatory complex detected by bimanual examination or by sonography; patient is a sexual contact of a person known to have gonorrhea, chlamydia, or nongonococcal urethritis.[17]

We examined all cases of PID among San Francisco residents reported to the San Francisco Department of Public Health with a date of diagnosis between January 1, 2004 and December 31, 2009. For the purposes of this analysis, we included all reports of PID; because case report data do not contain adequate clinical and laboratory information it is unclear from reported morbidity whether those reported cases met the surveillance or clinical definition of PID. Age and race/ethnicity of the PID case were determined from the CMR, as was the reporting provider. Reported cases of PID were matched to the San Francisco STD Prevention and Control Services Surveillance registry to determine whether there was a corresponding clinical or laboratory report for either chlamydia or gonorrhea within the last 3 months of the PID case report. Cases of PID were also matched to the registry to determine residence. Patients were considered to live in a high morbidity area if they resided in 1 of 6 neighborhoods in San Francisco that consistently had the highest chlamydia rates in women over the last 5 years (range: 556–2197 cases per 100,000 in 2007).

Pearson $\chi^2$ and Fisher exact tests were used to assess significance ($P < 0.05$ level) in the trend analysis. All analysis was done using SAS version 9.2 (SAS Institute Inc., Cary, NC). As these were de-identified surveillance data used for public health purposes, this study was considered exempt from human-subjects considerations in accordance with the Code of Federal Regulations, Title 45.

## RESULTS

From 2004 to 2009, there were 245 PID cases reported in San Francisco. Over 75% of cases PID were in women under the age of 35 (Table 1). Black women comprised approximately one-third of the total number of cases of PID each year. There were no statistically significant differences by year during the 6-year period with regards to the distribution of age, race/ethnicity, history of gonorrhea or chlamydia within the previous 3 months, or residence in a high morbidity area for gonorrhea and chlamydia (Table 1).

Although the demographic profile of reported PID cases has remained relatively stable during the study period, the distribution of providers who reported diagnosed cases shifted over this 6-year period (Fig. 1). In 2004, San Francisco City Clinic (the only municipal STD clinic in San Francisco) reported 44% of cases. This proportion steadily increased with San Francisco City Clinic reporting over 95% of cases by 2008. Until 2008, case counts at San Francisco City Clinic had remained stable with approximately 20 to 25 cases being diagnosed each year.

## DISCUSSION

To direct programs toward successful infertility prevention, measurable outcomes are critical. Despite being a potentially important outcome measure of the effectiveness of chlamydia screening programs, pelvic inflammatory disease is notifiable in less than half of the states in the United States.[11] In California, PID is a notifiable condition; however, very few cases are reported in San Francisco. Whereas over 2000 cases of gonorrhea and chlamydia are reported each year among women in San Francisco, approximately 50 or fewer cases of PID are reported annually.[18] During the study period (2004–2009), 11,309 cases of chlamydia and 1685 cases of gonorrhea were reported among female San Francisco residents (unpublished data). Passively collected PID surveillance data are limited because of the likely underreporting by diagnosing providers. In San Francisco, an increasing proportion of diagnosed cases were reported by the municipal STD clinic, which suggests that fewer outside providers are notifying the Department of Public Health about diagnosed cases of PID. Data from PID cases reported from the STD clinic suggest that PID morbidity has been stable with potential increases in the last 2 years in San Francisco over the period where fewer PID case reports were received from non-STD clinic providers. Furthermore, visits to Title X funded clinics in San Francisco remained stable from 2005–2009 (Rebecca Braun, personal communication). In San Francisco, the ability to effectively monitor PID is compromised by limited reporting of this important infertility associated outcome.

Several factors may account for the underreporting of PID. First, unlike other notifiable sexually transmitted diseases, PID diagnosis is based on clinical findings and not a laboratory

**TABLE 1.** Reported PID Cases, San Francisco, 2004–2009

| | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | *P* |
|---|---|---|---|---|---|---|---|
| Total | 50 | 32 | 28 | 29 | 51 | 53 | |
| Age | | | | | | | 0.5042 |
| <20 | 5 (10.0) | 8 (25.0) | 3 (10.71) | 3 (10.34) | 6 (11.76) | 4 (7.27) | |
| 20–24 | 21 (42.0) | 13 (40.63) | 8 (28.57) | 6 (20.69) | 18 (35.29) | 16 (29.09) | |
| 25–29 | 7 (14.0) | 3 (9.38) | 7 (25.0) | 8 (27.59) | 7 (13.73) | 11 (20.00) | |
| 30–34 | 8 (16.0) | 4 (12.5) | 7 (25.0) | 6 (20.69) | 8 (15.69) | 10 (18.18) | |
| 35+ | 9 (18.0) | 4 (12.5) | 3 (10.71) | 6 (20.69) | 12 (23.53) | 14 (25.45) | |
| Race | | | | | | | 0.4533 |
| Asian/Pacific Islander | 3 (6.25) | 1 (3.13) | 8 (29.63) | 1 (3.57) | 6 (11.76) | 10 (18.87) | |
| Black | 18 (37.5) | 9 (28.13) | 9 (33.33) | 10 (35.71) | 20 (39.22) | 16 (30.19) | |
| Hispanic | 11 (22.92) | 10 (31.25) | 5 (18.52) | 10 (35.71) | 13 (25.49) | 13 (24.53) | |
| White | 15 (31.25) | 10 (31.25) | 5 (18.52) | 6 (21.43) | 11 (21.57) | 13 (24.53) | |
| Other | 1 (2.08) | 2 (6.25) | 0 | 1 (3.57) | 1 (1.96) | 1 (1.89) | |
| GC or CT diagnosis within the prior 3 mo before PID diagnosis* | | | | | | | 0.1261 |
| Y | 4 (66.7) | 5 (83.3) | 3 (50.0) | 3 (37.5) | 4 (33.3) | 3 (21.43) | |
| N | 2 (33.3) | 1 (16.7) | 3 (50.0) | 5 (62.5) | 8 (66.7) | 11 (78.57) | |
| GC or CT test within the prior 12 mo | | | | | | | 0.0545 |
| Y | 16 (32.00) | 11 (34.38) | 12 (42.86) | 14 (48.28) | 30 (58.82) | 30 (54.55) | |
| N | 34 (68.00) | 21 (65.63) | 16 (57.14) | 15 (51.72) | 21 (41.18) | 25 (45.45) | |
| GC or CT test within the prior 12 mo among women <26 yr | | | | | | | 0.2312 |
| Y | 9 (32.14) | 8 (38.10) | 5 (38.46) | 5 (55.56) | 15 (57.69) | 13 (61.90) | |
| N | 19 (67.86) | 13 (61.90) | 8 (61.54) | 4 (44.44) | 11 (42.31) | 8 (38.10) | |
| High morbidity area† | | | | | | | 0.6907 |
| Y | 12 (24.0) | 10 (31.25) | 11 (39.29) | 7 (24.14) | 12 (23.53) | 15 (27.27) | |
| N | 38 (76.0) | 22 (68.75) | 17 (60.71) | 22 (75.86) | 39 (76.47) | 40 (72.73) | |

*Among those who had been tested in the prior 3 mo.
†High morbidity area defined as patient residing in one of 6 neighborhoods with highest CT rates in women in past 5 yr.
PID indicates pelvic inflammatory disease; GC, Gonorrhea; CT, Chlamydia; Y, yes; N, no.

test. For example, chlamydia and gonorrhea surveillance is largely based on laboratory reporting. Positive laboratory results are reported to the health department and provider. With PID, the health department relies solely on the provider for these cases. Second, some providers may be unaware that PID is a reportable condition, which would account for the lack of case reports. Additionally, the definition of PID is complicated and relies on clinical interpretation; providers may be less likely to report cases if they have any uncertainty in the diagnosis. It is possible that this clinical uncertainty may be more of a problem in outpatient settings compared to inpatient settings where there are more definitive data supporting a diagnosis. Finally, data suggest that management of pelvic inflammatory disease has shifted from inpatient to outpatient settings. Between 1985 and 2001, the estimated rate of hospitalization for all PID declined by 68% among women aged 15 to 44[12]; however, surveillance activities may have not adjusted to this change in the locus of care for PID patients.

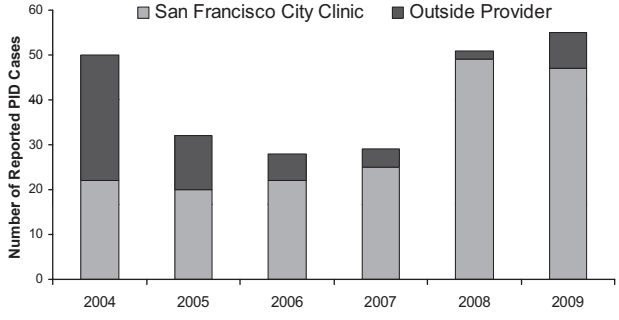


**Figure 1.** Reported PID cases by provider, San Francisco, 2004–2009.

The majority of women with reported PID did not reside in an area of high chlamydia morbidity. In San Francisco, the neighborhoods designated as high morbidity account for approximately 27% of the reported female Chlamydia (unpublished data), which is almost identical to the proportion of PID cases from these neighborhoods. This finding may represent the population seen at San Francisco City clinic, the provider site that reported the overwhelming majority of PID cases analyzed.

Given the problems with passive surveillance based on receipt of PID case reports, additional data sources are necessary to measure and monitor incidence of PID. Administrative and claims data, from patients in local hospitals, family planning clinics, and Health Maintenance Organizations, as well as other settings, may all be useful in identifying unreported PID and monitoring trends through sentinel surveillance. Additionally, sentinel surveillance sites may also provide an opportunity to gather data on incidence of pelvic inflammatory disease and evaluate its relationship with trends in chlamydia and gonorrhea screening. Although this may require additional resources, particularly with initial implementation, sentinel surveillance would further elucidate the local PID picture and provide additional measures for evaluating existing chlamydia screening programs.

Other programs have been successful in exploring innovative ways to conduct PID surveillance. Sutton et al utilized data from 3 national probability surveys to estimate the inci-

dence of PID among women aged 15 to 44 years old in hospital and ambulatory settings.[12] Using ICD-9 codes, the authors found there were on average 88,743 annual hospitalizations for PID between 1995 and 2001; during this same time period, 735,316 women were diagnosed with PID in ambulatory settings.[12] In California, the Department of Public Health has utilized paid claims data from the Family PACT Family Planning program as well as line-listed test result data from a commercial laboratory to ascertain the number of potential PID cases in the state through ICD-9 codes and treatment claims as well as to estimate the prevalence of current chlamydia and gonorrhea infection among family planning clients with PID in outpatient settings.[19] Using those data sources, they found a chlamydia and gonorrhea prevalence of 12% among outpatient PID cases, which was lower than prevalence estimates in previous studies of hospitalized PID cases.[19] Additionally, Bohm et al. used large administrative databases that showed in 2005, over 70% of women received care through physician offices and other outpatient settings.[13] Those data sources may prove valuable in monitoring PID and other infertility related outcomes.

As a result of this analysis, we are exploring the potential of sentinel surveillance for PID through the use of additional administrative data sources not routinely used for surveillance. Additionally, we are currently working with local providers to determine the clinical sites where PID is being diagnosed and treated and then plan to improve case based surveillance at those sites. In San Francisco, we are developing a triangulation approach to monitor progress in infertility prevention, which draws on several data sources and outcome measures.

There were several limitations to this analysis. First, these cases were collected through passive surveillance. We do not investigate reported PID cases so data were limited to the information reported on the CMR. Our analysis only examined a history of chlamydia and gonorrhea. Although *Mycoplasma genitalium*, as well as facultative and anaerobic bacteria, have shown to be potentially etiologically related to PID,[9,20,21] none are routinely tested for. Furthermore, we did not validate PID case reports by reviewing medical records. As a result we were unable to determine whether reported cases met the surveillance or clinical definitions of PID.

PID is an important condition that can lead to infertility. PID can be an intermediary between chlamydia and gonorrhea screening and infertility.[22] Because PID is caused by a variety of pathogens, surveillance of PID may be a better measure of infertility prevention programs than the measurement of chlamydia and gonorrhea morbidity alone.[15] However, data from our STD program suggests that passive surveillance for PID is poor and used alone does not reflect the true burden of disease. Whereas efforts should be made to increase provider awareness that pelvic inflammatory disease is a notifiable condition and improve reporting among providers by devoting resources to improving current passive surveillance, the development of new, innovative ways to conduct PID surveillance through administrative data-based platforms is essential.

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