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# Investigation of Pelvic Inflammatory Disease, Anchorage

# 1994 - 1995

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## Abstract

**Background:** Although pelvic inflammatory disease (PID) is the major cause of infertility among American women, few State health departments conduct surveillance specifically for this condition. This project was undertaken to help evaluate the effectiveness of the sexually transmitted disease control program, to describe the occurrence of PID in Anchorage, and to assess the usefulness of medical record review for identifying cases of PID.

**Methods:** We reviewed medical records of patients seen in Anchorage during 1994 and 1995 at three hospitals, a multi-facility urgent care center, and a large family practice clinic. Charts of patients with an International Classification of Disease, Ninth Revision (ICD-9) diagnostic code 098-098.89, 614-614.9, 615-615.9 were identified and abstracted. A case of confirmed PID was defined as lower abdominal tenderness, tenderness with motion of the cervix, adnexal tenderness, absence of established causes other than PID plus at least one confirmatory finding including temperature >38°C, >10,000 white blood cells/$mm^3$ , or a positive test for *Neiserria gonorrhoeae* or *Chlamydia trachomatis* from a pelvic organ, abscess or fluid.

**Results:** Of the 597 records identified and reviewed, 289 (48%) either had a clinical diagnosis of PID (198), met the definition of a confirmed case (18), or both (73). ICD-9 code 614.9 (unspecified inflammatory disease of female pelvic organs and tissues), had a sensitivity of 80% (224/279) and a predictive value positive of 88% (224/256). The predictive value positive of other ICD-9 codes was low, ranging from 7% to 59%. The mean age of women with PID was 23 years, 14 women had more than one case of PID during the study interval. Only 28% (82) of the 289 PID cases were prescribed a regimen recommended by the U.S. Centers for Disease Control and Prevention (CDC) 1993 treatment guidelines. Of the 47 women with laboratory confirmed *Neisseria gonorrhoeae* infection, 43 (91%) had been reported to public health.

**Conclusions:** Health care providers frequently treated PID with regimens that were not recommended by CDC. Medical record review can successfully identify PID cases, but no single ICD-9 code detected more than 80% of cases. Codes other than 614.9 performed poorly. The proportion of confirmed gonococcal infections that were reported to public health was high.

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## Investigation of Pelvic Inflammatory Disease, Anchorage

Alaska has a recent history of very high rates of sexually transmitted disease. During the mid-1980's, the annual incidence of gonococcal infection was over 1600 per 100,000 population, 3- to 6-times the national average during the same time period.[1, 2] More recently, the rate of chlamydial infection in Alaska for 1998, 307 per 100,000, was slightly more than 50% higher than the national average for 1997, 196 per 100,000.[2,3] The high rates of sexually transmitted diseases in Alaska suggest that pelvic inflammatory disease (PID) incidence may also be high.

*Neisseria gonorrhoeae* and *Chlamydia trachomatis* are considered to be the principle agents responsible for causing PID. In Alaska, patients diagnosed with PID are not required to be reported to the Division of Public Health unless laboratory testing confirms the presence of *N. gonorrhoeae* or *C. trachomatis*. For many years, health care providers and laboratories in Alaska have both been required to report gonorrhea; chlamydial infection was made reportable in January 1996. The Section of Epidemiology has not collected information on the occurrence of complicated gonococcal infection (i.e., disseminated disease, septic arthritis, etc.).

This project was undertaken to help evaluate the effectiveness of the sexually transmitted disease control program, including surveillance, disease reporting, and treatment. Secondarily, the project was designed to describe the occurrence of PID and other complications of *N. gonorrhoeae* or *C. trachomatis* infection in Anchorage and to evaluate the use of medical record review as a mechanism for identifying and studying these conditions. Each acute care hospital in Anchorage, as well as an Anchorage multi-facility urgent care provider and a large family practice center, was invited to participate in the review. After identifying patients diagnosed with PID, gonorrhea, or chlamydial infection, we collected information from each patient's chart including details concerning symptoms, laboratory findings, and treatment. This edition of the *Epidemiology Bulletin Recommendations and Reports* presents the findings and recommendations of the project.

## Methods

*1. Identification of cases* - The participating facilities were Providence Alaska Medical Center, Alaska Regional Hospital, Anchorage Neighborhood Health Center, and North Care Medical Centers (four urgent care clinics), and Elmendorf Air Force Base (EAFB) 3rd Medical Group Hospital. The Alaska Native Medical Center declined to be included in the study. To identify patients having PID, we first obtained lists of patients with a condition having an *International Classification of Diseases, Ninth Revision* (ICD-9) diagnostic code considered possibly indicative of PID or complicated gonorrhea infection (Table 1). Because no single ICD-9 code corresponded to the diagnosis of PID, we used an ICD-9 code list from the US Centers for Disease Control and Prevention (CDC) to identify PID cases from discharge data (Appendix 1). To facilitate the selection of records at each facility, the ICD-9 codes were treated as a range rather than a list of individual codes (Table 1).

**Table 1. ICD-9 code ranges used to identify pelvic inflammatory disease and complicated gonorrhea infection**

| | |
|---|---|
| 098 – 098.89 | Gonococcal infection |
| 0614 – 0614.9 | Inflammatory diseases of the female pelvis, ovary, fallopian tube, or peritoneum |
| 0615 – 0615.9 | Inflammatory diseases of the uterus, except cervix |

Each facility was requested to identify records of patients with any of the specified ICD-9 codes (Table 1) that had one or more visits during 1994 or 1995. Although all facilities were able to identify records for this time period, they varied in their ability to identify both inpatient and outpatient visits. Therefore, since records were organized and accessed differently at each facility, the procedures for identifying medical records for review varied among facilities.

At Providence Alaska Medical Center, inpatient and outpatient (including day surgery and emergency room) medical records were computerized and could be searched and identified by diagnostic code(s). We obtained a list of all inpatients and outpatients treated during 1994 or 1995 who had been diagnosed as having at least one condition on the ICD-9 code list.

At Alaska Regional Hospital, inpatient and outpatient (including day surgery but not emergency room) records were computerized and could be searched and identified by diagnostic code(s). We obtained a list of inpatients and day surgery patients seen during 1994 or 1995 who had been diagnosed with at least one condition on the ICD-9 code list.

At the Anchorage Neighborhood Health Center, computerized billing records were used to identify outpatient records for review. However, the system permitted only records with ICD-9 code 098.0 to be selected. Accordingly, a list of all patients diagnosed with ICD-9 code 098.0 during 1994 or 1995 was prepared.

At North Care Medical Centers, it was not possible to query the computerized billing system by ICD-9 code. To identify records to be reviewed, a list of all patients who were billed for a laboratory test for either *N. gonorrhoeae* or *C. trachomatis* during 1994 or 1995 was compiled.

At EAFB Hospital, inpatient and outpatient medical records were computerized and could be searched and identified by diagnostic code(s). We obtained a list of all patients (active duty members and their dependents, military retirees, and others eligible for medical care at the hospital) who had been diagnosed in 1994 or 1995 with at least one condition on the ICD-9 code list. Medical records were available only for persons who had not been transferred to another location as of April-June, 1996 when records were reviewed.

*2. Data collection and entry* - We attempted to review all of the medical records identified above; a small number of records could not be located. For each record reviewed, we examined the visit of interest and abstracted information including patient demographics and identifiers, symptoms, laboratory findings and other diagnostic test results, diagnoses, and treatment; all information was recorded on a data collection form.

Information on completed data collection forms was entered into a database using Epi Info, version 6 software. Two clerical staff members did data entry in duplicate and independently. The two data sets were compared, all differences were rectified, and a single, unified data set was prepared.

*3. Data analysis and evaluation* - The dataset was manually examined to identify multiple visits of the same patient. This was done by individually examining the patient name on each record to identify matches or near matches. This procedure was twice repeated: date of birth and social security number matches (or near matches) were identified. When two of these three variables (name, date of birth, and social security number) were either identical or nearly identical on two (or more) records, these records were considered to be from the same person.

A case of confirmed PID was defined according to the CDC case definition of PID - a woman having each of the following:[4]

- lower abdominal tenderness,
- tenderness on motion of the cervix,
- adnexal tenderness, and
- an absence of an established cause (such as appendicitis or ectopic pregnancy) for these symptoms.

Plus at least one of the following:

- laboratory confirmation of an etiologic agent associated with PID from a pelvic organ, abscess, or fluid;
- temperature greater than 38° C;
- leukocytosis with >10,000 WBC/cc;
- purulent material obtained by culdocentesis or laparoscopy;
- pelvic abscess or inflammatory complex on bimanual exam or sonography; or
- sexual contact with a person with confirmed *N. gonorrhoeae*, *C. trachomatis*, or nongonococcal urethritis.

Patient records which did not meet the criteria for confirmed PID were classified in one of three ways: clinical PID (if the medical record documented that diagnosis), unknown if PID (if PID was not clinically diagnosed and documentation was insufficient to determine if the patient met the definition of confirmed PID), or not PID. Many records that received a clinical diagnosis of PID also satisfied the criteria for confirmed PID; these records were counted as confirmed PID. Each record classified as not PID was further broken-out into one of the following categories:

- Other causes of pelvic inflammation present (ectopic pregnancy, appendicitis, etc.)
- Pelvic inflammation was absent and illness was not due to *N. gonorrhoeae* or *C. trachomatis*
- Illness was an uncomplicated infection caused by *N. gonorrhoeae* or *C. trachomatis*
- Pelvic inflammation was absent and illness was a complicated *N. gonorrhoeae* infection (arthritis, bacteremia, etc).

The sensitivity and predictive value positive of various ICD-9 codes for detecting PID were calculated for records examined at Providence Alaska Medical Center, Alaska Regional Hospital, and EAFB Hospital; North Care Medical Centers and Anchorage Neighborhood Health Center were not included because neither institution was able to use ICD-9 codes to identify records. Sensitivities were calculated by determining the proportions of confirmed, clinical, and confirmed or clinical PID cases that were assigned an ICD-9 code or set of ICD-9 codes of interest. The predictive value positive was calculated by determining the proportion of records with a particular ICD-9 code or set of ICD-9 codes that met the criteria of confirmed, clinical, and confirmed or clinical PID. For records (n=13) with multiple ICD-9 codes, sensitivities and predictive value positives were calculated by considering all assigned codes.

We compared the antimicrobial treatment prescribed for each person having PID (whether meeting the confirmed or clinical case definition), *C. trachomatis* infection, or *N. gonorrhoeae* infection (complicated or uncomplicated) to the sexually transmitted disease treatment guidelines published by the CDC in 1993.[5] The prescribed antimicrobial regimen was classified as either recommended by CDC, not recommended by CDC, or possibly recommended by CDC. A regimen was classified as possibly recommended if it otherwise met the CDC recommendations but no duration of treatment was specified.

When a patient had more than one record, all visits within 3 days of each other were considered to be the result of a single episode of illness. Reinfection was defined as the diagnosis of an infection more than 3 days after prescription of a recommended antimicrobial regimen or more than 30 days after prescription of either a not recommended or possibly recommended antimicrobial regimen.

For each patient with laboratory confirmed gonococcal infection, we reviewed disease reporting records at the Section of Epidemiology to determine whether or not the infection had been reported to public health.

*4. Comparison to national PID data* - In order to put the occurrence of PID in Anchorage in a broader context, we examined published studies describing epidemiologic characteristics of PID. The methods used by the CDC to estimate PID incidence were compared with our methodology.

## Results

Overall, 597 records were located, reviewed and abstracted (Table 2). For Providence Alaska Medical Center, North Care Medical Centers, and Anchorage Neighborhood Health Center, 86% (479) of the 560 identified records were located and reviewed. Because Alaska Regional Hospital and Elmendorf AFB Hospital retained the original lists of identified records, the number of records identified for review at these sites could not be determined.

**Table 2. Records identified and reviewed, by facility, Anchorage, 1994-1995**

| | *Number of records* | | *Percent* |
|---|---|---|---|
| | *Identified* | *Reviewed* | *Reviewed* |
| Providence AK Medical Center | 352 | 318 | 90% |
| North Care Medical Centers | 184 | 138 | 75% |
| Alaska Regional Hospital | * | 97 | -- |
| Anchorage Neighborhood HC | 24 | 23 | 96% |
| Elmendorf AFB Hospital | * | 21 | -- |
| Total | --- | 597 | 86%+ |

*Number of records identified for review was not available because original lists were retained by the facility.
+Calculated for Providence, North Care, and Anchorage Neighborhood Health Center only.

After reviewing all available records (n = 597), 289 patient visits were classified as either clinical PID (n = 198) or confirmed PID (n = 91); there were 73 records that had a clinical diagnosis of PID and met the criteria for confirmed PID and were therefore counted as confirmed PID cases (Table 3). There were 32 records classified as unknown if PID - they did not contain enough information to classify as PID or not PID. These records were excluded from further analysis. This left 276 visits which were classified as not PID: of these, 71 were classified as having another cause for pelvic inflammation; 41 were classified as having gonorrhea or chlamydia but not PID; and 164 were classified as not having PID, gonorrhea, or chlamydia. Most of the records that did not have PID, gonorrhea, or chlamydia were at the facility where charts were identified by laboratory testing bills rather than by diagnostic codes.

**Table 3. Classification of records selected for review for PID, Anchorage, 1994-1995**

| | *Number* | *(%)* |
|---|---|---|
| Selected for review | 679 | |
| Not located | 82 | (12%) |
| Reviewed | 597 | (88%) |
| Confirmed PID | 91 | (15%*) |
| (Confirmed PID with clinical diagnosis PID | 73) | |
| Clinical PID | 198 | (33%*) |
| Unknown if PID | 32 | (5%*) |
| Not PID: Other cause for pelvic inflammation | 71 | (12%*) |
| Gonorrhea or chlamydial infection (uncomplicated) | 41 | (7%*) |
| Not gonorrhea or chlamydial infection | 164 | (27%*) |

*Refers to percent of reviewed records.

*Male illness and complicated gonorrhea or chlamydial infection* - Because we wanted to identify cases of complicated gonorrhea or chlamydial infection among both men and women, males diagnosed with gonorrhea or chlamydial infection were included. There were 19 male cases of uncomplicated gonorrhea, four cases of uncomplicated chlamydial infection, and three cases of complicated gonorrhea (Table 4). In addition, there were 15 females who did not have PID but who were diagnosed with one of the following: uncomplicated gonorrhea (n=9), uncomplicated chlamydial infection (n=3), or complicated gonorrhea (n=3).

The complicated gonorrhea cases included a newborn with disseminated disease, three cases of septic arthritis, one case of epididymitis, and one case of bacteremia; five required hospitalization. Of the 34 cases of gonorrhea, 25 (73%) had been reported to public health. Of the 41 cases of uncomplicated chlamydial infection or complicated or uncomplicated gonorrhea, 31 were treated with a regimen recommended by CDC, six were not, and four were treated with a possibly recommended regimen (Table 4).

**Table 4. Complicated and uncomplicated cases of gonorrhea and uncomplicated chlamydial infection, not including pelvic inflammatory disease, by sex, Anchorage, 1994-1995**

| | *Male* | *Female* | *Total* |
|---|---|---|---|
| Uncomplicated gonorrhea | 19 | 9 | 28 |
| Complicated gonorrhea | 3 | 3 | 6 |
| Uncomplicated chlamydial infection | 4 | 3 | 7 |

**Table 5. Classification of records by ICD-9 code, Anchorage, 1994-1995**

| *ICD-9 code* | *Confirmed PID* | *Clinical PID* | *Not PID* | *Total* |
|---|---|---|---|---|
| 098.0-098.9 | 3 | 7 | 7 | 17 |
| 614.0-614.9 | 88 | 181 | 103 | 372 |
| 615.0-615.9 | 0 | 3 | 43 | 46 |
| 614.9* | 72 | 152 | 32 | 256 |
| CDC codes[+] | 89 | 186 | 145 | 420 |

*614.9 is the code for unspecified inflammatory disease of the female pelvic organs and tissues.
[+]Codes used by CDC to identify pelvic inflammatory disease. See Appendix 1.

*Sensitivity and predictive value positive of ICD-9 codes* - A record at Providence Alaska Medical Center without an ICD-9 code was identified while reviewing other records of the same patient; the record without a code was excluded. We next excluded three records of male patients since they could not possibly have had PID. Of the remaining 432 records, 419 were assigned a single ICD-9 code and 13 were assigned two codes. Among the 432 records, 88 (98%) of the 90 classified as confirmed PID had been assigned an ICD-9 code in the range of 614.0 to 614.9; of these, 72 had been coded as ICD-9 code 614.9 - unspecified inflammatory disease of the female pelvic organs and tissues (Table 5).

For identifying confirmed PID alone or clinical PID alone, no ICD-9 code or range of codes had both a sensitivity and predictive value positive above 60% (Table 6). The single ICD-9 code that identified the greatest number of confirmed or clinical PID cases, 614.9 (unspecified inflammatory disease of the female pelvic organs and tissues), had a sensitivity and predictive value positive of 80% and 88%, respectively. The ICD-9 codes used by CDC to identify PID (Appendix 1) had a predictive value positive of 65%. This means that 35% (n = 145) of the 420 records classified by the CDC ICD-9 codes as having PID, did not actually meet the criteria for either confirmed or clinical PID.

**Table 6. Sensitivity and predictive value positive of ICD-9 codes, Anchorage, 1994-1995**

| | *Confirmed PID* | | *Clinical PID* | | *Confirmed or Clinical PID* | |
|---|---|---|---|---|---|---|
| *ICD-9 code(s)* | *Sensitivity* | *PVP** | *Sensitivity* | *PVP* | *Sensitivity* | *PVP* |
| 098.0-098.9 | 0.03 (3/90) | 0.18 (3/17) | 0.04 (7/189) | 0.41 (7/17) | 0.04 (10/279) | 0.59 (10/17) |
| 614.0-614.9 | 0.98 (88/90) | 0.24 (88/372) | 0.96 (181/189) | 0.49 (181/372) | 0.96 (269/279) | 0.72 (269/372) |
| 615.0-615.9 | 0.00 (0/90) | 0.00 (0/46) | 0.02 (3/189) | 0.07 (3/46) | 0.01 (3/279) | 0.07 (3/46) |
| 614.9[+] | 0.80 (72/90) | 0.28 (72/256) | 0.80 (152/189) | 0.59 (152/256) | 0.80 (224/279) | 0.88 (224/256) |
| CDC codes[§] | 0.99 (89/90) | 0.21 (89/420) | 0.98 (186/189) | 0.44 (186/420) | 0.99 (275/279) | 0.65 (275/420) |

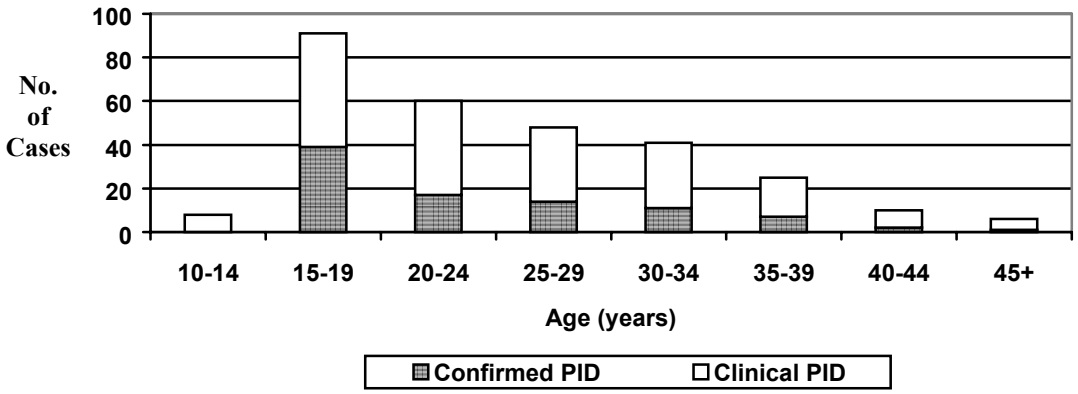
[*] Predictive value positive.
[+] 614.9 is the code for unspecified inflammatory disease of the female pelvic organs and tissues.
[§] Codes used by CDC to identify pelvic inflammatory disease. See Appendix 1.

**The remainder of the results focuses on 289 cases of confirmed or clinical PID.**

*Age* - The median age of cases was 23 years with a range of 13-49 years. When examined by 5-year-age group, the greatest number of cases (n = 91 or 31%) were 15-19 years of age (Figure 1).

*Residence* - Place of residence was known for 285 of the 289 cases; 260 resided in Anchorage, 17 somewhere else in Alaska, and the remainder (n = 4) out of state.

**Figure 1. Confirmed and clinical pelvic inflammatory disease by 5 year age group, Anchorage, 1994-1995**




*Race and ethnicity* - The racial distribution was white 66% (n= 191), Black 16% (n= 46), Alaska Native 3% (n= 9), Asian 2% (n= 7), and other or unknown 13% (n= 23 and 13, respectively). The median age of whites (22 years) was similar to that of non-whites (24 years).

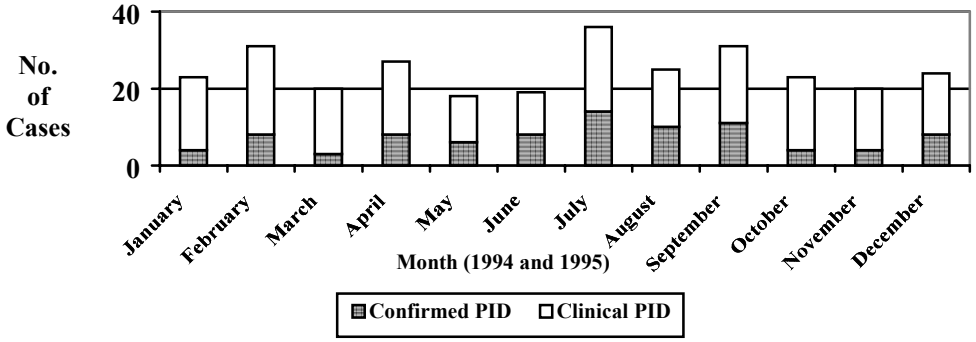
Information on ethnicity was frequently not included in the records. The ethnicity of 13 cases was Hispanic; all other cases had unknown ethnicity.

*Date of episode* - Cases were more or less evenly split between 1994 (n=158) and 1995 (n=131). Examining the 2 years taken together, there were an average of 24 cases per month (range 13 to 36 cases); the months of July thru September accounted for 93 cases (32%), no other 3 month interval had more than 74 cases (25%) (Figure 2).

*In- or outpatient care* - There were 85 cases treated as inpatients and 204 treated as outpatients. At Providence Alaska Medical Center, where both inpatient and outpatient records were available, 194 cases received only outpatient treatment and 44 were admitted to the hospital.

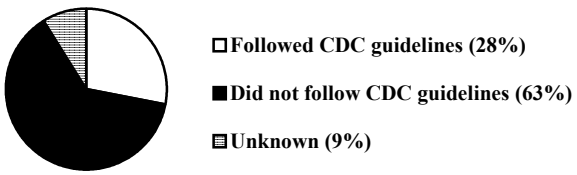
*Laboratory testing* - Overall, 256 cases were tested for *N. gonorrhoeae*, of the 47 (18%) that were positive, 43 (91%) were reported to public health. For chlamydial infection, 260 were tested and 30 (11%) were positive. There were seven cases that had dual infections with *N. gonorrhoeae* and *C. trachomatis*. Thus, the total number of cases having at least one positive test was 70 (47 women with *N. gonorrhoeae* infection, plus 30 women with chlamydial infection, minus 7 women with dual infections) and there were 219 (76%) cases that did not have a positive test for gonorrhea or chlamydial infection.

**Figure 2. Confirmed and clinical pelvic inflammatory disease by month, Anchorage, 1994-1995**




*Treatment* - Overall, 82 (28%) of the 289 cases were treated with a regimen recommended by CDC (Figure 3). Among the 91 confirmed cases of PID, 34 (37%) were treated using a CDC recommended regimen. If the 8 confirmed cases who were treated with a possibly recommended regimen were included with those known to have been treated with a recommended regimen, then 42 (46%) of the 91 confirmed cases were treated using a CDC recommended regimen. For clinical cases (n = 198), 48 (24%) were treated using a CDC recommended regimen. If the 18 clinical cases who were treated with a possibly recommended regimen were included with those known to have been treated with a recommended regimen, then 66 (33%) of the 198 clinical cases were treated using a CDC regimen. A greater proportion of confirmed cases received CDC recommended treatment (34 of 91; 37%) than did clinical cases (48 of 198; 24%; $p<0.031$, chi-square = 4.65).

**Figure 3. Proportion of confirmed and clinical pelvic inflammatory disease cases receiving CDC recommended antimicrobial treatment**




Examining only the 70 PID cases with laboratory confirmation of *N. gonorrhoeae* or *C. trachomatis*, 22 (31%) were treated with a regimen recommended by the CDC. This was similar to the 60 (27%) of 219 cases that did not have laboratory confirmation and were treated with a CDC recommended regimen.

Taking confirmed and clinical cases of PID together, whites were treated with a CDC recommended regimen 31% of the time and persons of other races were treated with a CDC recommended regimen 30% of the time. There did not appear to be any significant difference by age in the proportion of women treated using a CDC recommended regimen.

A variety of regimens that did not follow the CDC recommended treatment guidelines were prescribed. The three most common regimens were:

- the use of azithromycin;
- prescribing a regimen appropriate only for gonorrhea or chlamydial infection, but not for both; or
- duration of treatment was shorter than recommended by CDC.

*Reinfection* - There were 14 women who had PID reinfections during the study interval; 12 had one reinfection, one had two reinfections, and one had four reinfections. Of those with reinfection, we

examined the earliest record in the interval and found that three (21%) were treated with a CDC recommended antimicrobial regimen. For the 257 women with PID that did not have a reinfection, 76 (30%) were treated with a CDC recommended regimen.

*Comparison to national PID data* - A number of epidemiologic studies either examined the frequency that *Neisseria gonorrhoeae* and *Chlamydia trachomatis* infection were detected among patients with PID or estimated the burden of PID in various populations (Table 7). Several reports examined women's cumulative lifetime incidence of PID.[21, 22, 26, 31] These studies provided only limited and indirect information about annual incidence rates. Scandinavian researchers reported that 22% to 40% of women with PID had endocervical chlamydial infection.[13, 15, 19] In the US, depending on the setting and study methods, 18% to 81% of women with PID had *Neisseria gonorrhoeae* isolated from the lower genital tract.[11,14,24,27] We found that detection rates for *Neisseria gonorrhoeae* and *Chlamydia trachomatis* were 18% and 11%, respectively. These rates were low when compared to those previously reported, especially for chlamydial infection.

Several studies estimated PID incidence in either specific populations or the US as a whole (Table 7). In the US during the 1970s, estimated annual incidence rates for inpatient PID varied from 2/1000 females >10 years of age to 18/1000 sexually experienced 15 year olds.[8-10,12] During the 1980s and 1990s, estimates for in- and outpatient PID incidence ranged from 19/1000 14-20 year olds to 22/1000 unmarried 18-34 year olds.[17,28,30] More recently, the National Institutes of Health (NIH) estimated that in the US during 1994 there were 115,670 hospitalizations and 1,160,580 initial visits to physicians' offices, emergency rooms, and clinics for PID.[35]

The NIH figures can be used to estimate the number of PID cases in Anchorage that would be expected if PID incidence in Anchorage was similar to the national average. For the 2 year period of 1994-95 there would be an expected 242 hospitalizations and 2430 initial visits for PID.* There is a large discrepancy between the number of expected initial visits (2430) and the number of women we identified who received outpatient treatment for PID (204). We attempted to enumerate PID cases only at a limited number of sites - it is likely that many more cases would have been found if we had reviewed medical records at clinics providing reproductive health care to women and at the offices of obstetrician/gynecologists, family practitioners, and internists in Anchorage. This may explain much of the difference between measured outpatient PID and the number of cases that would be expected if outpatient PID incidence in Anchorage was the same as the rate reported by NIH.

There is also a discrepancy between the number of women expected to be hospitalized (242) and the number we found in the record review (85). Since the Alaska Native Medical Center (ANMC) (one of the four acute care general hospitals in Anchorage) declined to participate in the review, women with PID treated at that hospital were not counted. However, even if PID incidence was considerably higher in the relatively small Anchorage population served by ANMC, this factor probably explains only part of the discrepancy. Probably the major cause for the difference between the numbers of cases expected and identified relates to the methodology used by NIH to estimate national PID incidence. NIH estimated 1994 PID incidence by updating CDC estimates for 1984-88.[16,35] The CDC used the National Hospital Discharge Survey to estimate the average annual rate of hospitalization for PID. CDC counted every patient discharged with

*The overwhelming majority of PID cases occur among women aged 15-44 years; in 1994, Anchorage had approximately 62,000 women 15-44 years of age. Since the US population in 1994 included an estimated 59,237,000 women 15-44 years of age, if Anchorage had the same rate of PID as the nation, there would be 1215 initial visits (1,160,580 x [62,000÷59,237,000]) and 121 hospitalizations (115,670 x [62,000÷59,237,000]) for PID. Thus, for 1994-95, it is reasonable to estimate that in Anchorage there would be 242 hospitalizations and 2430 initial visits to physicians' offices, emergency rooms, and clinics for PID if the national and Anchorage rates were similar.

specific ICD-9 codes as having PID.* The ICD-9 codes included by CDC overlapped with those we used, however medical records were not actually reviewed to determine if patients did or did not meet the CDC case definition for PID. We found that the ICD-9 codes used by CDC to identify PID had very poor predictive value positive (Table 6; i.e., after examining medical records, ICD-9 codes identified many women who were not considered to have PID). Therefore, the number of cases enumerated in Anchorage should not be compared to the expected number of cases derived from NIH national estimates.

## Discussion

PID affects more than one million women in the United States annually and causes more morbidity in 15-25 year old women than all other serious infections combined.[16,36] Treatment of PID may be costly and the sequelae can be serious and chronic. Complications include: ectopic pregnancy (risk increased 6- to 10-fold), fallopian tube dysfunction, infertility, chronic pelvic pain, dyspareunia, pelvic adhesions, recurrent PID, and tubo-ovarian abscess.[36, 37] Treatment costs for PID were estimated to be $4.2 billion for 1990 and are projected to reach $10 billion annually by the year 2000.[38]

The majority of PID cases are related to infection caused by sexually transmitted disease (STD) microorganisms. There is broad agreement that PID occurs when a STD pathogen ascends the lower genital tract to the fallopian tubes; this makes detection of a pathogen from a cervical specimen of a woman with PID less likely. STD organisms initiate fallopian tube inflammation and leave the tubes susceptible to additional damage by secondary invaders from the vaginal flora.[37-40]

Although STDs are considered the causative agents for most PID, a STD pathogen is not usually detected at the time of PID diagnosis. We found that the majority of women with PID were tested for *N. gonorrhoeae* (89%) and *C. trachomatis (*90%) but that only a small percentage had laboratory confirmation of *N. gonorrhoeae* or *C. trachomatis* infection (18% and 11%, respectively).

Of the 47 PID cases with a positive test for *N. gonorrhoeae*, most (93%) had been reported to public health. If chlamydial infection had been reportable during the study, a total of 70 (24%) of the PID cases should have been reported based on laboratory findings (47 with gonorrhea, plus 30 with chlamydial infection, minus 7 with dual infection). Clearly, reporting of laboratory confirmed gonorrhea and chlamydial infection is not an effective method for conducting PID surveillance. The impact of PID in Anchorage is underestimated by examining reported cases of gonorrhea and chlamydial infection: among the PID cases we identified, although most had a test for gonorrhea or chlamydial infection, nearly 80% did not have a positive laboratory result. Even if every laboratory confirmed gonorrhea or chlamydial infection had been reported to public health, only 24% of the PID cases we found would have been reported.

During 1994-95, the numbers of male and female gonorrhea cases reported in Alaska were 830 and 658, respectively. Among female cases of gonorrhea, 92 (14%) were identified as having PID. During the same time period in Anchorage, male and female gonorrhea cases were 567 and 518, respectively. Among Anchorage females with gonorrhea, 71 (14%) were identified as having PID. These data demonstrate the difficulty of using gonorrhea surveillance data to understand PID epidemiology.

*Discharges were counted by CDC as PID if at least one of the following ICD-9 codes was listed as a final diagnosis: 614.0-614.2, 098.17, 098.37 (salpingitis and oophoritis); 614.3-614.5, 098.86 (parametritis and pelvic peritonitis); 614.7-614.9, 098.10, 098.30, 098.39 (pelvic inflammatory disease); and 615.0, 615.1, 615.9, 098.16, 098.36 (inflammatory disease of the uterus, except cervix).

**Table 7. Selected epidemiologic studies of pelvic inflammatory disease (PID), 1965-1995**

| Year(s) | Setting | *Population** | *Outcome measure* | Major finding(s) | Reference |
|---|---|---|---|---|---|
| 1965 | Atlanta, GA | 15-45 years | in- and outpatient PID | annual incidence: 10/1000 | 6 |
| 1970-1974 | U.S. | 14-34 years | in- and outpatient PID | annual incidence: 14/1000 | 7 |
| 1970-1975 | U.S. | >14 years | inpatient PID | annual incidence: 3/1000 | 8 |
| 1970-1975 | U.S. | >10 years | inpatient PID | annual incidences: 2/1000 overall, 2/1000 for whites, 5/1000 for "other" races | 9 |
| 1971,1976 | U.S. | 15 and 25 year olds, sexually experienced | inpatient PID | annual incidences: 1971 – 18/1000 for 15 year olds, 5/1000 for 25 year olds. 1976 – 13/1000 for 15 year olds, 6/1000 for 25 year olds | 10 |
| 1972 | Memphis, TN | not specified | in- and outpatient PID | 81% of patients had positive $GC^+$ culture | 11 |
| 1975-1981 | U.S. | 15-44 years | inpatient PID | annual incidence: 5/1000 | 12 |
| 1977 | Lund, Sweden | 15-35 years | laparoscopically proven PID | 36% of cases had cervical CT | 13 |
| 1977-1978 | Massachusetts | not specified | hospital emergency room PID | ratio of non-GC PID to GC PID = 4.6:1 | 14 |
| 1979 | Aarhus, Denmark | 16-40 years | inpatient PID | 22% of cases had cervical CT[§] | 15 |
| 1979-1988 | U.S. | 15-44 years | inpatient PID and private physician outpatient PID | annual incidences: inpatient 3/1000, outpatient 7/1000 | 16 |
| 1980 | Rochester, NY | 14-20 years | in- and outpatient PID | annual incidence 19/1000 | 17 |
| 1980 | U.S. | 15-19 years | inpatient PID | annual incidence: 14/1000 | 18 |
| 1981 | Oslo, Norway | ≥15 years | laparoscopically proven PID | 40% of cases had cervical CT | 19 |
| 1981 | U.S. | 15-50 years | private practice outpatient PID | annual consultation rate: 23/1000 to 27/1000 | 20 |
| 1982 | U.S. | 15-44 years | PID self-report via survey | cumulative (lifetime) incidence: 14% (10% outpatient, 4% inpatient) | 21, 22 |
| 1982-1987 | Seattle, WA | ≥17 years | in- and outpatient PID | 67% of patients had GC or CT isolated from genital tract | 23 |

**Table 7** ***(continued)***

| Year(s) | Setting | *Population** | *Outcome measure* | Major finding(s) | Reference |
|---|---|---|---|---|---|
| 1982-1988 | Seattle, WA | ≥15 years | inpatient PID | 71% of patients had GC isolated from lower genital tract (84% had GC or CT) | 24 |
| 1985-1988 | Brooklyn, NY | <18 years | inpatient PID | 74% of patients had positive test for GC or CT in lower genital tract | 25 |
| 1988 | U.S. | 15-44 years | PID self-report via survey | cumulative (lifetime) incidence: 11% | 21, 26 |
| 1988-1990 | Jacksonville, FL | 14-45 years | inpatient PID | 48% of patients had positive GC culture | 27 |
| 1988-1990 | U.S. | 15-45 years | inpatient PID | annual incidences: 4/1000 for whites, 8/1000 for blacks | 28 |
| 1989 | Washington, DC | not specified | hospital emergency room PID | 45% of women treated for GC were diagnosed with PID | 29 |
| 1990-1992 | Seattle, WA | 18-34 years, not married | in- and outpatient PID | annual incidence: 22/1000 | 30 |
| 1992 | U.S. | 18-59 years | PID self-report via survey | cumulative (lifetime) number of cases: 1,477,000 | 31 |
| 1992-1994 | U.S. | 15-44 years | hospital emergency room PID | annual incidence: 6/1000 | 32 |
| 1993 | Colorado | 15-44 years | inpatient PID | annual incidence: 1/1000 population, 2/1000 for 20-24 year olds | 33 |
| 1994 | U.S. | all ages, male and female | inpatient PID | annual incidence: 0.2/1000 population | 34 |
| 1994 | U.S. | 15-44 years | in- and outpatient PID | annual incidence: 115,670 inpatient; 1,160,580 outpatient | 35 |
| 1995 | U.S. | 15-44 years | PID self-report via survey | cumulative (lifetime) incidence: 8% | 21 |

* All populations were female, unless otherwise specified.

[+] Gonococcal.

[§] *Chlamydia trachomatis*.

We found only one study that could be used to evaluate the significance of the 14% proportion of PID among reported female gonorrhea cases. Among women treated for gonorrhea in Washington, DC hospital emergency rooms, 45% were diagnosed as having PID.[29] This proportion is higher than the statewide or Anchorage proportion with PID, however only women presenting to a hospital emergency room were included in the Washington study and the proportion of gonorrhea cases having PID would be expected to be higher in this setting than for gonorrhea cases diagnosed in other settings.

At Providence Alaska Medical Center, where both outpatient and inpatient PID was identified, the ratio of outpatient to inpatient cases was 4.4 (194÷44). This ratio can be compared to the outpatient to inpatient ratio derived from the 1994 estimate of national PID incidence published by NIH: 10.0 (1,160,580÷115,670).[35] The lower ratio we found may be a result of our considering only emergency room outpatient visits - many outpatient visits occurred in doctor's offices which were not part of the study. To the extent that such visits resulted in direct admissions to the hospital, the outpatient to inpatient ratio would become smaller. A 1982 survey found that the ratio of outpatient to inpatient PID was 2.5; however, major changes in healthcare delivery since that time could have resulted in stricter criteria for hospital admission, thus raising the outpatient to inpatient ratio.[22]

A single ICD-9 code, 614.9, effectively identified 80% of the PID cases we found. No other code or range of codes had a higher sensitivity and predictive value positive for identifying PID cases from medical records. If we had reviewed every medical record at each of the facilities, rather than just those with an ICD-9 code in the selected ranges, it is possible that additional PID cases would have been identified. If PID cases had been found outside the examined ICD-9 code ranges, the sensitivities of the ICD-9 codes would be lower than we calculated. We believe it is unlikely that PID would be assigned an ICD-9 code other than those in the ranges examined, thus the reported sensitivities are likely to be accurate estimates. Specificity refers to the proportion of records not meeting the criteria of confirmed, clinical, and confirmed or clinical PID that were correctly not assigned an ICD-9 code or set of codes of interest. Since the study did not enumerate women not meeting the criteria for having PID (except among those assigned an ICD-9 code we examined), it was not possible to calculate the specificities of the various ICD-9 codes.

Only 28% of the cases were treated with a regimen recommended in the 1993 CDC treatment guidelines. The regimen that was most frequently prescribed but not recommended by CDC was the use of azithromycin. In the 1993 CDC treatment guidelines, azithromycin was recommended for uncomplicated chlamydial infection, not PID.[5] This continues in the 1998 CDC treatment guidelines.[41] Rolfs, et al found in a 1989 study of PID hospitalizations and office visits that only 21% of patients received an appropriate two-antibiotic combination.[16] Similarly, a survey of California primary care physicians conducted during 1992-1993 found that among those who said they had treated PID during the past 12 months, only 3% answered several PID management questions in accordance with the CDC guidelines.[42] The Section of Epidemiology recently evaluated the treatment regimens of all 32 reported cases of gonorrhea or chlamydial infection in Alaska during 1998 that were diagnosed with PID. Even though each case was a laboratory proven *N. gonorrhoeae* or *C. trachomatis* infection, only 25% of women received an antimicrobial regimen included in the 1998 CDC treatment guidelines for PID. Appropriate early treatment of PID is needed to keep fallopian tubes patent: when treatment is delayed by 6 days or more, 30% of infected women may develop tubal obstruction.[36] Although there are few studies on the effectiveness of outpatient treatment for PID, it is clear that better adherence to CDC treatment guidelines is needed.

We found that many cases of PID (n = 91, 31%) were in women 15-19 years of age. This corresponds to the age range with the most cases of gonorrhea reported to public health during the study period (1994-95); in each year, the highest number of cases was among 15-19 years olds. Similarly, Rolfs, et al found that hospitalization rates for acute PID were highest for 15-19 year olds.[16] PID has been described as a disease of the late teenage years due to the convergence of multiple factors including: penetrable cervical mucus, lack of development of protective antibodies to chlamydial infection, a large zone of cervical ectopy, greater number of sexual partners, and selection of partners from a pool of men with a high prevalence of STDs.[37]

The set of ICD-9 codes used by CDC and NIH to estimate national PID incidence had a sensitivity and predictive value positive for confirmed PID of 99% and 21%, respectively. If these findings were to hold up in other states, then the published national estimates could significantly over-estimate actual PID incidence.

Only a few cases of complicated gonococcal infection were found. Medical records included only limited details of risk reduction behaviors, duration of disease symptoms, testing of sexual partners, or tests-of-cure. Available information did include reports of unprotected vaginal and oral sex, and an infected newborn infant whose mother had been diagnosed and treated for gonococcal infection 3 months prior to delivery. These anecdotes reinforce the need to make individual assessments of each patient's behaviors and risks as well as provide information on STD risk reduction.

## Limitations

1. Clinical diagnosis of PID is difficult. The CDC criteria are imperfect and are neither 100% sensitive nor 100% specific. ICD-9 codes could not be used at all sites to identify possible PID cases. Furthermore, the CDC criteria are cumbersome to use when reviewing medical records: it is possible that some of the records that contained insufficient information and were classified as "PID unknown" were actually PID. For all these reasons, the true number of women with PID is probably larger than we found.

2. The data is not representative of all PID in Anchorage or the State. One of the four general acute care hospitals in Anchorage declined to participate in the study. Similarly, none of the obstetrician/gynecologists and internists and only one family practice clinic was included in the study. Therefore, women who received outpatient treatment for PID from their primary-care physicians were not included in the evaluation, again emphasizing that the true burden of PID in Anchorage is larger than we found.

3. Follow-up medical records on many PID cases were not available; women were often referred to other medical providers for follow-up. This made it impossible to evaluate the extent to which partners were notified and treated. Women who received follow-up may have been switched to an antimicrobial regimen recommended by the CDC treatment guidelines. If this occurred, the proportion of PID cases receiving a CDC recommended regimen would be larger than we reported.

## Recommendations

1. The CDC treatment guidelines for PID need to be promoted in Alaska.[41] Findings from this study, the recent statewide review of reported cases of gonorrhea or chlamydial infection, as well as studies in other states all demonstrate that a large proportion of women with PID do not receive an antimicrobial regimen consistent with CDC recommendations.[16,42] The specific treatment problems identified in the investigation will be provided to staff at each of the sites. Current CDC treatment guidelines for PID are included in Appendix 2.

2. Public health agencies need to promote and support comprehensive partner identification, notification, diagnostic testing, and empiric treatment activities. Sex partners of patients with PID should be located and treated if they had sexual contact the patient during the 60 days preceding onset of symptoms. Empiric treatment should cover both *N. gonorrhoeae* and *C. trachomatis*, regardless of the apparent etiology of PID or if laboratory results are negative. Health-care providers who do not treat the sex partners of their patients with PID need to ensure that the partners receive appropriate treatment. When left untreated, infections caused by *N. gonorrhoeae* or *C. trachomatis* may become complicated by PID, septic arthritis, or septicemia.

3. A single ICD-9 code, 614.9, effectively identified PID. Future investigators should consider using this code to locate medical records of patients with PID. In contrast, the set of ICD-9 codes used by CDC to identify PID has poor predictive value positive. Analyses based on counting all such records as cases of PID will severely overestimate PID incidence.

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**Appendix 1. ICD-9 codes used by CDC to identify pelvic inflammatory disease***

| | |
|---|---|
| 098.10 | Acute gonococcal infection of upper genitourinary tract, unspecified |
| 098.16 | Acute gonococcal endometritis |
| 098.17 | Acute gonococcal salpingitis |
| 098.30 | Chronic gonococcal infection of upper genitourinary tract, unspecified |
| 098.36 | Chronic gonococcal endometritis |
| 098.37 | Chronic gonococcal salpingitis |
| 098.39 | Chronic gonococcal infection of upper genitourinary tract, other |
| 098.86 | Gonococcal peritonitis, unspecified |
| 0614.0 | Acute salpingitis and oophoritis |
| 0614.1 | Chronic salpingitis and oophoritis |
| 0614.2 | Salpingitis and oophoritis, unspecified |
| 0614.3 | Acute parametritis and pelvic cellulitis |
| 0614.4 | Chronic or unspecified parametritis and pelvic cellulitis |
| 0614.5 | Acute or unspecified pelvic peritonitis |
| 0614.7 | Pelvic peritonitis |
| 0614.8 | Inflammatory disease of the female pelvic organs and tissues |
| 0614.9 | Unspecified inflammatory disease of the female pelvic organs and tissues |
| 0615.0 | Inflammatory disease of the uterus |
| 0615.1 | Chronic inflammatory disease of the uterus |
| 615.9 | Inflammatory disease of the uterus, unspecified |

*Reference: K. Southwick, MD, MSc; Division of STD Prevention, National Center for HIV, STD, and TB Prevention, U.S. Centers for Disease Control and Prevention; Atlanta, GA; personal communication February 8, 1996.

**Appendix 2. CDC guidelines for treatment of pelvic inflammatory disease, 1998***

Oral regimen A: ofloxacin 400 mg po twice a day for 14 days *plus* metronidazole 500 mg po twice a day for 14 days.

OR

Oral regimen B: doxycycline 100 mg po twice a day for 14 days *plus one of either*

- ceftriaxone 250 mg IM once; *or*
- cefoxitin 2 g IM with probenicid 1 g po; *or*
- a third-generation parenteral cephalosporin (e.g., ceftizoxime or cefotaxime).

OR

Parenteral regimen A: doxycycline 100 mg IV or po every 12 hours *plus either*:

- cefotetan 2 g IV every 12 hours; *or*
- cefoxitin 2 g IV every 6 hours

OR

Parenteral regimen B: clindamycin 900 mg IV every 8 hours *plus* gentamicin 2 mg/kg IV or IM loading dose followed by 1.5 mg/kg every 8 hours (single daily dosing is also acceptable)

OR

Alternate parenteral regimens: a. metronidazole 500 mg IV every 8 hours *plus either*:

- ofloxacin 400 mg IV every 12 hours; *or*
- doxycycline 100 mg IV or po every 12 hours and ciprofloxacin 200 mg IV every 12 hours;

or

b. Ampicillin/sulbactam 3 g IV every 6 hours *plus either*:

- doxycycline 100 mg IV or po every 12 hours; *or*
- ciprofloxacin 200 mg IV every 12 hours.

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Patients started on parenteral therapy can generally be switched to an on oral regimen within 24 hours of clinical improvement. All patients should receive a minimum of 14 days of treatment whether oral or a combination of oral and parenteral. Appropriate oral regimens for use following parenteral treatment include:

- doxycycline 100 mg po twice a day; or
- clindamycin 450 mg po four times a day.

*From Centers for Disease Control and Prevention. 1998 Guidelines for treatment of sexually transmitted diseases. MMWR 1998. 47(RR-1);1-116.