Scientific Research Publishing

Open Journal of Obstetrics and Gynecology, 2026, 16(2), 283-296
https://www.scirp.org/journal/ojog
ISSN Online: 2160-8806
ISSN Print: 2160-8792

Prevalence, Pathogenic Profile, and Risk Factors of Pelvic Inflammatory Disease at a Referral Hospital in Sub-Saharan Africa: A Case-Control Study

Théophile Nana Njamen[1,2], Robert Tchounzou[2,3*], Alphonse Ngalame[2], Fulbert Mangala Nkwele[1], Fidelia Mbi Kobenge[1], Ayiagnigni Mounchili[4], Isaac Mboh Eyong[2], Andre Gaetan Simo Wambo[2], Humphry Tatah Neng[2], Crysantus Yimlefac Nzometia[2], Cedric J. Nana Njamen[1], Charlotte Nguefack Tchente[1,4], Emile Mboudou[3], Gregory Halle Ekane[1,2], Thomas Obinchemti Egbe[1,2], Henri Essome[4]

[1]Department of Obstetrics and Gynecology, Douala General Hospital, Douala, Cameroon
[2]Department of Obstetrics and Gynecology, Faculty of Health Sciences, University of Buea, Buea, Cameroon
[3]Department of Obstetrics and Gynecology, Gyneco-Obstetric and Pediatric Hospital of Douala, Douala, Cameroon
[4]Department of Surgery and Specialties, Faculty of Medicine and Pharmaceutical Sciences, University of Douala, Douala, Cameroon
Email: *rtchounzou@yahoo.fr

How to cite this paper: Njamen, T.N., Tchounzou, R., Ngalame, A., Nkwele, F.M., Kobenge, F.M., Mounchili, A., Eyong, I.M., Wambo, A.G.S., Neng, H.T., Nzometia, C.Y., Njamen, C.J.N., Tchente, C.N., Mboudou, E., Ekane, G.H., Egbe, T.O. and Essome, H. (2026) Prevalence, Pathogenic Profile, and Risk Factors of Pelvic Inflammatory Disease at a Referral Hospital in Sub-Saharan Africa: A Case-Control Study. *Open Journal of Obstetrics and Gynecology*, **16**, 283-296.
https://doi.org/10.4236/ojog.2026.162029

Received: November 15, 2025
Accepted: February 1, 2026
Published: February 4, 2026

Abstract

Background: Pelvic Inflammatory Disease (PID) remains a significant public health issue in low-resource settings due to its adverse effects on female reproductive health. This study aimed to determine the prevalence, microbial profile, and associated risk factors of PID at the Douala General Hospital in Cameroon. **Methods:** A retrospective case-control study was conducted over a 10-year period (January 2013-December 2023) at the Douala General Hospital. Sexually active women aged 15 - 50 diagnosed with PID were included as cases, and healthy pregnant women served as controls (1:2 ratio). Data were analyzed using SPSS version 24.0. Logistic regression was used to identify risk factors, and adjusted odds ratios (AORs) with 95% confidence intervals (CI) were calculated. Statistical significance was set at $p < 0.05$. **Results:** A total of 257 PID cases and 514 controls were analyzed. The mean age was 31.6 ± 7.7 years, with the 25 - 30 age group most affected. The prevalence of PID was 11.93%. The leading pathogens were *Chlamydia trachomatis* (33.9%), *Ureaplasma urealyticum* (24%), and *Mycoplasma hominis* (22.88%), with all cases showing polymicrobial infections. Significant risk factors included age 35 - 40 years (AOR = 1.74), being single (AOR = 2.62), secondary education (AOR = 1.84), being a housewife (AOR = 2.46), history of intrauterine procedures (AOR = 2.68), history of STDs (AOR = 18.87), having ≥2 sexual partners (AOR = 8.67),

early sexual debut (<20 years: AOR = 4.67), use of the calendar method (AOR = 2.85), intrauterine device (AOR = 10.05), and contraceptive implants (AOR = 12.17) (all $p < 0.05$). **Conclusion:** PID prevalence was 11.93%, with polymicrobial infections dominated by *C. trachomatis*, *U. urealyticum*, and *M. hominis*. Identified behavioral and reproductive risk factors highlight the need for targeted prevention strategies and the use of multiplex PCR testing for early diagnosis and management.

Keywords

Pelvic Inflammatory Disease, Prevalence, Pathogens, Risk Factors, Douala General Hospital, Cameroon

1. Introduction

Pelvic Inflammatory Disease (PID) is an infection of the upper female genital tract that includes a range of clinical conditions such as endometritis, salpingitis, oophoritis, pelvic peritonitis, parametritis, and tubo-ovarian abscesses [1]-[3]. In low- and middle-income countries (LMICs), PID represents a major public health concern due to its long-term sequelae, including chronic pelvic pain, ectopic pregnancy, and tubal factor infertility—all of which significantly compromise women's reproductive health and quality of life [4]-[7].

The etiology of PID is primarily polymicrobial, and the disease is most frequently associated with sexually transmitted infections (STIs), notably *Chlamydia trachomatis*, *Neisseria gonorrhoeae*, and genital mycoplasmas [8]-[10]. However, ascending infections caused by organisms from the gastrointestinal or oropharyngeal microbiota—such as enterobacteria, *Staphylococcus* spp., and *Streptococcus* spp.—are also increasingly implicated in both acute and subclinical cases [8] [10] [11].

The global incidence of PID is estimated to range between 0.28% and 1.67% [12]. In high-income countries such as the United States, the prevalence is approximately 4.4%, with identified risk factors including vaginal douching, multiple sexual partners, and untreated STIs [13]. Additional well-established risk factors include early sexual debut, low socioeconomic status, limited educational attainment, and sexual intercourse during menstruation. Reported prevalence in Asia varies considerably, reaching 24% in India and 8% in Pakistan [14].

In sub-Saharan Africa, the true burden of PID remains poorly defined due to underreporting, diagnostic challenges, and the limited availability of advanced microbiological testing [15]. For instance, a Nigerian study by Howells *et al.* reported a PID prevalence of 5.7%, identifying nulliparity as a primary risk factor [16]. The paucity of region-specific data—combined with the common occurrence of subclinical presentations—complicates clinical suspicion and timely diagnosis.

In the Cameroonian context, data on PID are scarce, and the diagnostic landscape is constrained by limited access to molecular testing. In particular, the underuse of nucleic acid amplification tests (NAATs), such as Polymerase Chain Reaction

(PCR), for pathogens like *C. trachomatis*, *Mycoplasma hominis*, and *Ureaplasma urealyticum* contributes to diagnostic underestimation [17].

This study aims to bridge existing knowledge gaps by determining the prevalence, microbial profile, and risk factors associated with PID at a major referral hospital in Cameroon. Findings from this investigation are expected to inform local prevention strategies, guide early intervention, and support the integration of molecular diagnostic tools in routine clinical practice.

2. Methods

Study Design and Setting

This was a retrospective case-control study conducted in the Gynecology-Obstetrics Department of the General Hospital of Douala (GHD), a tertiary referral and teaching facility located in Douala, the economic capital of Cameroon. The hospital is equipped with advanced diagnostic infrastructure, including modern microbiology and imaging units, making it suitable for the management of complex gynecological conditions such as Pelvic Inflammatory Disease (PID).

The Gynecology-Obstetrics Department consists of eight outpatient consultation rooms, an operating theatre, inpatient wards, and a maternity unit. Outpatient consultations are conducted by eight board-certified gynecologists. The microbiology laboratory is staffed by four medical biologists and supported by trained laboratory technicians and includes a bacteriology section equipped for routine cultures and some molecular diagnostics.

Study Period

Data collection was carried out over a 9-month period from October 1, 2022, to July 30, 2023. However, the patient data reviewed spanned a 10-year period, from January 1, 2013, to December 31, 2022.

Study Population and Sampling

The study population included the medical records of all women aged 15 to 50 years who consulted in the Gynecology-Obstetrics Department during the study period.

Two groups were defined:

- Cases: Records of women diagnosed with PID based on the Centers for Disease Control and Prevention (CDC) clinical diagnostic criteria [2]. These include lower abdominal tenderness, adnexal tenderness, and cervical motion tenderness, with or without additional criteria such as fever, abnormal discharge, or laboratory findings.
- Controls: Records of healthy pregnant women seen during the same period, with no history or clinical suspicion of PID, STIs, or gynecologic infections.

Cases and controls were selected using a 1:2 matching ratio, with matching based only on:

- Obstetric and gynecological history.

Inclusion and Exclusion Criteria

- Only records with complete data on at least 95% of variables of interest were included.

- Records were excluded if PID diagnosis did not meet CDC criteria or if more than 5% of required information was missing.

Data Collection and Quality Control

Data were manually abstracted from archived patient records using a structured, pre-tested data extraction form. To ensure data reliability:

- A team of two trained data abstractors conducted the review independently.
- A third investigator resolved any discrepancies.
- Inter-rater reliability was assessed on a sample of 30 records (Cohen's kappa = 0.89).
- Data abstraction was cross-checked against laboratory and imaging reports where available.

Data Entry and Statistical Analysis

Data were entered into SPSS version 24.0 (IBM Corp., Armonk, NY) after double-entry validation. Descriptive statistics were used to summarize variables. Categorical variables were reported as frequencies and percentages, and compared using the chi-square or Fisher's exact test as appropriate. Continuous variables were expressed as means with standard deviations (SD), and compared using Student's t-test.

To identify factors associated with PID, univariate logistic regression was first conducted. Variables with $p < 0.20$ in univariate analysis were entered into a multivariate logistic regression model, and adjusted odds ratios (AORs) with 95% confidence intervals (CIs) were reported. A p-value < 0.05 was considered statistically significant.

Ethical Considerations

Ethical approval was obtained from the Institutional Ethics Committee of the General Hospital of Douala. Since this was a retrospective study using anonymized records, informed consent was waived.

3. Results

Study Population and Prevalence of Pelvic Inflammatory Disease

Between 2013 and 2023, a total of 2154 women presented for gynecological consultation. Among these, 257 were diagnosed with pelvic inflammatory disease (PID), corresponding to a prevalence of 11.93%. A case-control analysis was conducted on 771 patient files—comprising 257 cases (PID) and 514 controls (pregnant women)—selected using a 1:2 case-to-control ratio.

Sociodemographic Characteristics

Table 1 summarizes participants' sociodemographic characteristics. The overall age range was 15 - 50 years, with similar mean ages in the two groups (cases: 31.03 ± 7.36 years; controls: 30.73 ± 7.18 years). The most represented age group among cases was 25 - 29 years (26.85%), whereas among controls it was 30 - 34 years (28.79%). On univariate analysis, women aged 30 - 34 years were significantly less likely to have PID (OR: 0.59, 95% CI: 0.41 - 0.85; p = 0.005), while those aged 35 - 39 years showed higher odds (OR: 1.49, 95% CI: 1.00 - 2.21; p = 0.04).

Marital status was strongly associated with PID. Being single increased the likelihood of PID (OR: 2.10, 95% CI: 1.54 - 2.85; $p < 0.001$), while being married or cohabiting was protective (OR: 0.48, 95% CI: 0.36 - 0.66; $p < 0.001$). Widowhood was not significantly associated with PID.

Education level also showed significant associations. Women with secondary education had higher odds of PID (OR: 2.14, 95% CI: 1.52 - 3.01; $p < 0.001$), whereas higher education was not significantly associated with PID.

Regarding occupation, being a housewife was associated with increased PID risk (OR: 1.82, 95% CI: 1.27 - 2.59; $p = 0.0008$). Employment in the formal sector showed no significant association, while working in the informal sector appeared protective (OR: 0.41, 95% CI: 0.24 - 0.69; $p = 0.0007$).

Although not statistically significant, a trend was observed regarding religion; Christians were more represented among cases than Muslims (95.33% vs. 4.67%; $p = 0.06$).

Table 1. Univariate analysis of sociodemographic characteristics.

Variable	Cases (n = 257) (%)	Controls (n = 514) (%)	OR (95% CI)	p-value
Age group (years)				
15 - 19	11 (4.28%)	38 (7.39%)	0.56 (0.28 - 1.11)	0.09
20 - 24	32 (12.45%)	59 (11.48%)	1.09 (0.70 - 1.73)	0.69
25 - 29	69 (26.85%)	133 (25.88%)	1.05 (0.74 - 1.47)	0.77
30 - 34	50 (19.46%)	148 (28.79%)	0.59 (0.41 - 0.85)	**0.005**
35 - 39	51 (19.84%)	73 (14.20%)	1.49 (1.00 - 2.21)	**0.04**
40 - 44	29 (11.28%)	41 (7.98%)	1.46 (0.88 - 2.42)	0.13
45 - 50	15 (5.84%)	22 (4.28%)	1.38 (0.70 - 2.72)	0.34
Marital Status				
Single	124 (48.25%)	158 (30.74%)	2.10 (1.54 - 2.85)	**<0.0001**
Married/Cohabiting	129 (50.19%)	346 (67.32%)	0.48 (0.36 - 0.66)	**<0.0001**
Widow	3 (1.17%)	10 (1.95%)	0.59 (0.16 - 2.18)	0.42
Level of Education				
Secondary	87 (33.85%)	99 (19.26%)	2.14 (1.52 - 3.01)	**<0.0001**
Higher	129 (50.19%)	284 (55.25%)	0.81 (0.60 - 1.10)	0.18
Occupation				
Housewife	73 (28.40%)	92 (17.90%)	1.82 (1.27 - 2.59)	**0.0008**
Student	12 (4.67%)	38 (7.39%)	0.61 (0.31 - 1.19)	0.14
Unskilled/Informal Sector	19 (7.39%)	83 (16.15%)	0.41 (0.24 - 0.69)	**0.0007**
Salaried Employee	99 (38.52%)	203 (39.49%)	0.95 (0.70 - 1.30)	0.79
Religion				
Christian	245 (95.33%)	471 (91.63%)	1.86 (0.96 - 3.60)	0.06
Muslim	12 (4.67%)	43 (8.37%)	0.53 (0.27 - 1.03)	0.06

Microbial Profile of Pelvic Inflammatory Disease

Figure 1 presents the microbial profile among the 257 PID cases. All infections demonstrated a polymicrobial etiology. The most frequently identified pathogens were:

- *Chlamydia trachomatis*: 33.09%
- *Ureaplasma urealyticum*: 24.12%
- *Mycoplasma hominis*: 22.88%

Co-infections were common (Table 2). The most frequent combination was *M. hominis* + *U. urealyticum* (28.01%), followed by *C. trachomatis* + *M. hominis* (22.95%) and *C. trachomatis* + *U. urealyticum* (20.62%). A smaller proportion of cases involved mixed infections with *Candida albicans*, *Enterobacteriaceae*, *Neisseria gonorrhoeae*, or *Gardnerella vaginalis*.

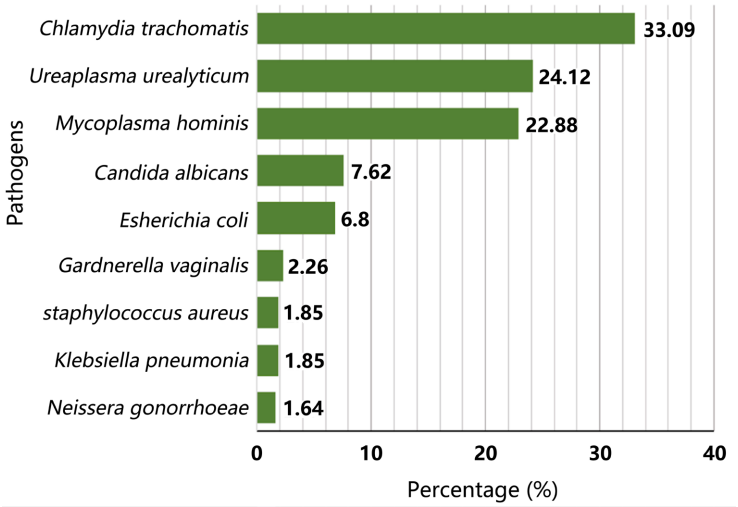

Figure 1. Pathogens found in PID cases.

Table 2. Distribution of pathogen combinations identified among PID patients (n = 257).

Pathogen Combination	Frequency (n)	Percentage (%)
Mycoplasma hominis + *Ureaplasma urealyticum*	72	28.01
Chlamydia trachomatis + *Mycoplasma hominis*	59	22.95
Chlamydia trachomatis + *Ureaplasma urealyticum*	53	20.62
Chlamydia trachomatis + *Mycoplasma hominis* + *Ureaplasma urealyticum*	37	14.39
Chlamydia trachomatis + *Ureaplasma urealyticum* + *Candida albicans*	9	3.50
Chlamydia trachomatis + *Ureaplasma urealyticum* + *Enterobacteriaceae*	6	2.33
Chlamydia trachomatis + *Candida albicans*	5	1.94
Chlamydia trachomatis + *Neisseria gonorrhoeae*	5	1.94
Ureaplasma urealyticum + *Enterobacteriaceae*	4	1.55
Ureaplasma urealyticum + *Gardnerella vaginalis*	4	1.55
Chlamydia trachomatis + *Ureaplasma urealyticum* + *Neisseria gonorrhoeae*	3	1.16

Gynecological, Obstetric and Medical History

Table 3 summarizes the distribution of gynecological and medical risk factors. Most participants in both groups were multiparous (cases: 59.53%; controls: 71.40%). Primiparity was protective (OR: 0.49, 95% CI: 0.31 - 0.78; p = 0.002), as was multiparity (OR: 0.58, 95% CI: 0.43 - 0.80; p = 0.009).

A history of abortion was significantly more frequent among cases (39.30% vs. 25.29%) and was associated with increased risk of PID (OR: 1.91, 95% CI: 1.38 - 2.63; p < 0.001).

Similarly, prior intrauterine procedures were reported by 54.47% of cases compared with 24.71% of controls, showing a strong association with PID (OR: 3.64, 95% CI: 2.65 - 5.00; p < 0.001).

A history of sexually transmitted infections (STIs) was one of the strongest predictors of PID: 84% of cases compared with 21.98% of controls (OR: 19.25, 95% CI: 12.95 - 28.63; p < 0.001).

Likewise, having two or more lifetime sexual partners markedly increased PID risk (OR: 14.40, 95% CI: 9.60 - 21.61; p < 0.001).

Early sexual debut was also associated with PID. Women who initiated sexual activity before age 15 had significantly higher odds (OR: 7.32, 95% CI: 2.96 - 18.13; p < 0.001), and initiation between ages 15 - 20 also increased risk (OR: 2.45, 95% CI: 1.73 - 3.47; p < 0.001).

Certain contraceptive methods were associated with an increased risk of PID. Compared with controls, cases reported less condom use (OR: 0.17, 95% CI: 0.12 - 0.25; p < 0.001), and greater use of IUDs (OR: 4.12, 95% CI: 1.39 - 12.19; p = 0.005), implants (OR: 7.42, 95% CI: 3.59 - 15.33; p < 0.001), and periodic abstinence (OR: 2.19, 95% CI: 1.61 - 2.97; p < 0.001).

Regarding medical history, HIV-positive status was significantly associated with PID (8.56% vs. 4.47%; OR: 1.99, 95% CI: 1.09 - 3.66; p = 0.02).

Multivariate analysis

Multivariate logistic regression identified several variables independently associated with PID (Table 4). These included:

- Age 35 - 39 years: aOR 1.74 (95% CI: 1.14 - 2.66)
- Single marital status: aOR 2.62 (95% CI: 1.86 - 3.67)
- Secondary education: aOR 1.84 (95% CI: 1.23 - 2.63)
- Housewife occupation: aOR 2.46 (95% CI: 1.65 - 3.67)

Significant gynecological predictors included:

- History of intrauterine procedures: aOR 2.68 (95% CI: 1.47 - 4.90)
- History of STIs: aOR 18.87 (95% CI: 11.41 - 31.20)
- ≥2 sexual partners: aOR 8.67 (95% CI: 5.12 - 14.66)
- Sexual debut before age 20: aOR 4.67 (95% CI: 3.12 - 6.98)

Contraceptive methods remained independently associated:

- IUD use: aOR 10.05 (95% CI: 3.15 - 32.04)
- Implants: aOR 12.17 (95% CI: 5.64 - 26.24)
- Periodic abstinence: aOR 2.85 (95% CI: 2.01 - 4.04)

In contrast, HIV infection and prior abortion did not remain independently associated with PID in the final model.

Table 3. Univariate analysis of gynecological, obstetric, and medical history and risk of pelvic inflammatory disease.

Variable	Cases (n = 257)	Controls (n = 514)	OR (95% CI)	p-value
Parity				
Primiparous	26 (10.12%)	95 (18.48%)	0.49 (0.31 - 0.78)	0.002
Multiparous	153 (59.53%)	367 (71.40%)	0.58 (0.43 - 0.80)	0.009
Abortion				
Yes	101 (39.30%)	130 (25.29%)	1.91 (1.38 - 2.63)	<0.001
No	156 (60.70%)	384 (74.71%)	0.50 (0.37 - 0.71)	<0.001
Intrauterine Procedures				
Yes	140 (54.47%)	127 (24.71%)	3.64 (2.65 - 5.00)	<0.001
No	117 (45.53%)	387 (75.29%)	0.27 (0.19 - 0.37)	<0.001
History of STIs				
Yes	217 (84.44%)	113 (21.98%)	19.25 (12.95 - 28.63)	<0.001
No	40 (15.56%)	401 (78.02%)	0.05 (0.03 - 0.07)	<0.001
Number of Sexual Partners				
0 - 1	116 (45.14%)	474 (92.22%)	0.06 (0.04 - 0.10)	<0.001
≥2	141 (54.86%)	40 (7.78%)	14.40 (9.60 - 21.61)	<0.001
Age at First Sexual Intercourse				
<15 years	25 (9.73%)	6 (1.17%)	7.32 (2.96 - 18.13)	<0.001
15 - 20 years	202 (78.60%)	308 (59.92%)	2.45 (1.73 - 3.47)	<0.001
>20 years	30 (11.67%)	200 (38.91%)	0.20 (0.13 - 0.31)	<0.001
Contraceptive Use				
Condom	56 (21.79%)	313 (60.89%)	0.17 (0.12 - 0.25)	<0.001
Emergency pill	29 (10.12%)	24 (4.67%)	0.19 (0.13 - 0.30)	<0.001
IUD	10 (3.89%)	5 (0.97%)	4.12 (1.39 - 12.19)	0.005
Implants	33 (12.84%)	10 (1.95%)	7.42 (3.59 - 15.33)	<0.001
Periodic Abstinence	129 (50.19%)	162 (31.52%)	2.19 (1.61 - 2.97)	<0.001
HIV Status				
HIV Positive	22 (8.56%)	23 (4.47%)	1.99 (1.09 - 3.66)	0.020
HIV Negative	235 (91.44%)	491 (95.53%)	0.50 (0.27 - 0.91)	0.020

Table 4. Multivariate logistic regression of factors associated with pelvic inflammatory disease.

Variable	Adjusted OR (95% CI)	p-value
Age group (35 - 39 years)	1.74 (1.14 - 2.66)	0.009
Marital status: Single	2.62 (1.86 - 3.67)	<0.001
Secondary education	1.84 (1.23 - 2.63)	0.008
Occupation: Housewife	2.46 (1.65 - 3.67)	<0.001
HIV positive	0.89 (0.41 - 1.92)	0.78
History of abortion	0.63 (0.34 - 1.17)	0.15
Intrauterine procedures	2.68 (1.47 - 4.90)	0.001
History of STIs	18.87 (11.41 - 31.20)	<0.001
≥2 sexual partners	8.67 (5.12 - 14.66)	<0.001
Sexual debut before 20 years	4.67 (3.12 - 6.98)	<0.001
Use of IUD	10.05 (3.15 - 32.04)	0.001
Use of implants	12.17 (5.64 - 26.24)	<0.001
Periodic abstinence	2.85 (2.01 - 4.04)	<0.001

4. Discussion

Age Distribution and Prevalence of PID

This retrospective case-control study examined risk factors associated with pelvic inflammatory disease (PID) among women aged 15 - 50 years at a tertiary hospital in Cameroon. The overall PID prevalence of 11.93% aligns with the high burden of reproductive tract infections reported in similar sub-Saharan African settings. The most represented age group was 25 - 30 years (26.85%), slightly older than the 20 - 24-year peak reported by Nkwabong *et al.* in Cameroon [17]. This difference may partly reflect the lower proportion of youth (16.73%) in our cohort and suggests that older reproductive-age women remain vulnerable, likely due to cumulative exposure to risk factors or delays in seeking care. The mean age of affected women (31.62 ± 7.70 years) was comparable to previous findings from Cameroon and Nigeria [16] [17], reinforcing that PID is most common during peak reproductive and sexual activity years.

Our observed prevalence exceeded the 4.7% reported by Nkwabong *et al.* [17] but remained below the 24% reported in India by Vanamala *et al.* [18]. Variations across studies may be attributable to differences in study duration, population characteristics, diagnostic techniques, and healthcare-seeking behavior. In particular, the 10-year timeframe and use of multiplex PCR in our study likely improved detection of both symptomatic and subclinical PID.

Microbiological Profile: Changing Trends and Diagnostic Sensitivity

Chlamydia trachomatis, Ureaplasma urealyticum, and Mycoplasma hominis were the most frequently identified pathogens, consistent with regional and global literature [6] [7] [19]. These organisms are common causes of non-gonococcal

PID and are known for their ability to persist asymptomatically.

Unexpectedly, Neisseria gonorrhoeae was rarely detected (1.64%), contrasting with historical data that typically rank it as the second most common etiologic agent after *Chlamydia trachomatis* [1] [2] [9]. Its pauci-symptomatic presentation in women often leads to underdiagnosis in settings without routine NAAT or PCR testing [15]. Our findings mirror those of Nana-Njamen *et al.* [8], who also reported low gonococcal detection in similar diagnostic environments.

Detection of enterobacteria such as *Escherichia coli* further supports the polymicrobial nature of PID, consistent with evidence from post-procedural and post-surgical infections [4] [20].

Risk Factors for PID: Contextual Insights

Sociodemographic Determinants

Older age (35 - 40 years) increased PID risk (OR: 1.74, 95% CI: 1.14 - 2.66), differing from reports that highlight adolescence as the highest-risk period [20]. This contrast may reflect lower rates of early sexual debut and distinct contraceptive patterns in developing regions, where older women accumulate greater exposure to untreated or recurrent infections.

Being single significantly increased the likelihood of PID (OR: 2.62, 95% CI: 1.86 - 3.67), consistent with findings from Simms *et al.* in the U.S. [21]. Single women may experience higher partner turnover or less relationship stability, thereby increasing STI exposure.

Low educational attainment also emerged as a risk factor (OR: 1.84; 95% CI: 1.23 - 2.63). Similar findings by Vanamala *et al.* [18] suggest that limited health literacy and poor knowledge of STI prevention likely contribute to this association.

Sexual and Reproductive Behavior

A history of STIs was the strongest predictor of PID (OR: 18.87; 95% CI: 11.41 - 31.20), consistent with literature demonstrating that recurrent or inadequately treated infections promote chronic inflammation and facilitate ascending infection [21] [22].

Multiple sexual partnerships (≥2 partners) increased PID risk by 8.67-fold, supporting Jossens *et al.*'s findings that recent partner change significantly elevates STI transmission [23]. Exposure to multiple microbial strains without consistent barrier protection likely underlies this risk.

Early sexual debut was a robust determinant, with initiation before age 15 increasing PID risk by 28.84 (95% CI: 10.64 - 78.16), and debut between 15 - 20 years by 3.88 (95% CI: 2.49 - 6.05). This pattern aligns with Simms *et al.*'s identification of early adolescence as a critical vulnerability period [21]. Biological susceptibility of the immature cervix and limited power to negotiate safe sex practices are key contributors.

Contraceptive Use and Procedure-Linked Risks

Implant users exhibited significantly higher PID risk (OR: 12.17; 95% CI: 5.64 - 26.24), possibly reflecting decreased condom use among women who feel protected from pregnancy but remain exposed to STIs.

IUD use was another strong predictor (OR: 10.05), consistent with reports by Jossens *et al.* [23] and Bhurt *et al.* [14]. Pathogen introduction during insertion and the potential for microbial biofilm formation on the device may increase infection risk, especially in the presence of undetected cervicitis.

Intrauterine procedures increased PID risk (OR: 2.68; 95% CI: 1.47 - 4.90), echoing findings from Kenya where up to 44% of hysteroscopies led to PID [20]. These procedures compromise cervical barriers and facilitate ascending infection.

Periodic abstinence also increased PID risk (OR: 2.85). In settings where 61% of women were married, reliance on this method without condom use may expose women to STIs from partners with unrecognized or extramarital infections.

Public Health and Clinical Implications

The high PID prevalence and predominance of polymicrobial infections underscore the need for integrated prevention and early detection strategies. Key actions include:

- Routine STI screening, especially for *Chlamydia trachomatis*, as part of primary reproductive healthcare.
- Expanded use of multiplex PCR, which offers superior sensitivity over conventional diagnostic methods.
- Comprehensive sexuality education for adolescents and young adults, emphasizing risks of early sexual debut, multiple partnerships, and unprotected sex.
- Enhanced counseling for women undergoing IUD insertion or intrauterine procedures, including consideration of targeted prophylactic antibiotics in high-risk individuals.

Strengths and Limitations

Strengths

- A large, 10-year dataset from a major referral hospital strengthens the representativeness and reliability of findings.
- Matched case-control design with multivariate regression improved control of confounding.
- Detailed microbiological profiling enabled robust characterization of PID etiology in this setting.

Limitations

This cross-sectional study relied on retrospective medical records, which may contain incomplete or inaccurate data, leading to misclassification bias. The design limits causal inference. Using pregnant women as controls may introduce selection bias due to differences in health-seeking behavior and risk profiles, affecting generalizability.

5. Conclusions

This study identified a PID prevalence of 11.93%, with a predominantly polymicrobial etiology driven by *Chlamydia trachomatis*, *Ureaplasma urealyticum*, and *Mycoplasma hominis*. Contrary to global trends, *Neisseria gonorrhoeae* was rarely detected. Classical PID risk factors were confirmed, including early sexual

debut, multiple sexual partners, single marital status, low educational level, IUD and implant use, and prior STIs.

These findings emphasize the need for a multipronged approach to PID prevention, combining advanced diagnostic tools such as multiplex PCR with risk-based screening and targeted public health interventions. Strengthening reproductive health education and improving access to STI prevention and early treatment are essential for reducing the burden and long-term complications of PID in resource-limited settings.

Ethical Considerations

Ethical approval was obtained from the Institutional Ethics Committee of the General Hospital of Douala. Since this was a retrospective study using anonymized records, informed consent was waived.

Availability of Data and Materials

The datasets (patient medical files) are available at DGH upon reasonable request.

Authors' Contributions

RT, TNN, FGM, and ANN and HE conceptualized and designed the study. FMN, CNN were responsible for participant recruitment at the study sites. AGSW and CNT, HNT also contributed to participant recruitment and provided feedback on the manuscript. The manuscript was written by TNN, RT, CN. ETM, TEO, GHE and FGM. HE, GHE critically revised and reviewed the manuscript for important intellectual content. All authors read and approved the final version of the manuscript.

Acknowledgements

We would like to express our sincere gratitude to all the doctors, nurses, medical students, and statisticians for their dedication and assistance in retrieving patient records and analyzing the data.

Conflicts of Interest

Authors declare no competing interests

References

[1] Ross, J., Guaschino, S., Cusini, M. and Jensen, J. (2017) 2017 European Guideline for the Management of Pelvic Inflammatory Disease. *International Journal of STD & AIDS*, **29**, 108-114. https://doi.org/10.1177/0956462417744099

[2] Centers for Disease Control and Prevention (2021) Sexually Transmitted Infections: Treatment Guidelines, 2021. CDC. https://www.cdc.gov/mmwr/volumes/70/rr/RR7004a1.htm

[3] Centers for Disease Control and Prevention (2021) Pelvic Inflammatory Disease (PID) Management Guidelines, 2021. CDC. https://www.cdc.gov/std/treatment-guidelines/pid.htm

[4] Nana Njamen, T., Messina, R., Enama, B., Kasia, J.M., Toukam, M., Medou, A., *et al.* (2006) Coelioscopie pour douleur pelvienne: retrouvailles de 40 cas en séries. *Clinics in Mother and Child Health*, **3**, 427-431.

[5] Nana Njamen, T., Mboudou, E., Belley Priso, E. and Sama, D.A. (2013) Certains facteurs cliniques de risque des grossesses extra-utérines identifiés à l'Hôpital Général de Douala. *Health Sciences and Disease*, **10**. https://www.hsd-fmsb.org/

[6] Bender, N., Herrmann, B., Andersen, B., Hocking, J.S., van Bergen, J., Morgan, J., *et al.* (2011) Chlamydia Infection, Pelvic Inflammatory Disease, Ectopic Pregnancy and Infertility: Cross-National Study. *Sexually Transmitted Infections*, **87**, 601-608. https://doi.org/10.1136/sextrans-2011-050205

[7] Fernandes, L.B., Arruda, J.T., Approbato, M.S. and García-Zapata, M.T.A. (2014) Infecção por *Chlamydia trachomatis* e Neisseria gonorrhoeae: fatores associados à infertilidade em mulheres atendidas em um serviço público de reprodução humana. *Revista Brasileira de Ginecologia e Obstetrícia*, **36**, 353-358. https://doi.org/10.1590/so100-720320140005009

[8] Nana Njamen, T., Nguefack, T., Njamen Nana, T., Nkemtendong, N., Okalla Ebongue, C., Belley Priso, E., *et al.* (2017) Pathogenic Profile of Female Patients with Genital Tract Infections in a Tertiary Hospital in Sub-Saharan Africa's Setting. *African Journal of Integrated Health*, **7**, 42-48.

[9] Dubbink, J.H., de Waaij, D.J., Bos, M., van der Eem, L., Bébéar, C., Mbambazela, N., *et al.* (2016) Microbiological Characteristics of *Chlamydia Trachomatis* and Neisseria Gonorrhoeae Infections in South African Women. *Journal of Clinical Microbiology*, **54**, 200-203. https://doi.org/10.1128/jcm.02848-15

[10] Okon, K., Ayilara, R., Bello, K., Uba, A. and Aniesona, T. (2008) Microbial Spectrum of Pelvic Inflamatory Diseases in Nguru, Nigeria. *African Journal of Clinical and Experimental Microbiology*, **9**, 157-165. https://doi.org/10.4314/ajcem.v9i3.7500

[11] Eze, E.M., Unegbu, V.N., Ezebialu, C.U. and Nneji, I.R. (2018) Prevalence of Microorganisms Associated with Pelvic Inflammatory Disease in Reproductive-Aged Women in Onitsha North, Anambra State, Nigeria. *Novel Research in Microbiology Journal*, **2**, 147-155.

[12] French, C.E., Hughes, G., Nicholson, A., Yung, M., Ross, J.D., Williams, T., *et al.* (2011) Estimation of the Rate of Pelvic Inflammatory Disease Diagnoses: Trends in England, 2000-2008. *Sexually Transmitted Diseases*, **38**, 158-162. https://doi.org/10.1097/olq.0b013e3181f22f3e

[13] Kreisel, K., Torrone, E., Bernstein, K., Hong, J. and Gorwitz, R. (2017) Prevalence of Pelvic Inflammatory Disease in Sexually Experienced Women of Reproductive Age—United States, 2013-2014. *MMWR. Morbidity and Mortality Weekly Report*, **66**, 80-83. https://doi.org/10.15585/mmwr.mm6603a3

[14] Bhurt, A.W., Fikree, F.F., Bhurt, A.M., Channa, G.Z., Soomro, R.A. and Bhurt, N. (1999) Prevalence and Risk Factors of Symptoms of Pelvic Inflammatory Disease in a Rural Community of Jamshoro, Sindh, Pakistan. *Journal of the Pakistan Medical Association*, **49**, 188-194.

[15] Reekie, J., Donovan, B., Guy, R., Hocking, J.S., Jorm, L., Kaldor, J.M., *et al.* (2014) Hospitalisations for Pelvic Inflammatory Disease Temporally Related to a Diagnosis of Chlamydia or Gonorrhoea: A Retrospective Cohort Study. *PLOS ONE*, **9**, e94361. https://doi.org/10.1371/journal.pone.0094361

[16] Howells, I. and Okwudili, E. (2018) Acute Pelvic Inflammatory Disease and Its Long-Term Sequelae: The University of Port Harcourt Experience. *Journal of Advances in Medicine and Medical Research*, **26**, 1-11. https://doi.org/10.9734/jammr/2018/41437

[17] Nkwabong, E. and Dingom, M.A.N. (2015) Acute Pelvic Inflammatory Disease in Cameroon: A Cross-Sectional Descriptive Study. *African Journal of Reproductive Health*, **19**, 87-91.

[18] Vanamala, V.G., Pakyanadhan, S., Rachel, A. and P., S.A. (2018) Pelvic Inflammatory Disease and the Risk Factors. *International Journal of Reproduction, Contraception, Obstetrics and Gynecology*, **7**, 3572-3575. https://doi.org/10.18203/2320-1770.ijrcog20183373

[19] Tao, X., Ge, S., Chen, L., Cai, L., Hwang, M. and Wang, C. (2018) Relationships between Female Infertility and Female Genital Infections and Pelvic Inflammatory Disease: A Population-Based Nested Controlled Study. *Clinics*, **73**, e364. https://doi.org/10.6061/clinics/2018/e364

[20] Majinge, C.R. and Lema, V.M. (1993) Acute Pelvic Infection Following Hysterosalpingography at Kenyatta National Hospital in Nairobi. *East African Medical Journal*, **70**, 551-555.

[21] Simms, I., Stephenson, J.M., Mallinson, H., Peeling, R.W., Thomas, K., Gokhale, R., *et al.* (2006) Risk Factors Associated with Pelvic Inflammatory Disease. *Sexually Transmitted Infections*, **82**, 452-457. https://doi.org/10.1136/sti.2005.019539

[22] Wiesenfeld, H.C., Hillier, S.L., Meyn, L.A., Amortegui, A.J. and Sweet, R.L. (2012) Subclinical Pelvic Inflammatory Disease and Infertility. *Obstetrics & Gynecology*, **120**, 37-43. https://doi.org/10.1097/aog.0b013e31825a6bc9

[23] Jossens, M.O.R., Eskenazi, B., Schachter, J. and Sweet, R.L. (1996) Risk Factors for Pelvic Inflammatory Disease. *Sexually Transmitted Diseases*, **23**, 239-247. https://doi.org/10.1097/00007435-199605000-00014