Nursing Science and Clinical Practice

https://nscp.cultechpub.com/nscp

E-ISSN: 3141-1029

Vol. 2, No. 2, November 2026

DOI: 10.64229/xmaq8x42

Article

Pelvic Inflammatory Disease (PID) Among Women of Reproductive and Perimenopausal Age in Delta State, Nigeria: Prevalence, Symptoms, Risk Factors, Awareness, and Health-Seeking Behaviours; A Cross-Sectional Study

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Abstract

Background: Pelvic inflammatory disease (PID) is a major reproductive-health problem associated with tubal infertility, ectopic pregnancy, chronic pelvic pain and recurrent infection. Objective: To determine and compare the prevalence, symptoms, risk factors, awareness and health-seeking behaviours associated with PID among reproductive-age and perimenopausal women in Delta State, Nigeria. Methods: An analytical cross-sectional study was conducted among 400 women aged 18-55 years attending six selected public hospitals in Delta State between November 2024 and July 2025. Participants were classified as reproductive-age women (18-44 years) or perimenopausal women (45-55 years). Data were collected using a structured questionnaire, clinical examination and supportive laboratory or imaging investigations. Clinically supported PID was the primary outcome. Results: The study included 255 reproductive-age and 145 perimenopausal women. Overall PID prevalence was 31.0% (95% CI: 26.7%-35.7%), with prevalence of 28.6% and 35.2%, respectively; the difference was not statistically significant (p=0.174). Previous PID, previous sexually transmitted infection, inconsistent condom use, vaginal douching and previous uterine instrumentation were significant independent predictors. Awareness was lower among perimenopausal women, who also had more delayed healthcare seeking. Conclusion: PID constituted a substantial clinical burden in both groups. Reproductive stage was not an independent predictor after adjustment. Prevention and management should emphasise individual risk assessment, improved awareness, prompt clinical evaluation and timely treatment.

Keywords

Pelvic inflammatory disease, Clinical assessment, Reproductive-aged women, Perimenopause, Prevalence, Awareness, Health-seeking behaviour, Delta State

Article History

Received: 30 January 2026 Revised: 27 July 2026

Accepted: 21 August 2026 Available Online: 13 November 2026

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1. Introduction

Pelvic inflammatory disease (PID) comprises infection-induced inflammatory disorders of the upper female genital tract, including endometritis, salpingitis, tubo-ovarian abscess and pelvic peritonitis. Infection commonly develops through the ascending spread of microorganisms from the vagina or cervix into the uterus and fallopian tubes. Although Chlamydia trachomatis and Neisseria gonorrhoeae remain important causes, PID is frequently polymicrobial and may involve anaerobes, bacterial-vaginosis-associated organisms, Trichomonas vaginalis, Mycoplasma genitalium and other components of the vaginal flora. Furthermore, no single symptom, examination finding or laboratory result can confirm every case; diagnosis therefore requires consideration of clinical history, pelvic examination, exclusion of alternative conditions and supportive laboratory or imaging findings [1,2].

PID remains an important global reproductive-health problem, particularly in lower-resource settings where sexually transmitted infection screening and early treatment may be inadequate. Global Burden of Disease 2021 estimates showed that Western sub-Saharan Africa had the highest regional age-standardised PID prevalence rate among females of all ages, at 29.13 per 100,000 women. Among women aged 15-49 years, the estimated rate in Western sub-Saharan Africa was 103.03 per 100,000, compared with substantially lower rates in many high-income regions. Country-level estimates also identified high burdens in Guinea-Bissau and Sierra Leone, with prevalence rates of 59.48 and 59.25 per 100,000 women, respectively [3,4]. These modelled estimates demonstrate that West Africa remains an important setting for PID prevention, diagnosis and treatment.

Reliable population-based estimates remain limited in Nigeria because most available studies have involved selected hospital populations and varying diagnostic criteria. In Onitsha North, Anambra State, PID-associated microorganisms were identified in 300 of 500 women examined, representing 60.0% of the study population [5]. In another hospital-based investigation conducted across nine hospitals in North-Central Nigeria, 720 of 1,170 women were classified as PID cases, giving a proportion of approximately 61.5% [6]. These data suggest a considerable clinical burden but should not be interpreted as nationally representative prevalence estimates because the studies involved healthcare attendees rather than randomly selected community populations. In a multicountry West African study involving women with vaginal discharge in Benin, Burkina Faso, Ghana, Guinea and Mali, the combined prevalence of cervical gonorrhoea or chlamydia was 4.4%; prevalence was approximately 2% in Ghana and Benin and 6% in Burkina Faso, Mali and Guinea [7]. Although cervical infection is not equivalent to PID, untreated infection may ascend into the upper genital tract and contribute to its development.

Established PID risk factors include untreated sexually transmitted infections, previous PID, multiple or concurrent sexual partners, inconsistent condom use and having a partner with other sexual partners. Early sexual debut may extend the period of exposure to sexually transmitted pathogens and has been associated with subsequent PID occurrence [8]. Previous PID is particularly important because affected women remain susceptible to recurrent infection. Poor genital-health practices, especially vaginal douching, may disrupt protective vaginal microorganisms and facilitate ascending infection; observational evidence has associated frequent douching with an increased risk of acute PID [9]. Contraceptive-related risk also requires careful interpretation. The small increase in PID risk among intrauterine device users is concentrated mainly within the first three weeks after insertion, particularly when an untreated cervical infection is present, rather than throughout the entire period of device use [1,10].

Failure to diagnose and treat PID promptly may result in permanent inflammatory damage and scarring of the fallopian tubes. Major complications include tubal-factor infertility, ectopic pregnancy, chronic pelvic pain, recurrent PID, pelvic adhesions and tubo-ovarian abscess. Approximately one in eight women with a history of PID experiences difficulty becoming pregnant, while treatment delay increases the likelihood of infertility or ectopic pregnancy [10,11]. Antimicrobial treatment may eliminate the active infection but cannot reverse reproductive-tract damage that occurred before treatment. Timely symptom recognition, clinical assessment, treatment completion and partner management are therefore essential for preventing long-term morbidity.

PID is commonly investigated among adolescents and younger reproductive-age women because sexually transmitted infections are concentrated within these groups. However, perimenopausal women may also develop PID and related complications. Their clinical assessment may be more complex because pelvic pain, irregular bleeding, dyspareunia, vaginal discharge and urinary symptoms can also result from hormonal changes, urinary infection, structural gynaecological disease or malignancy. Evidence from older women indicates that PID may involve polymicrobial infection, tubo-ovarian abscess, previous pelvic procedures or other coexisting pelvic abnormalities [12]. Awareness and health-seeking behaviour are also important because limited knowledge, stigma, treatment costs and self-medication may delay attendance at an appropriate healthcare facility. Nigerian research has shown that women may have heard of reproductive tract infections while still having inadequate knowledge of their symptoms, complications and appropriate sources of care [13].

Despite the recognised burden of PID, evidence directly comparing reproductive-age and perimenopausal women in Nigeria remains limited. Previous Nigerian studies have predominantly involved reproductive-age women, symptomatic hospital attendees, microbiological isolates or retrospective clinical records [5,6,13,14]. In Delta State, available research has examined PID cases documented in a health facility and vaginal infections among selected female patients, but these studies did not compare clinically assessed PID prevalence, symptoms, risk factors, awareness and health-seeking

behaviours between reproductive-age and perimenopausal women using a common diagnostic framework [14,15]. This leaves uncertainty regarding whether differences between the two groups are attributable to reproductive stage or to variations in previous PID, STI exposure, sexual behaviour, genital-health practices, reproductive procedures and access to healthcare. The present study therefore assessed and compared PID among reproductive-age and perimenopausal women in Delta State, Nigeria.

2. Materials and Methods

2.1 Research Design

An analytical cross-sectional design was used to estimate clinically supported PID prevalence and examine associations between PID, reproductive stage, symptoms, risk factors, awareness, and health-seeking behaviours. The design permitted group comparison at a defined assessment period but did not establish temporal or causal relationships.

2.2 Study Area

The study was conducted in Delta State, located in the South-South geopolitical zone of Nigeria. Six Local Government Areas were included: Oshimili South, Ethiope East, Ughelli North, Warri South, Ndokwa West and Patani. These Local Government Areas comprise urban, semi-urban and rural communities with variations in socioeconomic conditions, population characteristics and access to reproductive-health services.

Participants were recruited from six public healthcare facilities: Federal Medical Centre, Asaba, in Oshimili South LGA; Government Hospital, Isiokolo, in Ethiope East LGA; Central Hospital, Ughelli, in Ughelli North LGA; Central Hospital, Warri, in Warri South LGA; Central Hospital, Kwale, in Ndokwa West LGA; and General Hospital, Patani, in Patani LGA [16,17]. These facilities provide general outpatient, family-medicine, obstetric, gynaecological, family-planning, laboratory and reproductive-health services to women from urban, semi-urban and rural communities within the selected Local Government Areas and surrounding communities.

A review of the attendance registers for November 2024 - July 2025 showed that approximately 255 women aged 18-39 years and 145 women aged 40-55 years attended the participating hospitals each month. The monthly attendance data demonstrated that the facilities had an adequate source population from which the required number of eligible participants could be recruited during the study period.

2.3 Study Population and Reproductive-Stage Classification

The study population consisted of women aged 18-55 years attending the selected healthcare facilities in Oshimili South, Ethiope East, Ughelli North, Warri South, Ndokwa West and Patani Local Government Areas of Delta State between November 2024 and July 2025.

Participants were categorised as reproductive-age women aged 18-44 years and perimenopausal women aged 45-55 years. Women who met the eligibility criteria and provided written informed consent were enrolled in the study.

A total of 445 eligible women were approached for participation. Of these, 45 declined participation or had incomplete information, while 400 women with complete questionnaire and clinical information were included in the final analysis [7,8].

2.4 Sample Size Determination

The minimum sample size was calculated using Cochran's formula for estimating a single population proportion:

$$n_0 = \frac{Z^2 pq}{d^2} \tag{1}$$

Where:

$$Z=1.96,\ p=0.50,\ q=0.50,\ d=0.049 \tag{2}$$

Substituting the values:

$$n_0 = \frac{(1.96)^2(0.50)(0.50)}{(0.049)^2} \tag{3}$$

$$n_0 = \frac{0.9604}{0.002401} \approx 400 \tag{4}$$

The initial minimum sample size was therefore 400 participants. To account for an anticipated 10% non-response or incomplete-response rate, the sample size was adjusted as follows:

$$n_{adjusted} = \frac{n_0}{1 - r} \tag{5}$$

Where r=0.10:

$$n_{adjusted} = \frac{400}{1 - 0.10} \tag{6}$$

$$n_{adjusted} = \frac{400}{0.90} = 444.44 \tag{7}$$

The minimum recruitment target was therefore rounded upward to 445 women to ensure that at least 400 participants with complete data would be available for analysis.

2.5 Sampling Technique

A multistage procedure was specified. Delta State was stratified by senatorial district, two LGAs were selected from each district, and participating communities and facilities were treated as clusters. Within each cluster, eligible women were selected using systematic or simple random procedures from household, attendance, or community sampling lists. Women were not selected because of a known PID diagnosis or reproductive-health complaint, as purposive oversampling of symptomatic or previously diagnosed women would inflate prevalence and weaken population inference. Equal reproductive-stage quotas were applied to achieve the planned comparative sample.

2.6 Data Collection Procedure

After written informed consent, each participant completed the questionnaire and then proceeded to a separate clinical assessment conducted by trained, qualified health professionals. Questionnaire and clinical forms were linked using unique participant codes. Specimens were collected before antibiotic treatment whenever this could be done without delaying clinically indicated care. Participants with severe pain, guarding, rebound tenderness, a positive pregnancy test, suspected ectopic pregnancy, tubo-ovarian abscess, or another emergency condition were referred immediately.

2.7 Questionnaire Component

The structured questionnaire assessed sociodemographic characteristics, previous PID and STI history, sexual and reproductive risk factors, PID awareness, current symptoms, self-reported previous PID diagnosis, and health-seeking behaviour. Self-reported PID was retained as a distinct validation variable and was not used to replace the clinical outcome.

2.8 Clinical Assessment of Participants

All 400 participants underwent a standardised clinical assessment. This component was not another questionnaire. A clinician recorded temperature and other vital signs; performed abdominal examination for lower abdominal tenderness, guarding, rebound tenderness, and masses; undertook speculum examination for abnormal or mucopurulent discharge, cervical friability, contact bleeding, and other cervical abnormalities; and completed bimanual examination for cervical motion tenderness, uterine tenderness, and adnexal tenderness. Pregnancy testing preceded final PID classification where pregnancy was possible.

2.9 Laboratory Investigations

The investigation package comprised vaginal-fluid saline microscopy for abundant white blood cells, bacterial vaginosis, and Trichomonas vaginalis; nucleic acid amplification testing for Neisseria gonorrhoeae and Chlamydia trachomatis; C-reactive protein, erythrocyte sedimentation rate, full blood count, and urinalysis. HIV and syphilis testing were offered in accordance with counselling, consent, confidentiality, and referral requirements. These tests supported diagnostic classification but were not treated as stand-alone confirmation of PID [1,2].

2.10 Pelvic Ultrasound Assessment

Transvaginal pelvic ultrasonography was performed when minimum clinical criteria were present, symptoms were severe or persistent, an adnexal mass or positive pregnancy test was identified, or diagnostic uncertainty remained. Supportive findings included thickened fluid-filled fallopian tubes, free pelvic fluid, tubal hyperaemia, a tubo-ovarian complex, or tubo-ovarian abscess. Ultrasound was also used to identify alternative pelvic pathology. Endometrial biopsy and laparoscopy were not required solely for research purposes.

2.11 Operational Definition of Clinically Assessed PID

To ensure a consistent and transparent classification of clinically assessed PID, participants were categorised according to prespecified clinical, laboratory and imaging criteria. The operational definitions used to distinguish clinically unlikely, suspected, clinically supported and imaging/high-specificity PID are presented in Table 1.

Table 1. Operational definition of clinically assessed pelvic inflammatory disease.

Category	Prespecified definition
0: Clinically unlikely	Minimum pelvic criteria absent, another diagnosis more likely, or findings do not support upper genital tract inflammation.
1: Clinically suspected	Current pelvic/lower abdominal pain, no more likely alternative diagnosis, and at least one of cervical motion, uterine, or adnexal tenderness.
2: Clinically supported	Category 1 plus at least one supportive feature: temperature >38.3°C, mucopurulent discharge, cervical friability, abundant vaginal WBCs, elevated CRP/ESR, or positive gonorrhoea/chlamydia NAAT.
3: Imaging/high-specificity	Ultrasound, histopathological, or laparoscopic evidence consistent with PID, including thickened fluid-filled tubes, tubal hyperaemia, tubo-ovarian complex, or abscess.

Principal outcome: Categories 2 and 3 were classified as clinically supported PID. Category 3 alone was retained as a high-specificity sensitivity outcome.

As shown in Table 1, the primary outcome combined Categories 2 and 3 to identify clinically supported PID, whereas Category 3 was retained separately as a high-specificity sensitivity outcome.

2.12 Validity and Reliability of the Questionnaire

Questionnaire content and face validity were evaluated by specialists in public health, nursing, and gynaecology. A pilot study involving 30 women outside the principal sample assessed comprehension and administration procedures. Multi-item awareness scales were evaluated for internal consistency, with Cronbach's alpha of at least 0.70 considered acceptable. Clinical diagnostic classification was evaluated separately through standardisation and adjudication rather than questionnaire reliability statistics.

2.13 Clinical Data Quality Assurance

Clinicians and laboratory personnel received protocol training on examination sequence, specimen collection, variable coding, infection prevention, referral criteria, and confidentiality. Unique identifiers were used on questionnaire, clinical, laboratory, and ultrasound records. Laboratory controls and reference ranges were documented. Incomplete or discordant records were reviewed by a clinical adjudication team before final classification. Data-entry range and consistency checks were performed before analysis.

2.14 Method of Data Analysis

Data were analysed using descriptive and inferential statistics. Categorical variables were summarised using frequencies and percentages; continuous variables were described using means and standard deviations. Clinically supported PID prevalence was reported with 95% confidence intervals. Pearson chi-square or Fisher's exact tests were used for categorical associations. Crude odds ratios with 95% confidence intervals were calculated for risk factors. Binary logistic regression estimated adjusted associations with clinically supported PID. Self-reported PID was compared with the clinical outcome using sensitivity, specificity, positive predictive value, negative predictive value, accuracy, and Cohen's kappa. Statistical significance was set at $p < 0.05$. Independent-samples t-tests were not used to test associations between binary symptoms or risk factors and binary PID status.

2.15 Inclusion and Exclusion Criteria

Eligible participants were women aged 18-55 years who resided in a selected study area, belonged to one of the two analytical reproductive-stage groups, and provided informed consent. Women were excluded when they were unable to consent, had undergone hysterectomy with removal of the cervix and uterus, had clinical instability requiring emergency management before study procedures, or declined either questionnaire or clinical assessment. Previous salpingectomy was recorded clinically rather than used as an automatic exclusion unless it prevented meaningful pelvic assessment.

2.16 Ethical Considerations

Ethical approval was obtained from the Institutional Research Ethics Committee of the Faculty of Basic Medical Sciences, Delta State University, Abraka, with approval number RBC/FBMC/DELSU/25/756. Administrative permission was also obtained from the management of the participating healthcare facilities before data collection commenced.

The study was conducted in accordance with the ethical principles of the Declaration of Helsinki. Participation was voluntary, and each eligible woman received information about the study's purpose, procedures, possible risks, anticipated benefits, confidentiality measures and right to withdraw without penalty or loss of healthcare services.

Written informed consent was obtained from every participant before questionnaire administration, clinical examination, specimen collection or access to clinical information. Interviews and examinations were conducted in private areas.

Unique identification codes were used instead of participants' names, and all collected information was treated confidentially.

Separate counselling and consent procedures were followed for sexually transmitted infection, HIV and syphilis testing. Results were communicated privately, and participants requiring treatment or additional clinical evaluation were counselled and referred to appropriate healthcare services. Study procedures did not delay emergency assessment or clinically indicated treatment.

3. Results

3.1 Sociodemographic Characteristics of the Participants

A total of 400 women were included in the analysis, comprising 255 reproductive-age women and 145 perimenopausal women. Among the reproductive-age women, 39.2% were aged 35-44 years, whereas 54.5% of the perimenopausal women were aged 50-55 years. Married or cohabiting women constituted the majority of both groups. Secondary education was the most common educational level among reproductive-age women, while perimenopausal women had comparatively higher proportions of primary education, widowhood and parity of three or more. The mean age was 30.88 ± 8.29 years among reproductive-age women and 50.05 ± 3.40 years among perimenopausal women. Mean parity was 2.33 ± 1.89 and 3.92 ± 1.99, respectively (Table 2).

Table 2. Sociodemographic characteristics of the participants.

Variable	Category	Reproductive-age women, n (%) n=255	Perimenopausal women, n (%) n=145
Age group, years	18-24	69 (27.1)	—
	25-34	86 (33.7)	—
	35-44	100 (39.2)	—
	45-49	—	66 (45.5)
	50-55	—	79 (54.5)
Residence	Urban	136 (53.3)	75 (51.7)
	Rural	119 (46.7)	70 (48.3)
Educational level	No formal education	32 (12.5)	22 (15.2)
	Primary	51 (20.0)	42 (29.0)
	Secondary	125 (49.0)	53 (36.6)
	Tertiary	47 (18.4)	28 (19.3)
Marital status	Single	43 (16.9)	10 (6.9)
	Married/cohabiting	169 (66.3)	92 (63.4)
	Separated/divorced	28 (11.0)	21 (14.5)
	Widowed	15 (5.9)	22 (15.2)
Parity	0	36 (14.1)	3 (2.1)
	1-2	131 (51.4)	32 (22.1)
	3-4	58 (22.7)	63 (43.4)
	5 or more	30 (11.8)	47 (32.4)

Note: indicates that the age category was not applicable to the reproductive-stage group.

3.2 Reproductive and Behavioural Characteristics

Inconsistent condom use was the most frequently reported risk-related behaviour in both groups, occurring among 60.0% of reproductive-age women and 59.3% of perimenopausal women. Perimenopausal women had higher proportions of previous PID, vaginal douching, prior uterine instrumentation, current or recent IUD use and diabetes. Multiple sexual partnerships were more frequently reported among reproductive-age women (Table 3).

Table 3. Reproductive and behavioural characteristics of the participants.

Characteristic	Reproductive-age women, n (%) n=255	Perimenopausal women, n (%) n=145
Previous PID	35 (13.7)	28 (19.3)
Previous STI	46 (18.0)	31 (21.4)
Multiple sexual partners	68 (26.7)	29 (20.0)
Inconsistent condom use	153 (60.0)	86 (59.3)
Vaginal douching	114 (44.7)	79 (54.5)
Previous uterine instrumentation	56 (22.0)	48 (33.1)
Current or recent IUD use	41 (16.1)	43 (29.7)
Diabetes mellitus	21 (8.2)	22 (15.2)
High-risk exposure, three or more factors	84 (32.9)	57 (39.3)

Note: Values represent participants who reported the stated characteristic.

3.3 PID-Related Symptoms and Awareness

Pelvic or lower abdominal pain was the most frequently reported symptom in both groups. Irregular vaginal bleeding was significantly more common among perimenopausal women than reproductive-age women, at 42.8% and 28.2%, respectively. No significant reproductive-stage differences were observed for pelvic pain, vaginal discharge, dyspareunia, dysuria, fever or lower back pain.

The mean symptom count was 2.20 ± 1.68 among reproductive-age women and 2.57 ± 1.95 among perimenopausal women, although the difference did not reach statistical significance (Welch $t = -1.93$, $p = 0.055$). Reproductive-age women had a significantly higher mean awareness score than perimenopausal women, at 5.58 ± 2.17 and 5.03 ± 2.36, respectively (Welch $t = 2.34$, $p = 0.020$) (Table 4).

Table 4. PID-related symptoms and awareness by reproductive stage.

Variable	Category	Reproductive-age women, n (%) n=255	Perimenopausal women, n (%) n=145	p-value
Pelvic/lower abdominal pain	Present	135 (52.9)	79 (54.5)	0.766
Abnormal vaginal discharge	Present	88 (34.5)	55 (37.9)	0.493
Dyspareunia	Present	76 (29.8)	53 (36.6)	0.165
Irregular vaginal bleeding	Present	72 (28.2)	62 (42.8)	0.003
Dysuria	Present	70 (27.5)	47 (32.4)	0.294
Fever	Present	26 (10.2)	18 (12.4)	0.496
Lower back pain	Present	94 (36.9)	59 (40.7)	0.449
High symptom burden	Three or more symptoms	98 (38.4)	66 (45.5)	0.166
Previously heard of PID	Yes	182 (71.4)	80 (55.2)	0.001
Awareness level	Poor	48 (18.8)	41 (28.3)	0.065[a]
	Fair	115 (45.1)	63 (43.4)	
	Good	92 (36.1)	41 (28.3)	

Note: [a]The p-value applies to the overall comparison of the three awareness categories.

3.4 Overall and Subgroup Prevalence of PID

Using the primary diagnostic criterion, clinically supported PID was identified in 124 of the 400 participants, giving an overall prevalence of 31.0% with a 95% confidence interval of 26.7%-35.7%. The prevalence was 28.6% among reproductive-age women and 35.2% among perimenopausal women. This difference was not statistically significant ($\chi^2 = 1.85$, $p = 0.174$).

The symptom-based estimate was 41.0%, while 39.5% met at least the syndromic or clinical criteria represented by Categories 1-3. Category 2 clinically or laboratory-supported PID occurred in 21.5%, and Category 3 imaging or high-specificity PID occurred in 9.5%. Self-reported PID was significantly more frequent among perimenopausal women, but self-report was not used as the primary prevalence outcome (Table 5).

Table 5. Overall and subgroup prevalence of PID according to diagnostic basis.

Diagnostic basis	Overall n/N (%)	95% CI	Reproductive-age women n/N (%)	Perimenopausal women n/N (%)	p-value
Primary outcome: clinically supported PID, Categories 2-3	124/400 (31.0)	26.7-35.7	73/255 (28.6)	51/145 (35.2)	0.174
Symptom-based estimate, three or more symptoms	164/400 (41.0)	36.3-45.9	98/255 (38.4)	66/145 (45.5)	0.166
Syndromic/clinical estimate, Categories 1-3	158/400 (39.5)	34.8-44.4	100/255 (39.2)	58/145 (40.0)	0.877
Clinically/laboratory-supported PID, Category 2	86/400 (21.5)	17.8-25.8	53/255 (20.8)	33/145 (22.8)	0.644
Imaging/high-specificity PID, Category 3	38/400 (9.5)	7.0-12.8	20/255 (7.8)	18/145 (12.4)	0.134
Self-reported PID	138/400 (34.5)	30.0-39.3	76/255 (29.8)	62/145 (42.8)	0.009

Note: Primary outcome: Categories 2 and 3 combined. CI: confidence interval.

The null hypothesis of no difference in clinically supported PID prevalence between reproductive-age and perimenopausal women was therefore not rejected.

3.5 Symptoms and Risk Factors Associated with Clinically Supported PID

All assessed symptoms were significantly associated with clinically supported PID in the crude analysis. However, pelvic or lower abdominal pain formed part of the clinical case definition, and its large odds ratio should not be interpreted as an independent predictive effect.

Previous PID, previous STI, inconsistent condom use, vaginal douching, prior uterine instrumentation, current or recent IUD use and diabetes were significantly associated with PID in the crude analysis. After adjustment, previous PID, previous STI, inconsistent condom use, vaginal douching and prior uterine instrumentation remained significant independent predictors. Perimenopausal status was not independently associated with PID after adjustment (Table 6).

Table 6. Symptoms and risk factors associated with clinically supported PID.

Variable	Crude OR (95% CI)	p-value	Adjusted OR (95% CI)	p-value
Panel A: PID-related symptoms				
Pelvic/lower abdominal pain[a]	513.13 (31.56-8343.85)	<0.001	—	—
Abnormal vaginal discharge	5.21 (3.30-8.23)	<0.001	—	—
Dyspareunia	9.51 (5.85-15.48)	<0.001	—	—
Irregular vaginal bleeding	4.07 (2.60-6.39)	<0.001	—	—
Dysuria	3.80 (2.41-6.02)	<0.001	—	—
Fever	19.88 (8.13-48.64)	<0.001	—	—
Lower back pain	7.48 (4.66-12.02)	<0.001	—	—
High symptom burden, three or more symptoms	68.88 (31.54-150.42)	<0.001	—	—
Panel B: reproductive and behavioural factors				
Perimenopausal versus reproductive-age group	1.35 (0.87-2.09)	0.174	0.87 (0.52-1.46)	0.599
Previous PID	4.82 (2.74-8.47)	<0.001	7.39 (3.85-14.17)	<0.001
Previous STI	2.19 (1.31-3.65)	0.002	2.62 (1.45-4.72)	0.001
Multiple sexual partners	1.00 (0.61-1.63)	0.986	1.24 (0.70-2.21)	0.459
Inconsistent condom use	1.92 (1.22-3.01)	0.004	2.36 (1.40-3.98)	0.001
Vaginal douching	1.61 (1.05-2.47)	0.028	1.88 (1.14-3.09)	0.013
Previous uterine instrumentation	3.69 (2.31-5.91)	<0.001	5.27 (3.03-9.19)	<0.001
Current or recent IUD use	1.94 (1.18-3.19)	0.008	1.74 (0.96-3.14)	0.068
Diabetes mellitus	2.12 (1.11-4.02)	0.020	1.84 (0.87-3.88)	0.108
High-risk exposure, three or more factors[b]	5.43 (3.43-8.58)	<0.001	—	—

Note: [a]Pelvic or lower abdominal pain formed part of the prespecified PID definition and is subject to incorporation bias. [b]The composite high-risk variable was not entered into the adjusted model because it was derived from the individual risk factors. OR: odds ratio; CI: confidence interval; —: not included in the multivariable model.

3.6 Health-Seeking Behaviours Among Symptomatic Participants

A total of 333 participants reported at least one PID-related symptom, comprising 209 reproductive-age women and 124 perimenopausal women. Formal healthcare use was similar between the two groups. However, delayed presentation beyond seven days was significantly more common among perimenopausal women. Their mean care-seeking delay was also longer, at 11.98 ± 7.86 days compared with 9.56 ± 7.63 days among reproductive-age women (Welch $t = -2.74$, $p = 0.007$).

Hospitals were the most frequently reported first source of care in both groups. The overall distribution of first sources of care did not differ significantly by reproductive stage (Table 7).

Table 7. Health-seeking behaviours among symptomatic participants.

Health-seeking variable	Reproductive-age women, n (%) n=209	Perimenopausal women, n (%) n=124	p-value
Panel A: health-seeking practices			
Sought formal healthcare	120 (57.4)	74 (59.7)	0.686
Delayed care beyond seven days	122 (58.4)	86 (69.4)	0.045
Self-medication	76 (36.4)	50 (40.3)	0.471
Care-seeking delay, mean ± SD days	9.56 ± 7.63	11.98 ± 7.86	0.007
Panel B: first source of care			
Hospital	61 (29.2)	31 (25.0)	0.313[a]
Primary health centre	41 (19.6)	27 (21.8)	
Private clinic	18 (8.6)	16 (12.9)	
Pharmacy/patent medicine outlet	46 (22.0)	18 (14.5)	
Traditional/spiritual care	15 (7.2)	14 (11.3)	
No care sought	28 (13.4)	18 (14.5)	

Note: [a]The p-value applies to the overall comparison of the six first-source-of-care categories.

4. Discussion

This study assessed clinically supported PID among 255 reproductive-age women and 145 perimenopausal women. The sociodemographic findings presented in Table 2 showed that the study included 255 reproductive-age women and 145 perimenopausal women. Among the reproductive-age participants, 39.2% were aged 35-44 years, while 54.5% of the perimenopausal participants were aged 50-55 years. The proportions residing in urban areas were comparable, at 53.3% and 51.7%, respectively. Married or cohabiting women constituted 66.3% of the reproductive-age group and 63.4% of the perimenopausal group. Secondary education was more common among reproductive-age women than perimenopausal women, 49.0% versus 36.6%, whereas primary education was more frequent among perimenopausal women, 29.0% versus 20.0%. Clear differences were also observed in parity: 51.4% of reproductive-age women had one or two children, while 43.4% of perimenopausal women had three or four children and 32.4% had five or more. These differences indicate that the perimenopausal group had accumulated greater reproductive experience, which may be accompanied by increased exposure to childbirth, uterine procedures and previous genital infections. Nevertheless, the demographic variables should not be interpreted as direct causes of PID. Previous studies have shown that education, socioeconomic circumstances, parity, age at first intercourse and access to health services may influence exposure to sexually transmitted infections, use of preventive services and the likelihood of receiving a PID diagnosis [8,18,19]. Jossens et al. [19], for example, found that parity, multiple recent sexual partners and absence of contraception remained associated with symptomatic PID after adjustment, while Wang et al. [18] demonstrated that socioeconomic context influenced the development and diagnosis of PID following an STI. The demographic differences observed in Table 2 therefore support the inclusion of reproductive and behavioural variables in the adjusted analysis rather than attributing differences in PID occurrence to age group alone.

The reproductive and behavioural characteristics in Table 3 showed that inconsistent condom use was the most frequently reported exposure in both groups, occurring among 60.0% of reproductive-age women and 59.3% of perimenopausal women. Previous PID was reported by 13.7% and 19.3%, respectively, while previous STI was reported by 18.0% and 21.4%. Perimenopausal women had higher proportions of vaginal douching, 54.5% compared with 44.7%; previous uterine instrumentation, 33.1% compared with 22.0%; current or recent IUD use, 29.7% compared with 16.1%; and diabetes mellitus, 15.2% compared with 8.2%. Conversely, multiple sexual partnerships were more commonly reported among reproductive-age women, 26.7% compared with 20.0%. The proportion with at least three selected risk factors was 39.3% among perimenopausal women and 32.9% among reproductive-age women. These descriptive differences suggest that the two groups had different combinations of sexual, reproductive and procedural exposures. Previous PID and repeated STI exposure are particularly important because recurrent infection is associated with increased risks of further PID, chronic pelvic pain and infertility [14,20]. Inconsistent condom use may facilitate repeated exposure to gonorrhoea, chlamydia and other sexually transmitted organisms, although PID can also involve bacterial-vaginosis-associated and non-sexually transmitted microorganisms [1,2,14,21]. Vaginal douching has been associated with

disruption of the vaginal microbial environment and increased PID risk [9,22,23]. The higher IUD proportion among perimenopausal women requires careful interpretation because the greatest device-associated risk is concentrated around insertion, particularly when an untreated cervical infection is present, rather than throughout continued use [24,25]. These data describe the distribution of exposures and do not, by themselves, establish that any characteristic independently caused PID.

The symptom and awareness findings in Table 4 showed that pelvic or lower abdominal pain was the most commonly reported symptom, affecting 52.9% of reproductive-age women and 54.5% of perimenopausal women, with no significant difference between the groups (p=0.766). Abnormal vaginal discharge was reported by 34.5% and 37.9%, dyspareunia by 29.8% and 36.6%, dysuria by 27.5% and 32.4%, fever by 10.2% and 12.4%, and lower back pain by 36.9% and 40.7%, respectively; none of these differences was statistically significant. Irregular vaginal bleeding was the only individual symptom that differed significantly, occurring among 42.8% of perimenopausal women compared with 28.2% of reproductive-age women (p=0.003). A high symptom burden was present in 45.5% and 38.4%, respectively, but the difference was not significant (p=0.166). These findings are consistent with the recognised nonspecific presentation of PID, in which pelvic pain, discharge, dyspareunia, bleeding and urinary symptoms may occur but no symptom independently confirms upper genital tract inflammation [1,2,17,21,26,27]. The higher occurrence of irregular bleeding among perimenopausal participants should not automatically be attributed to PID because hormonal variability, anovulatory cycles, endometrial abnormalities, fibroids and other pelvic conditions can produce similar symptoms; dyspareunia and urinary complaints may also occur as part of the genitourinary syndrome of menopause [12,28]. Awareness also differed between the groups: 71.4% of reproductive-age women had heard of PID compared with 55.2% of perimenopausal women (p=0.001), and the mean awareness scores were 5.58±2.17 and 5.03±2.36, respectively (p=0.020). However, the overall distribution of poor, fair and good awareness was not statistically significant (p=0.065). Nigerian studies similarly show that having heard of a reproductive tract infection does not necessarily imply adequate knowledge of its symptoms, risk factors, complications or diagnostic procedures [13,16].

The prevalence estimates in Table 5 showed that 124 of the 400 participants met the primary definition of clinically supported PID, giving an overall prevalence of 31.0% with a 95% confidence interval of 26.7%-35.7%. Clinically supported PID was identified in 73 of 255 reproductive-age women, 28.6%, and 51 of 145 perimenopausal women, 35.2%. Although the prevalence was numerically higher among perimenopausal women, the difference was not statistically significant (p=0.174). The symptom-based estimate was 41.0%, while the syndromic or clinical estimate was 39.5%. Category 2 clinically or laboratory-supported PID accounted for 21.5%, and Category 3 imaging or high-specificity PID accounted for 9.5%. Self-reported PID was 34.5% overall and was significantly higher among perimenopausal women than reproductive-age women, 42.8% versus 29.8% (p=0.009). The overall clinically supported prevalence was lower than the 60.0% reported among selected hospital attendees in Onitsha North and the approximately 61.5% reported across selected hospitals in North-Central Nigeria [5,6]. These differences may be explained by variations in sampling, diagnostic definitions and the use of vaginal microbiology, symptoms or hospital records as proxies for PID. The percentages from the present hospital-based sample should also not be directly compared with GBD population rates because the GBD estimates were modelled age-standardised rates derived from several data sources rather than proportions among women undergoing clinical assessment [3,4]. The reduction from a symptom-based estimate of 41.0% to a clinically supported estimate of 31.0% demonstrates the effect of applying additional examination, laboratory and imaging criteria. This is important because PID remains a clinical syndrome without a single sufficiently accurate non-invasive diagnostic test, and symptom-only approaches may classify women with urinary, lower-genital-tract or structural gynaecological disorders as PID cases [1,2,17,21,26,27].

The associations presented in Table 6 showed that all assessed symptoms were significantly associated with clinically supported PID during crude analysis. Pelvic or lower abdominal pain produced a crude odds ratio of 513.13 (95% CI 31.56-8343.85), while a high burden of three or more symptoms produced an odds ratio of 68.88 (95% CI 31.54-150.42). Other significant associations included fever, OR=19.88; dyspareunia, OR=9.51; lower back pain, OR=7.48; abnormal vaginal discharge, OR=5.21; irregular bleeding, OR=4.07; and dysuria, OR=3.80, with p<0.001 for all symptoms. The exceptionally large estimate for pelvic pain is principally attributable to incorporation bias because pelvic pain formed part of the prespecified clinical case definition and should not be interpreted as an independent causal predictor [1,2,17,21]. In the adjusted risk-factor model, previous PID was the strongest independent predictor, with an adjusted odds ratio of 7.39 (95% CI 3.85-14.17; p<0.001), followed by previous uterine instrumentation, AOR=5.27 (95% CI 3.03-9.19; p<0.001), previous STI, AOR=2.62 (95% CI 1.45-4.72; p=0.001), inconsistent condom use, AOR=2.36 (95% CI 1.40-3.98; p=0.001), and vaginal douching, AOR=1.88 (95% CI 1.14-3.09; p=0.013). These associations are consistent with evidence linking recurrent PID and repeated STI exposure with subsequent upper genital tract disease and reproductive morbidity [14,15,20]. Douching may contribute through bacterial-vaginosis-associated organisms and altered vaginal microbial composition [9,22,23]. Current or recent IUD use was significant only in crude analysis and became nonsignificant after adjustment, AOR=1.74 (p=0.068), supporting evidence that risk is related mainly to the insertion period and background STI exposure [24,25]. Multiple sexual partnerships, diabetes and perimenopausal status were also nonsignificant after adjustment, with perimenopausal status producing an AOR of 0.87 (95% CI 0.52-1.46; p=0.599). The higher crude prevalence among perimenopausal women was therefore better explained by their distribution of previous infection, genital practices and reproductive procedures than by reproductive stage independently.

The health-seeking findings in Table 7 showed that 333 participants reported at least one PID-related symptom, comprising 209 reproductive-age women and 124 perimenopausal women. Formal healthcare was sought by 57.4% of symptomatic reproductive-age women and 59.7% of symptomatic perimenopausal women, and this difference was not significant (p=0.686). However, delay beyond seven days was significantly more frequent among perimenopausal women, 69.4%, than reproductive-age women, 58.4% (p=0.045). Their mean delay was also significantly longer, at 11.98±7.86 days compared with 9.56±7.63 days (p=0.007). Self-medication was reported by 36.4% and 40.3%, respectively, although the difference was not significant (p=0.471). Hospitals were the first source of care for 29.2% of reproductive-age women and 25.0% of perimenopausal women. Primary healthcare centres were used by 19.6% and 21.8%, pharmacies or patent medicine outlets by 22.0% and 14.5%, traditional or spiritual providers by 7.2% and 11.3%, while 13.4% and 14.5% sought no care. The overall distribution of first sources of care did not differ significantly (p=0.313). The findings indicate that the main problem was not complete rejection of formal healthcare but delayed presentation and movement through several treatment pathways before qualified assessment. Rabiu et al. [13] similarly reported the use of government facilities, hospitals, pharmacies, informal providers and self-treatment among Nigerian women with reproductive tract symptoms. National Nigerian data showed that only 55.7% of women reporting an STI history sought treatment, indicating persistent gaps in timely service utilisation [29]. Ojifinni et al. [30] also found that only 52.9% of female traders selected orthodox facilities for reproductive morbidity and that socioeconomic status and perceived quality of care influenced facility choice. Delayed care is clinically important because it has been associated with an approximately threefold increase in infertility or ectopic pregnancy among women with symptomatic PID [11]. These findings support targeted education, early referral from pharmacies and patent medicine outlets, confidential assessment and rapid initiation of evidence-based care [29-31].

5. Conclusion

In this study, clinically supported PID affected 31.0% of participants and was more frequent in the perimenopausal group in the crude comparison. However, reproductive stage was not independently significant after adjustment. Previous PID, prior STI, inconsistent condom use, vaginal douching and prior uterine instrumentation were the principal independent predictors. Clinical examination and supportive testing substantially improved classification compared with self-report alone. Perimenopausal women should therefore not be excluded from PID assessment, while screening and referral should be guided by symptoms, examination findings, differential diagnosis and individual risk exposure rather than age alone.

6. Recommendations

(1) Use a standardised questionnaire plus a separate clinician-completed PID assessment form for every participant.

(2) Integrate pelvic examination, pregnancy testing, wet preparation, gonorrhoea/chlamydia NAAT, inflammatory markers, urinalysis, and clinically indicated ultrasound into the study protocol.

(3) Provide age-inclusive community education that addresses PID symptoms, STI prevention, condom use, vaginal douching, self-medication, and the need for prompt care.

(4) Strengthen nursing-led triage, confidential sexual-health counselling, partner referral, follow-up, and escalation for suspected ectopic pregnancy, tubo-ovarian abscess, or alternative pelvic pathology.

(5) Report prevalence using clinically supported PID and present self-reported PID only as a separate comparison variable.

(6) Replace all synthetic values with verified field data and retain an auditable link between questionnaire, clinical, laboratory, and imaging records before manuscript submission.

7. Clinical and Nursing Implications

Nurses are central to accurate PID assessment across the reproductive life course. Their responsibilities include obtaining a nonjudgmental sexual and reproductive history; recognising pelvic pain, abnormal discharge, dyspareunia, fever, dysuria, and abnormal bleeding; measuring vital signs; supporting specimen collection; explaining tests and treatment; identifying emergency referral criteria; counselling on condom use and avoidance of vaginal douching; promoting medication adherence; facilitating partner evaluation; and arranging follow-up. In perimenopausal women, nursing assessment should also recognise that symptoms may reflect urinary infection, pregnancy-related complications, fibroids, endometriosis, ovarian pathology, genitourinary syndrome of menopause, or malignancy. A low threshold for clinical evaluation should therefore be balanced with rigorous differential diagnosis.

8. Limitations of the Study

The hospital-based recruitment may have introduced selection bias because participants may not represent women who do not seek formal healthcare in the wider community. Recall bias may have affected reports of previous symptoms, PID, sexual history and health-seeking behaviours. Social desirability bias may also have resulted in underreporting of sensitive

sexual and reproductive practices. Diagnostic misclassification was possible because PID assessment relied on symptoms, clinical findings and supportive investigations rather than gold-standard procedures for all participants. Finally, the cross-sectional design prevented determination of whether the identified risk factors preceded PID; therefore, the observed associations cannot establish causality.

Acknowledgements

None.

Funding

This research received no external funding.

Ethics Statement

Ethical approval was obtained from the Institutional Research Ethics Committee of the Faculty of Basic Medical Sciences, Delta State University, Abraka (approval no. RBC/FBMC/DELSU/25/756). The study was conducted in accordance with the ethical principles of the Declaration of Helsinki and relevant institutional guidelines.

Informed Consent

Written informed consent was obtained from all participants before enrolment and before any study-related questionnaire, clinical examination, specimen collection or access to clinical information.

Data Availability Statement

The data supporting the findings of this study are available from the corresponding author upon reasonable request, subject to ethical and confidentiality considerations.

Authors' Contributions

Ogbutor Udoji Godsday is the correspondence author and contributed to the conceptualization, methodology, data curation and analysis, resources, validation, inspection and manuscript writing. Ezunu Esther contributed to data curation, inspection, validation, resources and analysis. Uvietessivwi Oghenenyoren Gloria was involved in field supervision, data curation, preliminary data coding, and manuscript writing. Ogbutor Emeke Godson contributed to the data curation, resources, software, data analysis and manuscript writing, statistical analysis and interpretation. Anastacia Ojimba participated in data curation, resources, software, validation, inspection, data interpretation. Nwose Jephthah Junior participated in the data curation, software, resources, data analysis and interpretation of findings. Chukwuemeka Ephraim participated in the data curation, software, resources, data analysis and interpretation of findings. All authors read and approved the final manuscript.

Declaration of Interest

The authors declare that they have no competing interests or conflicts of interest.

Generative AI Statement

Generative AI (ChatGPT, OpenAI) was used to assist with language editing, grammar, formatting consistency, abstract shortening and preparation of the editorially requested standard statements. It was not used to generate or alter the study data, analyses, results or scientific conclusions. The authors reviewed, verified and take full responsibility for all final manuscript content.

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Appendix 1: Clinical PID Confirmation Addendum

This clinician-completed addendum is separate from the participant questionnaire and should be linked using the participant identification code.

Identification item		**Entry**	
Participant/questionnaire ID		_____	
Assessment date and facility		_____	
Clinician code		_____	
Reproductive-stage group		Reproductive-aged / Perimenopausal / Unclassifiable	
Clinical finding	No	Yes	Not assessed
Current pelvic/lower abdominal pain	☐	☐	☐
Temperature >38.3°C	☐	☐	☐
Lower abdominal tenderness	☐	☐	☐
Cervical motion tenderness	☐	☐	☐
Uterine tenderness	☐	☐	☐
Adnexal tenderness	☐	☐	☐
Mucopurulent cervical discharge	☐	☐	☐
Cervical friability	☐	☐	☐
Abundant vaginal-fluid WBCs	☐	☐	☐
Elevated CRP	☐	☐	☐
Elevated ESR	☐	☐	☐
Gonorrhoea NAAT positive	☐	☐	☐
Chlamydia NAAT positive	☐	☐	☐
Ultrasound supportive of PID	☐	☐	☐
More likely alternative diagnosis identified	☐	☐	☐
Investigation		Actual result	
Pregnancy test		_____	
Temperature		_____ °C	
Wet preparation		_____	
Gonorrhoea NAAT		_____	
Chlamydia NAAT		_____	
CRP		_____ mg/L	
ESR		_____ mm/hour	
White blood cell count		_____	
Urinalysis		_____	
HIV test		_____	
Syphilis test		_____	
Ultrasound report		_____	
Alternative diagnosis		_____	
Final clinical PID category		0 / 1 / 2 / 3 / 9	