

## Original Article

**Clinically Recorded Etiology and Aerobic Culture Findings in Women with Vaginal Symptoms in Benghazi, Libya: A Cross-Sectional Study**

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**Abstract:**

**Background:** Vulvovaginal candidiasis and bacterial vaginosis account for most gynecological consultations for abnormal vaginal discharge. Treatment in low-resource settings often proceeds on bedside microscopy or clinical impression, and Libyan data on how closely such diagnosis tracks culture are scarce. To describe recorded etiology, symptoms, hygiene practices, awareness, and treatment-seeking among women attending gynecology clinics in Benghazi, and to compare etiologies recorded at consultation against organisms recovered by culture in an independent sample. **Methods:** This cross-sectional study ran for three months at two facilities in Benghazi. A structured Arabic questionnaire was administered to 119 women aged 18 and older, whose working diagnosis rested on potassium hydroxide wet mount microscopy. Fifty routine culture reports from the same facilities were drawn at random from laboratory records; Sabouraud dextrose agar was used in parallel with bacteriological media. Associations were tested by chi-square, Fisher exact test, and logistic regression. The arms were not linked individually. **Results:** Fungal infection was recorded most often (70 of 119, 58.8%), then bacterial infection (31, 26.1%), urinary tract infection (8, 6.7%), mixed infection (5, 4.2%), and *Trichomonas vaginalis* (5, 4.2%). Abnormal discharge (72.3%) and pruritus (58.8%) predominated. Culture differed: *Streptococcus pyogenes* was the leading isolate (11 of 50, 22.0%), ahead of *Candida* spp. (9, 18.0%). Twenty-two women (18.5%) used unprescribed intravaginal antibiotics. Prior infection was independently associated with fungal etiology (adjusted odds ratio 4.22, 95% CI 1.77 to 10.08). Pregnancy was associated with bacterial rather than fungal etiology (2.60, 1.11 to 6.12) and lower symptom burden (0.38, 0.17 to 0.85). Physician consultation was associated with improvement (8.17, 2.43 to 27.48). Only 44 women (37.0%) reported prior awareness, tracking previous infection (3.27, 1.41 to 7.63). **Conclusion:** Fungal etiology was recorded far more often than culture recovered *Candida*, and group A streptococcus was the most frequent isolate. Because the arms were independent samples, these are divergent distributions rather than demonstrated diagnostic error. Low fungal recovery is less likely to reflect a culture artifact, though variation in routine laboratory practice cannot be excluded, and the gap runs opposite to the sensitivity of microscopy against culture. These findings, although based on an unlinked ecological comparison, nonetheless argue for culture alongside microscopy where capacity allows, and for health education reaching women before a first episode.

**Keywords:** aerobic vaginitis; diagnostic stewardship; group A *Streptococcus*; Libya; vulvovaginal candidiasis

**Introduction:**

Abnormal vaginal discharge sends more women to gynecology clinics than any other genital complaint. Two conditions dominate the differential diagnosis. Vulvovaginal candidiasis affects an estimated three quarters of women at least once during their reproductive years, and bacterial vaginosis reflects a shift away from the Lactobacillus-dominated vaginal community toward a mixed anaerobic flora. Sobel and Vempati [1] argue that the two entities are linked rather than independent, with recurrent bacterial vaginosis creating the inflammatory conditions under which candidiasis recurs and fluconazole resistance emerges.

A third pattern receives far less attention. Donders et al. [2] described aerobic vaginitis as an inflammatory dysbiosis in which enteric and skin commensals such as *Escherichia coli*, *Staphylococcus aureus*, and group B streptococci replace lactobacilli, producing a clinical

picture that overlaps with both candidiasis and bacterial vaginosis. Donders et al. [3] put its prevalence at roughly 5 to 13 percent depending on population and scoring method, and Donders et al. [4] set out why culture results alone are a poor guide to treating it. Serretiello et al. [5] and Yasin et al. [6] describe the organisms involved and their resistance profiles in Italian and Ethiopian series respectively. Aklilu et al. [7] found aerobic vaginitis to be the single most common reproductive tract infection among women attending a gynecology department in southern Ethiopia, ahead of bacterial vaginosis and candidiasis alike. Zarmakoupi et al. [8] link the same condition to preterm labor. The IUSTI and World Health Organization guideline names aerobic vaginitis as one of four conditions that account for most vaginal discharge and recommends microscopy for every case [9,10]. Because aerobic vaginitis is diagnosed by microscopy and culture



rather than by symptom pattern, it goes unrecognized wherever laboratory confirmation is skipped.

Lactobacillus dominance underpins the resistance of a healthy vaginal community to colonization, and its loss is the common step in candidiasis, bacterial vaginosis, and aerobic vaginitis alike [11,12]. Skipping confirmation is common. Where clinics operate under supply constraints and patients pay out of pocket, physicians reasonably treat on clinical impression, and women often obtain antimicrobials without consultation at all. The cost of that practice is invisible unless someone compares what was presumed against what was grown. Bruins et al. [13], analyzing ten years of vulvovaginal swabs from Dutch general practice, recovered *Haemophilus influenzae*, beta-hemolytic streptococci, *Streptococcus pneumoniae*, and *Staphylococcus aureus* in 5.6% of cultures, organisms that empirical antifungal or antianaerobic therapy would miss entirely. In Libya, where Bleiblo et al. [14] document accelerating antimicrobial resistance across four decades of isolates, treating the wrong organism carries a compounding cost.

Published Libyan data on vaginal infection are thin. Alawkally et al. [15] reported bacterial vaginosis in 18.6% of 215 women in Benghazi and found *Escherichia coli* the most frequent isolate. Comparable African and eastern Mediterranean series report prevalence ranging from 18 to 41 percent, with aerobic organisms consistently dominant on culture [16,17,18,19]. Regional syntheses cover single pathogens rather than the full etiologic spectrum; Harfouche et al. [20] mapped *Trichomonas vaginalis* across the Middle East and North Africa and Tian et al. [21] did the same globally, with diagnostic standards set out by Kissinger et al. [22], but no comparable analysis exists for the fungal and aerobic bacterial causes. No Libyan study has set presumed etiology alongside culture results in the same clinic population.

This study describes the reported etiology, symptoms, hygiene practices, awareness, and treatment-seeking

behavior of women attending two gynecology facilities in Benghazi, and compares the etiologic distribution recorded at consultation against the organisms recovered from high vaginal swabs.

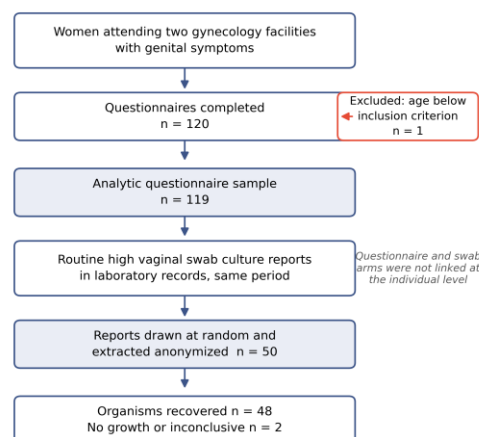
## Materials and Methods:

### Study design and setting

This descriptive cross-sectional study ran over three months at two health facilities in Benghazi, Libya: Benghazi Medical Center and Al-Manara Clinic. Data collection combined a prospective questionnaire arm with a retrospective review of routine high vaginal swab culture records from the same facilities.

### Participants

Women were eligible if they were aged 18 years or older, attended one of the participating facilities during the study period with genital symptoms, and gave written informed consent. Women were excluded if they were receiving antimicrobial or antifungal therapy at the time of recruitment, had taken either within the preceding two weeks, declined consent, or were under active treatment for chronic vaginal infection. Self-reported use of unprescribed products, including antibiotics, to treat the current episode was recorded as an exposure and did not lead to exclusion. One hundred twenty questionnaires were completed. One participant recorded an age below 18 years, which conflicted with the inclusion criterion; that record was removed, leaving 119 questionnaires for analysis. All percentages are calculated on this analytic sample of 119 unless stated otherwise. Separately, 50 high vaginal swab culture reports were selected at random from the laboratory records of the same facilities covering the same period. These reports relate to women swabbed as part of routine clinical care and not as a research procedure. They carried no identifier that could be matched back to a questionnaire, so the two arms function as independent samples drawn from one source population Figure 1.



**Figure 1.** Study flow. The questionnaire arm was prospective, with written consent from each participant. The laboratory arm was retrospective, comprising 50 routine high vaginal swab culture reports drawn at random from the records of the same facilities over the same period. The two arms were not linked at the individual level, so no within-woman comparison of recorded and cultured etiology was possible.

### Questionnaire

The instrument was written in Arabic for cultural and linguistic appropriateness and administered under direct investigator supervision. It covered six domains: personal characteristics including age band, marital status, and pregnancy status; history of previous vaginal infection and the etiologic category recorded at consultation; current symptoms, namely abnormal discharge, pruritus, dysuria, dyspareunia, and vulvar swelling or erythema; genital hygiene products, contraceptive use, and recent sexual intercourse; consultation and treatment history with self-reported outcome; and prior awareness of vaginal infection together with receipt of health counseling.

Etiologic category was transcribed from the clinical record at the time of consultation. The working diagnosis at the participating facilities was assigned on direct light microscopy of a potassium hydroxide wet mount of vaginal discharge, examined for budding yeast and pseudohyphae and, in the same preparation, for an amine odor on alkalization. Vaginal pH was not routinely measured, Gram stain was not performed, and no scoring system was applied. The recorded category therefore rests on a bedside microscopic test rather than on culture, and this distinction is treated explicitly in the Discussion.

### Laboratory procedures

The microbiological arm was retrospective. The research team did not collect swabs or perform any laboratory work. High vaginal swabs had been taken from women attending the participating facilities as part of routine clinical care and processed by the hospital laboratories under their own standing protocols. Fifty culture reports were drawn at random from the complete set of high vaginal swab cultures performed at the two facilities during the study period, and the recorded results were extracted in anonymized form. The laboratories did not retain a count of the total number of cultures performed over that interval, so the size of the sampling frame cannot be stated. According to those reports, swabs were processed by direct microscopy and aerobic culture on selective and non-selective bacteriological media, with Sabouraud dextrose agar inoculated in parallel for fungal recovery. Colonies were identified by morphology and biochemical characterization, and beta-hemolytic streptococci were assigned to Lancefield groups by serogrouping, which distinguishes group A *Streptococcus pyogenes* from group B *Streptococcus agalactiae*. Antimicrobial susceptibility results were not consistently recorded and are therefore not presented. Because the laboratory work was performed under routine service conditions rather than to a research protocol, the investigators could not verify the identification procedures independently, and the isolate data should be read as routine diagnostic output.

### Data management and coding

Responses were entered in English from the Arabic questionnaire, and several fields were recorded as free text. Before analysis every free-text field was harmonized against a written coding dictionary. Spelling

variants were mapped to a single term, so that *Fungia* resolved to *fungal*, *Trichomonas* to *Trichomonas vaginalis*, and *shaver*, *Aromataic*, and *intecourse* to their intended terms. Entries naming more than one category, such as *fungal* and *bacterial*, were assigned to a mixed category rather than to either single category. Mixed delimiters in the symptom field, including commas, periods, and line breaks, were parsed by keyword matching against the five predefined symptoms rather than by string splitting. Genital hygiene responses were coded twice, once as mutually exclusive combinations exactly as reported and once as separate binary indicators for any reported use of each product class, since several women named more than one product. Both codings are reported. Three variable names carried through from the original English data entry did not correspond to their content and were relabeled: *previous injury* denotes *previous vaginal infection*, *congress* denotes *recent sexual intercourse*, and *got a steering* denotes *receipt of health counseling*. The cleaning script is available with the dataset.

### Statistical analysis

Categorical variables are summarized as counts and percentages. Associations between categorical variables were tested by the Pearson chi-square test, with the Yates continuity correction applied to two-by-two tables and the Fisher exact test substituted where any expected cell count fell below five. Tables larger than two by two with sparse expected counts are reported with that limitation noted. Symptom burden, defined as the count of the five recorded symptoms, was compared between pregnant and non-pregnant women by the Mann-Whitney test.

Multivariable logistic regression estimated adjusted odds ratios with 95% confidence intervals for four outcomes: *fungal etiology*, *bacterial etiology*, *physician consultation*, and *self-reported symptom improvement*. *Bacterial etiology* and *fungal etiology* each included the five women with mixed infection, so those two outcomes overlap. Covariates were selected on clinical grounds before modeling. Two-tailed *p* values below 0.05 were treated as evidence of association. Because roughly fifty comparisons were examined and no correction for multiplicity was applied, the analysis is exploratory and hypothesis-generating; borderline values should not be read as confirmatory. Single-proportion goodness-of-fit tests, which compare one response distribution against an assumed equal split, are not reported here because they carry no epidemiological meaning; every *p* value in this paper comes from a test of association between two variables or from a regression model. Analyses were performed in Python 3.12 using SciPy 1.17 and stats models.

### Ethical considerations

The study was conducted with the written permission of the administration of Benghazi Medical Center (Ref. No. 14496.4., dated 14 September 2026) and Al-Manara Clinic (dated 10 September 2026). All questionnaire participants provided written informed consent in Arabic after receiving information about the study objectives,

procedures, the voluntary nature of participation, and confidentiality measures. Participants were informed of their right to withdraw at any time without consequences for their care. No personal identifiers were recorded on the questionnaires. The laboratory arm used pre-existing routine records extracted in anonymized form with no patient contact, and the participating facilities waived individual consent on that basis.

## Results:

### Participant characteristics

The 119 women ranged across four age bands, with the largest group aged 25 to 34 years (48, 40.3%) and the smallest aged 45 years or older (13, 10.9%). Ninety-seven women were married (81.5%), 17 were single (14.3%), and five were divorced (4.2%). Forty-seven women were pregnant, representing 39.5% of the sample and 48.5% of married participants; every pregnant participant was married. Sixty-six women (55.5%) reported at least one previous episode of vaginal infection, and 57 (47.9%) reported recent sexual intercourse. Contraceptive use was uncommon at 14 women (11.8%). Table 1 gives the full distribution.

**Table 1.** Sociodemographic and reproductive characteristics of participants (n = 119).

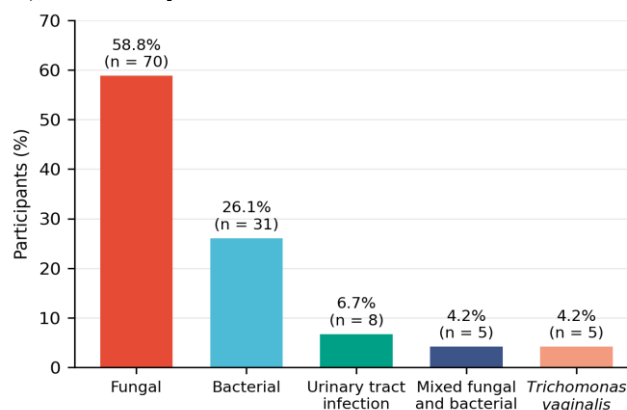
| Characteristic             | Category     | n   | %    |
|----------------------------|--------------|-----|------|
| Age group (years)          | 18 to 24     | 26  | 21.8 |
|                            | 25 to 34     | 48  | 40.3 |
|                            | 35 to 44     | 32  | 26.9 |
|                            | 45 or older  | 13  | 10.9 |
| Marital status             | Married      | 97  | 81.5 |
|                            | Single       | 17  | 14.3 |
|                            | Divorced     | 5   | 4.2  |
| Pregnancy status           | Pregnant     | 47  | 39.5 |
|                            | Not pregnant | 72  | 60.5 |
| Previous vaginal infection | Yes          | 66  | 55.5 |
|                            | No           | 53  | 44.5 |
| Recent sexual intercourse  | Yes          | 57  | 47.9 |
|                            | No           | 62  | 52.1 |
| Contraceptive use          | Yes          | 14  | 11.8 |
|                            | No           | 105 | 88.2 |

Percentages are calculated on the full analytic sample of 119.

### Reported etiology and symptom profile

Fungal infection was the etiologic category recorded most often, in 70 women (58.8%), followed by bacterial

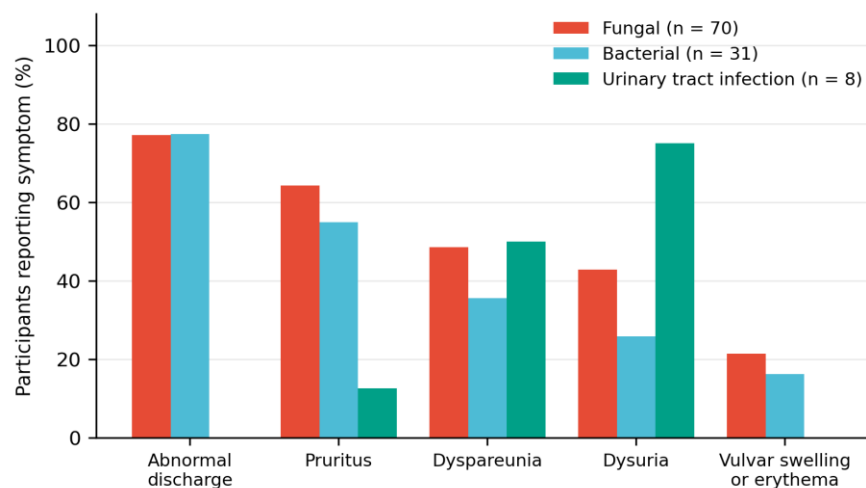
infection in 31 (26.1%), urinary tract infection in eight (6.7%), mixed fungal and bacterial infection in five (4.2%), and *Trichomonas vaginalis* in five (4.2%) Figure 2.



**Figure 2.** Etiologic category recorded at consultation among 119 women. Categories were transcribed from the clinical record and represent the working diagnosis, not an independent laboratory assignment. Bars show percentages with absolute counts in parentheses.

Abnormal vaginal discharge was the most frequent complaint, reported by 86 women (72.3%), followed by pruritus (70, 58.8%), dyspareunia (54, 45.4%), dysuria (51, 42.9%), and vulvar swelling or erythema (24, 20.2%). Forty-six women (38.7%) reported three or more concurrent symptoms. Symptom distribution differed by etiologic category for discharge and dysuria ( $p < 0.001$

and  $p = 0.008$  respectively), driven largely by the urinary tract infection group, in whom no participant reported vaginal discharge and six of eight reported dysuria Figure 3. This pattern is consistent with the recorded categories, although it does not establish their validity or their microbiological accuracy.

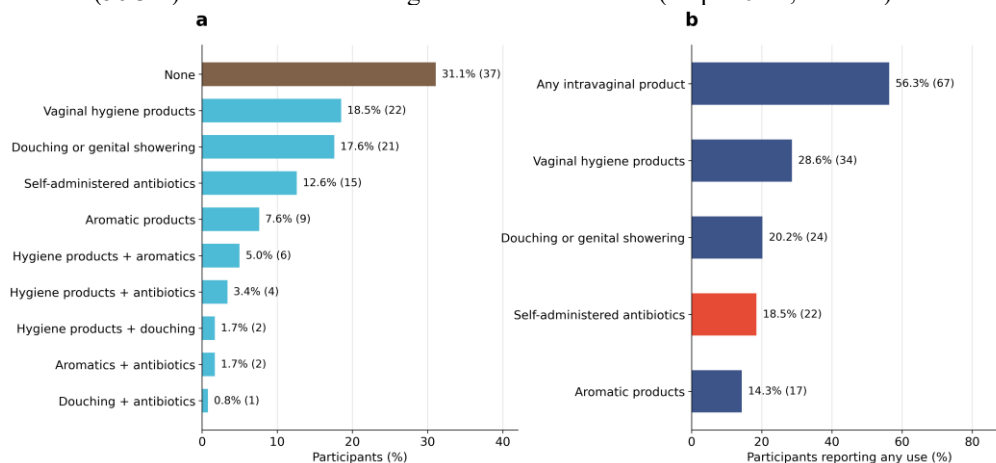


**Figure 3.** Symptom frequency by etiologic category. Bars show the percentage of women within each category reporting the symptom. Symptoms are not mutually exclusive. The urinary tract infection group is shown for completeness despite its small size (n = 8). Discharge and dysuria differed across categories ( $p < 0.001$  and  $p = 0.008$  respectively).

### Genital hygiene practices

Thirty-seven women (31.1%) used no genital hygiene product. Among the mutually exclusive categories, vaginal hygiene preparations were most common (22, 18.5%), followed by douching or genital showering (21, 17.6%), self-administered antibiotics (15, 12.6%), and aromatic products (9, 7.6%), with the remainder naming combinations. Counting every woman who named a product either alone or in combination gives a fuller picture: 67 women (56.3%) used some intravaginal

product, 34 (28.6%) used vaginal hygiene preparations, 24 (20.2%) practiced douching, 22 (18.5%) applied antibiotics without prescription, and 17 (14.3%) used aromatic products (Figure 4). Self-administered intravaginal antibiotic use at 18.5% is the practice with the clearest potential to select for resistance, and it is substantially higher than the exclusive-category figure suggests. None of these practices showed an association with etiologic category or with a history of previous infection (all  $p > 0.11$ ; Table 2).



**Figure 4.** Genital hygiene practices (n = 119). (a) Mutually exclusive categories as reported, with brown denoting women using no product. (b) Any reported use of each exposure, counting women who named it alone or in combination; red denotes self-administered intravaginal antibiotics, reported by 22 women (18.5%). No practice was associated with etiologic category or with a history of previous infection.

**Table 2.** Bivariate associations examined but not retained in the multivariable models (n = 119).

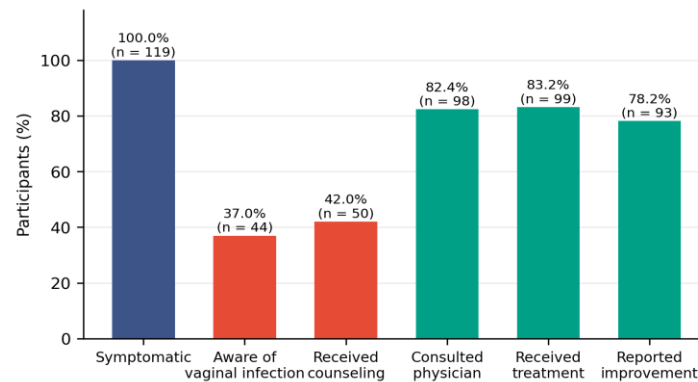
| Exposure                      | Outcome            | Test         | p     |
|-------------------------------|--------------------|--------------|-------|
| Contraceptive use             | Etiologic category | Chi-square   | 0.779 |
| Contraceptive use             | Fungal etiology    | Fisher exact | 1.000 |
| Douching or genital showering | Etiologic category | Chi-square   | 0.368 |
| Douching or genital showering | Previous infection | Chi-square   | 0.314 |
| Aromatic products             | Etiologic category | Chi-square   | 0.470 |
| Aromatic products             | Previous infection | Chi-square   | 0.970 |
| Self-administered antibiotics | Previous infection | Chi-square   | 0.117 |
| Any intravaginal product      | Previous infection | Chi-square   | 0.214 |

|                                     |                          |              |       |
|-------------------------------------|--------------------------|--------------|-------|
| Any intravaginal product            | Etiologic category       | Chi-square   | 0.762 |
| Recent sexual intercourse           | Etiologic category       | Chi-square   | 0.757 |
| Marital status                      | Etiologic category       | Chi-square   | 0.120 |
| Marital status                      | Awareness                | Chi-square   | 0.688 |
| Age band                            | Awareness                | Chi-square   | 0.081 |
| Awareness                           | Physician consultation   | Chi-square   | 0.259 |
| Awareness                           | Any intravaginal product | Chi-square   | 0.154 |
| Treatment without physician contact | Symptom improvement      | Fisher exact | 0.684 |

The Yates continuity correction was applied to two-by-two tables; the Fisher exact test replaced the chi-square where any expected cell count fell below five. These null results are reported to document the full scope of the exploratory analysis. Contraceptive use was examined against all 25 remaining variables and reached no p value below 0.023.

#### Awareness, care-seeking, and treatment outcome

Forty-four women (37.0%) reported prior awareness of vaginal infection as a condition, and 50 (42.0%) had received health counseling. Ninety-eight women (82.4%) consulted a physician for the current episode, 99 (83.2%) received pharmacological treatment, and 93 (78.2%) reported symptom improvement. Only eight women took treatment without any physician contact Figure 5.

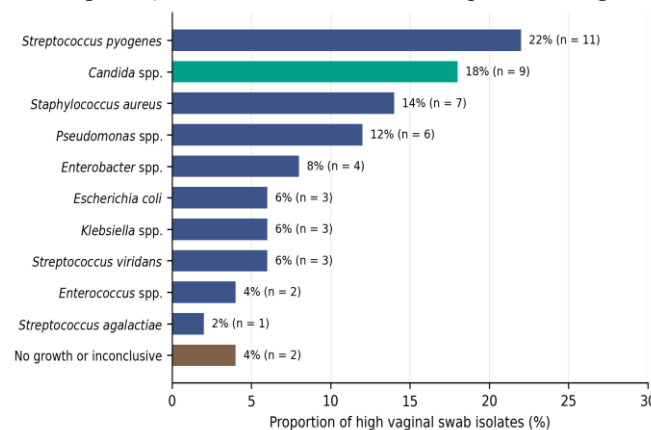


**Figure 5.** Awareness and care cascade. Blue denotes the full symptomatic sample, red denotes awareness and health education, green denotes the clinical care pathway. Counseling and awareness lag well behind care-seeking, and both were associated mainly with a previous episode.

#### Microbiological findings

The 50 extracted culture reports recorded ten distinct organisms; two samples yielded no growth or an inconclusive result. *Streptococcus pyogenes* was the most frequent isolate, accounting for 11 samples (22.0%, exact 95% confidence interval 11.5 to 36.0), ahead of *Candida* spp. (9, 18.0%, 8.6 to 31.4) and *Staphylococcus aureus* (7, 14.0%, 5.8 to 26.7). Aerobic bacteria of any species accounted for 39 of the 50 reports (78.0%, 64.0

to 88.5). Percentages refer to reports; the bacterial isolate counts total 40 across these 39 reports, so at least one report yielded more than one bacterial organism. *Pseudomonas* spp. accounted for six isolates (12.0%), and Enterobacteriaceae collectively for ten (20.0%), comprising *Enterobacter* spp. (4), *Escherichia coli* (3), and *Klebsiella* spp. (3). *Streptococcus viridans* accounted for three isolates, *Enterococcus* spp. for two, and *Streptococcus agalactiae* for one Figure 6.

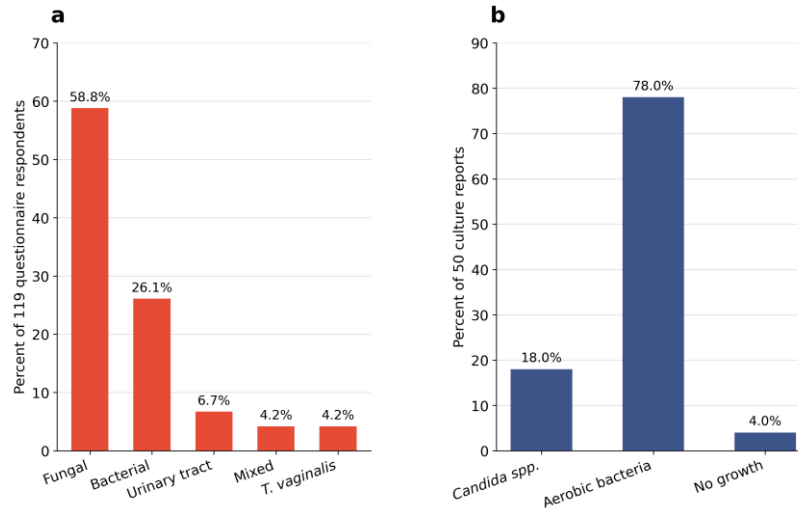


**Figure 6.** Organisms recovered from 50 high vaginal swabs by aerobic culture. Green denotes the fungal isolate, brown denotes samples with no growth or an inconclusive result. Beta-hemolytic streptococci were assigned to Lancefield

groups by serogrouping. Recovery indicates isolation, not established causation.

No *Lactobacillus*, *Gardnerella vaginalis*, or anaerobic organism was recovered, consistent with the aerobic culture protocol. Swabs and questionnaires were not

linked at the individual level, so no cross-tabulation between isolate and clinical variable was possible. Figure 7 places the recorded etiology and the aerobic culture recovery side by side as independent distributions with different denominators.

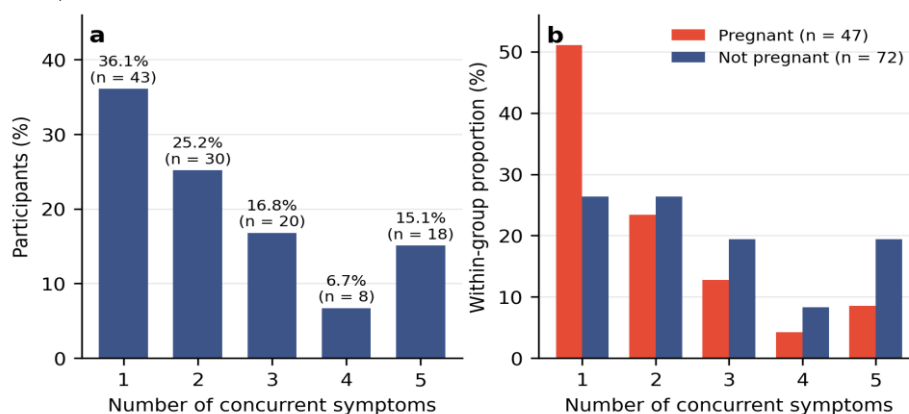


**Figure 7.** Etiology recorded at consultation (a) and organisms recovered by aerobic culture (b), shown as separate panels because the two arms are independent samples with different denominators. Panel a is the percentage of 119 questionnaire respondents; panel b is the percentage of 50 culture reports. Aerobic bacteria in panel b combine all bacterial isolates. The panels invite comparison of distributions and not a paired diagnostic accuracy analysis.

#### Factors associated with etiology, care-seeking, and outcome

A previous episode of vaginal infection was the strongest predictor of fungal etiology. Fungal infection was recorded in 49 of 66 women with prior infection (74.2%) compared with 26 of 53 without (49.1%), and the association held after adjustment for age, pregnancy, contraceptive use, douching, and self-administered antibiotics (adjusted odds ratio 4.22, 95% confidence interval 1.77 to 10.08,  $p = 0.001$ ). Self-administered antibiotic use (any reported use, 22 women) was inversely associated with fungal etiology in the same model (adjusted odds ratio 0.26, 95% confidence interval 0.08 to 0.83,  $p = 0.023$ ).

Pregnancy showed no association with fungal etiology ( $p = 0.410$ ). It was instead associated with bacterial etiology, defined to include the five mixed infections as in the regression model, and recorded in 20 of 47 pregnant women (42.6%) against 16 of 72 non-pregnant women (22.2%), with an adjusted odds ratio of 2.60 (95% confidence interval 1.11 to 6.12,  $p = 0.029$ ). Pregnant women also reported fewer symptoms, with 25.5% reporting three or more compared with 47.2% of non-pregnant women (odds ratio 0.38, 95% confidence interval 0.17 to 0.85,  $p = 0.021$ ; median symptom count 1 versus 2,  $p = 0.004$ ; Figure 8).



**Figure 8.** Symptom burden. (a) Distribution of concurrent symptom counts across the full sample. (b) The same distribution stratified by pregnancy status. Pregnant women reported fewer concurrent symptoms (median 1 versus 2,  $p = 0.004$ ).

Symptom burden drove care-seeking. Forty-four of 46 women reporting three or more symptoms consulted a

physician (95.7%) against 54 of 73 with fewer symptoms (74.0%), giving an adjusted odds ratio of 10.25 (95%

confidence interval 2.11 to 49.72,  $p = 0.004$ ). A history of previous infection independently raised the odds of consultation (adjusted odds ratio 3.29, 95% confidence interval 1.05 to 10.35,  $p = 0.042$ ).

Physician consultation was more strongly associated with improvement than any other variable: 85 of 98 women who consulted reported improvement (86.7%) against eight of 21 who did not (38.1%), yielding an adjusted odds ratio of 8.17 (95% confidence interval 2.43 to 27.48,  $p = 0.001$ ) after adjustment for counseling, previous infection, and symptom burden. Receipt of health counseling was independently associated with

improvement (adjusted odds ratio 5.31, 95% confidence interval 1.39 to 20.21,  $p = 0.014$ ).

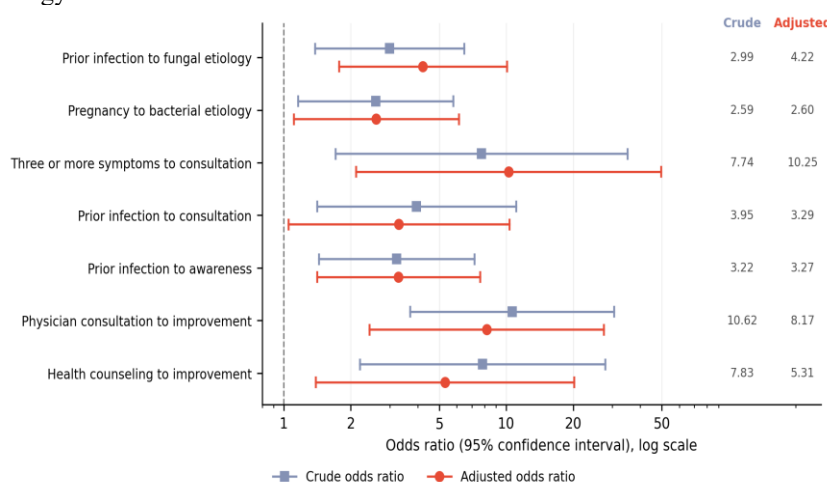
Awareness of vaginal infection was associated with previous infection (adjusted odds ratio 3.27, 95% confidence interval 1.41 to 7.63,  $p = 0.006$ ) and, among age bands, with age 45 years or older (adjusted odds ratio 6.13, 95% confidence interval 1.25 to 30.00,  $p = 0.025$ ). Marital status showed no association. Table 3 gives the underlying counts and Figure 9 shows crude and adjusted estimates side by side for every association entering the models.

**Table 3.** Counts underlying each association entered into the multivariable models ( $n = 119$ ).

| Exposure               | Outcome                | Exposed, n/N (%) | Unexposed, n/N (%) |
|------------------------|------------------------|------------------|--------------------|
| Previous infection     | Fungal etiology        | 49/66 (74.2)     | 26/53 (49.1)       |
| Pregnancy              | Bacterial etiology     | 20/47 (42.6)     | 16/72 (22.2)       |
| Pregnancy              | Three or more symptoms | 12/47 (25.5)     | 34/72 (47.2)       |
| Three or more symptoms | Physician consultation | 44/46 (95.7)     | 54/73 (74.0)       |
| Previous infection     | Physician consultation | 60/66 (90.9)     | 38/53 (71.7)       |
| Previous infection     | Awareness              | 32/66 (48.5)     | 12/53 (22.6)       |
| Physician consultation | Symptom improvement    | 85/98 (86.7)     | 8/21 (38.1)        |
| Health counseling      | Symptom improvement    | 47/50 (94.0)     | 46/69 (66.7)       |

Cells give the number of participants with the outcome over the number in that exposure group. Bacterial etiology and fungal etiology each include the five women

with mixed infection, so those two outcomes are not mutually exclusive. Crude and adjusted odds ratios for these same associations are shown in Figure 9.



**Figure 9.** Crude and adjusted odds ratios with 95% confidence intervals for each association entering the multivariable models. The dashed vertical line marks the null value of 1 and the horizontal axis is logarithmic. Models for etiology adjusted for age band, pregnancy, contraceptive use, douching, and self-administered antibiotics; the consultation model adjusted for symptom burden, previous infection, awareness, and age band; the improvement model adjusted for consultation, counseling, previous infection, and symptom burden; the awareness model adjusted for age band, previous infection, and marital status. Confidence intervals are wide because the analytic sample is small, and the estimates should be read as imprecise.

Contraceptive use showed no association with etiologic category ( $p = 0.779$ ) or with any other variable examined at a threshold approaching significance.

## Discussion:

The central observation of this study is a divergence between two distributions. Fungal infection was recorded as the working diagnosis in 58.8% of women, whereas *Candida* spp. accounted for 18.0% of organisms recovered from high vaginal swabs Figure 7. The two arms were drawn from the same facilities over the same period but were not linked at the individual level. This is

therefore an ecological comparison and not a diagnostic accuracy study. It cannot establish that any particular woman was misdiagnosed, and the word overcall would overstate what the design supports. The comparison is nonetheless the one that matters clinically, since Sherrard et al. [9] recommend microscopy for every case of vaginal discharge precisely because symptom-led and

microscopy-led diagnosis diverge from laboratory findings in ways that alter treatment.

What makes the gap difficult to dismiss is its direction. Wet mount microscopy is a markedly less sensitive test for vaginal yeast than culture. Chatwani et al. [23] recorded a sensitivity of 43.9 percent against yeast culture across symptomatic and asymptomatic women, rising only to 51.6 percent among symptomatic patients. The expected pattern is therefore for culture to recover more *Candida* than microscopy detects. Here the pattern runs the other way, and by a wide margin. The obvious technical explanation, that the culture arm simply failed to grow yeast, is less likely here, although variation in routine transport and incubation cannot be excluded. Sabouraud dextrose agar was inoculated in parallel with the bacteriological media, so *Candida* was actively sought rather than recovered incidentally, and the 18.0% figure is a reasonable estimate of fungal recovery under routine service conditions. That leaves over-reading of the wet mount as the leading explanation. Mucus strands, epithelial cell margins, and lactobacilli can all be mistaken for pseudohyphae by an observer working at the bedside without a scoring standard, and potassium hydroxide microscopy performed under service conditions is known to lose accuracy when the reader is not a trained microscopist. A diagnostic label that is both less sensitive than culture in principle and applied three times as often in practice points toward systematic over-diagnosis of candidiasis rather than toward a laboratory artifact.

The direction of the residual bias is worth stating. If the cultured women were sicker or more treatment-refractory than the questionnaire sample, the observed gap would be inflated, since refractory cases select against candidiasis. If instead they were less symptomatic, the gap would be understated. Random selection within the laboratory records controls sampling error but cannot correct a frame that was itself assembled by clinical judgment, and the first scenario is the more likely of the two. Using routine laboratory output rather than research-collected swabs trades experimental control for external validity: the culture results reflect exactly what clinicians in this setting receive from their service laboratory, which is the information actually available to inform treatment. Bruins et al. [13] took the same approach across ten years of Dutch general practice swabs and argued that service data of this kind reveal prescribing-relevant organisms that protocol-driven studies miss. A paired design was not feasible because the laboratory records were anonymized service data held under clinical protocols that precluded research linkage. A paired design, in which the same woman contributes both a recorded diagnosis and a culture result, is the only way to convert this signal into an estimate of diagnostic accuracy, and it is the central recommendation for follow-up work.

The organism that filled the gap was unexpected. *Streptococcus pyogenes* accounted for 22.0% of isolates, making group A streptococcus the single most common

organism recovered. Verstraelen et al. [24], reviewing the literature on group A streptococcal vaginitis in adults, identified only nine case reports covering twelve patients and concluded that the condition is a defined entity but is routinely misdiagnosed as vulvovaginal candidosis. Bruins et al. [25] had earlier established an association between group A beta-hemolytic streptococci and vulvovaginitis in adult women in a case-control design, and the condition is otherwise documented mainly in single reports involving breastfeeding women, household transmission, or progression to invasive disease [26,27,28]. Against that background, a rate of 22.0% is far above anything previously reported for an adult clinic population, and it deserves to be treated as a finding requiring replication rather than as an established local prevalence. Two qualifications bound it. The exact 95% confidence interval on eleven of fifty runs from 11.5 to 36.0 percent, so the facility-level prevalence could plausibly lie anywhere between roughly one in nine and one in three. More importantly, these were swabs ordered during routine care rather than collected to a sampling protocol, and the decision to culture is itself informative: clinicians in this setting order a high vaginal swab most often when empirical treatment has failed, when symptoms are severe or atypical, or when a woman is pregnant. Refractory vaginitis is enriched for aerobic and streptococcal etiology and depleted of straightforward candidiasis, so indication bias plausibly inflates the streptococcal figure and depresses the fungal one. Empirical antifungal treatment before swabbing could depress *Candida* yield in the same way.

Two considerations bear on its interpretation. Group B *Streptococcus agalactiae* colonizes the vagina of a substantial minority of reproductive-age women and is a recognized constituent of aerobic vaginitis, whereas group A carriage is uncommon. Russell et al. [29], pooling data from 390 studies worldwide, put adjusted maternal rectovaginal group B colonization at 18% overall and at 22.4% across Africa. That the African group B estimate and the group A figure reported here coincide almost exactly is a coincidence worth naming rather than burying, since it is the pattern that would arise if grouping had been misapplied. Serogrouping was performed in this study and assigned the isolates to group A, which is what permits the finding to be stated at all; without Lancefield grouping the two organisms cannot be separated on colony morphology and hemolysis. Confirmation by an independent laboratory, and ideally by molecular identification such as MALDI-TOF mass spectrometry or targeted PCR, would settle the question. Serogrouping establishes which organism grew; it does not establish where the organism came from, and introital or perineal contamination during collection remains a live alternative that only paired clinical correlation and repeat sampling can exclude. That the grouping was performed by a routine service laboratory rather than under a research protocol adds a further reason for caution, since the investigators could not audit the procedure. The second consideration is that recovery

of an organism from a high vaginal swab does not establish causation. *Staphylococcus aureus*, *Escherichia coli*, *Klebsiella* spp., *Enterococcus* spp., and viridans streptococci are frequently colonizers or introital contaminants. We therefore report these organisms as isolates rather than as confirmed pathogens.

The isolate profile as a whole is consistent with aerobic vaginitis. Enteric and skin organisms predominated, no *Lactobacillus* was recovered, and neither *Gardnerella vaginalis* nor any anaerobe appeared. Aklilu et al. [7] reported a comparable pattern in Ethiopia, where aerobic vaginitis was the leading reproductive tract infection and *Escherichia coli* and *Klebsiella pneumoniae* dominated the isolates. This consistency is not evidence against bacterial vaginosis. Because anaerobic culture was not performed and neither Nugent scoring nor Amsel criteria were applied, bacterial vaginosis was never tested for, so its prevalence here is unknown and could be substantial. The absence of *Gardnerella* reflects the method and nothing else, and the aerobic organisms recovered could well have coexisted with an undetected anaerobic dysbiosis. Muzny et al. [30] set out the diagnostic standards that future work in this setting should adopt.

The clinical implication should be stated carefully. These data do not justify changing empirical therapy, which would require paired diagnostic data and susceptibility testing that this study did not generate. What they do support is a case for laboratory confirmation. Where empirical antifungal therapy is the default response to discharge and pruritus, the culture distribution here raises the possibility that a meaningful fraction of women receive a drug with no activity against the organism present, and that possibility is testable at modest cost. Bleiblo et al. [14] document rising antimicrobial resistance across Libyan isolates over four decades, and empirical prescribing that does not match etiology contributes to exactly that trajectory.

The association between a previous episode and current fungal etiology was the strongest in the dataset and survived adjustment. Sobel and Vempati [1] describe a mechanism that fits, and Akinosoglou et al. [31] review the probiotic strategies proposed to interrupt it: repeated dysbiosis and repeated antimicrobial exposure compromise local immune tolerance of vaginal yeast and select for reduced fluconazole susceptibility, so each episode raises the probability of the next. The observed inverse association between self-administered antibiotic use and fungal etiology runs against that mechanism and against expectation. With 22 women reporting any antibiotic use the estimate is imprecise, and we treat it as an artifact of small numbers rather than a substantive result.

Pregnancy behaved contrary to the standard account. Elevated estrogen and vaginal glycogen are usually invoked to explain a higher candidiasis burden in pregnancy, a mechanism Sobel and Vempati [1] set out and that Ghaddar et al. [18] observed among Lebanese pregnant women, in whom candidiasis reached 39.4%. An earlier version of this analysis attributed the high

fungal proportion in our sample to the pregnant subgroup on that basis. The data do not support that explanation. Pregnancy was unassociated with fungal etiology and was instead associated with bacterial etiology and with fewer reported symptoms. The most economical reading is a detection effect: pregnant women in Benghazi attend antenatal care on a schedule, so infections are identified during routine review before symptoms accumulate, whereas non-pregnant women present when symptoms become intolerable. If that reading is right, the pregnant subgroup is not a higher-risk population but a more completely screened one, and the comparison is between screened and self-selected presentation rather than between biological risk strata. Prescriber behavior may also contribute, since reluctance to use azoles in early pregnancy could lead clinicians to record discharge as bacterial.

Awareness was low at 37.0% and tracked prior infection rather than age or marital status. Women in this sample learned about vaginal infection by having one. That pattern indicts primary health messaging rather than the women themselves, and it sets a clear target: education delivered through antenatal clinics, school curricula, and community outreach reaches women before a first episode, whereas clinic-based counseling reaches them only afterward. Shewarega et al. [32], analyzing demographic and health survey data across East Africa, found care-seeking for genital infection to be shaped more by education and household position than by symptom severity, which suggests the deficit here is structural rather than individual. Counseling did contribute independently to symptom improvement, which suggests the content works when it arrives.

The care pathway findings were reassuring on one point and concerning on another. Consultation with a physician was strongly associated with improvement, and self-medication without any physician contact occurred in only eight women, so the pattern of unsupervised antimicrobial use documented in several regional settings was not prominent here. Against that, 22 women (18.5%) reported applying antibiotics intravaginally without prescription, a practice that selects for resistance in exactly the aerobic organisms this study recovered and that Bleiblo et al. [14] and Atia et al. [33] both identify as a driver of the Libyan resistance burden. A further 17.6% of symptomatic women did not consult at all, and those with fewer symptoms were most likely to stay away. Since the etiologies recovered here include organisms associated with ascending infection and adverse obstetric outcome, low symptom burden is a poor triage criterion. Several constraints qualify these findings. The culture arm is retrospective service data subject to indication bias and unstandardized collection and identification, with no anaerobic technique or susceptibility testing. Self-reported symptoms and outcomes carry recall and social desirability bias, and the small sample yields wide confidence intervals across an exploratory set of comparisons. Recruitment from two

facilities in one city limits generalization to Libya as a whole.

### Conclusion:

Among symptomatic women attending gynecology clinics in Benghazi, the etiology recorded at consultation and the organisms recovered by aerobic culture followed markedly different distributions. Fungal infection was recorded in 58.8% of women while *Candida* spp. accounted for 18.0% of isolates, and group A *Streptococcus pyogenes* was the most frequently recovered organism at 22.0%. Because the two arms were independent samples, these findings are hypothesis-generating rather than a measure of diagnostic accuracy, and bacterial vaginosis was never assessed. The group A *Streptococcus* estimate should be regarded as provisional until confirmed by MALDI-TOF or PCR. Three actions follow. Laboratory confirmation should precede treatment wherever capacity allows; antimicrobial susceptibility testing belongs back in the diagnostic pathway, particularly given that 18.5% of women applied antibiotics intravaginally without prescription; and health education should reach women before a first episode. A larger study with individual-level linkage between clinical and laboratory data, paired microscopy and culture read independently, molecular identification of streptococcal isolates, and Nugent or

Amsel assessment for bacterial vaginosis is the priority for further work.

### Conflict of Interest

The authors declare no conflict of interest.

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### Data Availability

The anonymized questionnaire dataset, the extracted laboratory result table, the coding dictionary used to harmonize free-text responses, and the analysis code are available from the corresponding author on reasonable request.

### Authors' Contributions

AOB conceived and supervised the study, obtained institutional permission and access to the laboratory records, and reviewed the manuscript. AMA designed the reanalysis, performed the statistical analysis, prepared the figures, and wrote the manuscript. ZA contributed to drafting and critical revision of the manuscript. SAM, SSS, EAM, and SMBI administered the questionnaire, extracted the anonymized laboratory reports, and drafted the initial report. All authors read and approved the final version.

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