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## **Accuracy Level of Syndrome Management in Diagnosing Gonorrhea and Chlamydia in Pregnant Women with Vaginal Discharge Complaints**

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### **Abstract**

This study aims to assess the accuracy of syndrome management in diagnosing cervicitis caused by *Neisseria gonorrhoeae* (NG) or gonorrhea and *Chlamydia trachomatis* (CT) or chlamydia in pregnant women with vaginal discharge complaints, by comparing the accuracy of symptom-based syndrome management with an etiology-based laboratory approach. A Systematic Literature Review was conducted, searching five databases: PubMed, Cochrane, Google Scholar, and Garuda. The inclusion criteria included studies on pregnant women, comparisons between syndrome-based and laboratory-based management, and the presentation of diagnostic accuracy (sensitivity, specificity, positive predictive value, and negative predictive value). The quality of the studies was critically appraised using the QUADAS-2 instrument, and results were synthesized narratively. From the literature search, 673 studies were identified, of which 2 met the eligibility criteria for final analysis. The analysis revealed that syndrome management had low sensitivity (18–45%), moderate to high specificity (69–83%), low positive predictive value (10–24%), and high negative predictive value (77–92%). Syndrome-based management was found to be less accurate in detecting cervicitis, especially in asymptomatic cases, potentially leading to under-treatment or over-treatment. In contrast, laboratory-based etiology approaches such as NAAT demonstrated higher accuracy and are recommended as a more reliable diagnostic method.

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## 1. Introduction

The article discusses the challenges and impacts of sexually transmitted infections (STIs) on global health, with a focus on pregnant women. STIs such as gonorrhea, chlamydia, and syphilis continue to pose significant health risks, including for pregnant women, leading to complications like premature birth, neonatal infections, and fetal death. The prevalence of STIs among pregnant women is high globally, including in regions like Indonesia, where the rates of HIV and syphilis are concerning [1,2].

The article also highlights the diagnostic approaches used for STIs in pregnant women, particularly in resource-limited settings. The syndromic approach, which is commonly employed in many countries, diagnoses STIs based on symptoms without laboratory confirmation. While this approach allows for immediate treatment, it has limitations, such as low specificity and accuracy, which may lead to overdiagnosis and overtreatment, ultimately contributing to antibiotic resistance [3,4,5].

The article further emphasizes that the low detection rates of cervicitis caused by gonorrhea and chlamydia in pregnant women may be due to the limitations of the syndromic management approach. The paper suggests that laboratory-based diagnostic methods, such as nucleic acid amplification tests (NAATs), offer higher accuracy and should be considered as more reliable tools in diagnosing and treating STIs in pregnant women [6].

Through a systematic literature review, the study aimed to analyze the accuracy of the syndromic approach in diagnosing cervicitis due to gonorrhea and chlamydia, comparing it with laboratory-based methods. The findings suggest that syndromic management has lower sensitivity and specificity compared to laboratory-based approaches, underlining the need for better diagnostic methods and strategies in managing STIs, particularly in primary health care settings [7].

## 2. Method

This study uses the **Systematic Literature Review (SLR)** method, which consists of the following steps:

### a. Formulating the Research Question.

The first step is to formulate a clear and focused research question using the PICO framework (Population, Intervention, Comparison, Outcome). The PICO for this study is:

- **P (Population):** Pregnant women with vaginal discharge complaints
- **I (Intervention):** Syndromic management
- **C (Comparison):** Etiology-based or laboratory management (microscopy/NAAT/Point of Care)
- **O (Outcome):** Diagnostic accuracy of gonorrhea/chlamydia cervicitis

**Research Question:** How accurate is symptom-based syndromic management compared to laboratory-based etiology approaches in diagnosing gonorrhea and chlamydia cervicitis in pregnant women with vaginal discharge complaints?

**b. Determining the Literature Search Strategy.**

This step involves formulating a literature search strategy, including:

- **Keywords:** Pregnant women (pregnant women, pregnancy), vaginal discharge (vaginal discharge), syndromic management (syndromic management), etiology management (etiology management), laboratory management (laboratory management), cervicitis (cervicitis).
- **Search Method:** Literature was searched through electronic databases such as Garuda, Google Scholar, PubMed, Cochrane, and other sources such as Grey Literature, using Boolean search methods with operators like OR and AND.
- **Inclusion and Exclusion Criteria:**
  - **Inclusion:** Literature published within the last 20 years, involving pregnant women, comparing the effectiveness of syndromic and laboratory management with data on sensitivity, specificity, NPP, and NPN.
  - **Exclusion:** Literature in languages other than English or Indonesian, available only in abstract form, or research protocols and reviews.

**c. Conducting Literature Search and Selection.**

The literature search and selection process followed the *Preferred Reporting Items for Systematic Reviews and Meta-analysis* (PRISMA) flow, using the specified keywords and criteria.

**d. Critical Appraisal.**

Selected literature was critically appraised using the *Quality Assessment of Diagnostic Accuracy Studies 2* (QUADAS-2) tool. This tool assesses the quality of diagnostic accuracy studies based on four main domains: patient selection, index test, reference standard, and flow and timing. This appraisal helps assess the risk of bias in studies and their relevance to the research question.

**e. Data Extraction and Synthesis.**

At this stage, data from the selected articles were extracted, including study design, population, prevalence of sexually transmitted infections, types of syndromic management used, and laboratory methods as reference standards. Diagnostic accuracy values (sensitivity, specificity, NPP, NPN) were manually calculated using a 2x2 table. Data synthesis was conducted narratively, comparing the results of syndromic management with laboratory-based tests, while also considering the proportion of appropriate treatment, overtreatment, and missed treatment.

**f. Formulating Answers to the Research Question.**

The final step is to formulate answers to the research question based on the results of the systematic literature review.

By using this approach, the study aims to provide a deeper understanding of the diagnostic accuracy of syndromic management compared to laboratory-based methods in handling sexually transmitted infections in pregnant women.

### **3. Results**

#### **a. Literature Search Results.**

The literature search process was carried out using the Systematic Literature Review (SLR) approach, following the PRISMA flow. Articles were searched across five electronic databases: PubMed (183 articles), Cochrane Review (6 articles), Cochrane Trial (157 articles), Google Scholar (293 articles), and Garuda (34 articles), yielding a total of 673 articles. After deduplication, 172 articles were removed, leaving 501 articles for title and abstract screening. Subsequently, 434 articles were eliminated for being irrelevant or not meeting inclusion criteria, and 67 articles were moved to full-text screening.

From the 67 full-text articles, 17 were excluded due to being abstract-only, reviews, or protocols, and 33 were excluded because the sample populations were not pregnant women. A further 15 articles were excluded as they did not compare syndromic management with laboratory-based management for gonorrhea and chlamydia in pregnant women. Ultimately, 2 articles met all inclusion criteria and were included in the systematic analysis. This process is visually depicted in the PRISMA diagram (Figure 9).

#### **b. Critical Appraisal Results.**

The two studies analyzed showed low bias risk in patient selection, reference standard, and flow and timing domains. However, in the index test domain, the Romoren study was rated with unclear bias risk, as it did not clarify whether symptom interpretation was blinded to the reference standard results. Overall, most domains showed low bias risk, indicating the studies were valid and the data trustworthy for further analysis.

Both studies were relevant to the review objectives, using pregnant women populations from primary health services, syndromic management as the index test, and appropriate reference standards, including LCR and NAAT. Despite some methodological limitations, both studies were deemed suitable for synthesis, as detailed in **Table 4.**

**Table 4:** Critical Appraisal Results with QUADAS 2

| Domain                | Author: Romoren and his colleagues 2007 | Author: Vallely and his colleagues 2017 |
|-----------------------|-----------------------------------------|-----------------------------------------|
| Patient Selection     | Low Risk of Bias                        | Low Risk of Bias                        |
| Risk of Applicability | Low Risk                                | Low Risk                                |
| Index Test            | Low Risk of Bias                        | Low Risk of Bias                        |
| Risk of Applicability | Low Risk                                | Unclear                                 |
| Reference Standard    | Low Risk of Bias                        | Low Risk of Bias                        |
| Risk of Applicability | Low Risk                                | Low Risk                                |
| Flow and Timing       | Low Risk of Bias                        | Low Risk of Bias                        |
| Risk of Applicability | Low Risk                                | Low Risk                                |

### c. Study Characteristics.

The two studies meeting the inclusion criteria were conducted in Botswana and Papua New Guinea. Both studies were cross-sectional and carried out at antenatal care facilities. The total sample size was 1,468 pregnant women, aged within the reproductive range. All participants were pregnant women attending routine pregnancy check-ups at primary health services. Both studies were conducted in developing countries, Botswana in Southern Africa and Papua New Guinea in the Asia-Pacific region. The studies focused on pregnant women who had not yet received treatment, and cervical infection tests were performed using nucleic acid amplification tests (NAAT) as the reference standard. The Botswana study also evaluated a risk score based on a combination of symptom data and microscopy results, while the Papua New Guinea study focused on evaluating the accuracy of vaginal discharge symptoms as a single clinical indicator for syndromic management.

**Table 5:** Study Characteristics

| Description        | Literature 1                             | Literature 2                                  |
|--------------------|------------------------------------------|-----------------------------------------------|
| Author             | Romoren and his colleagues 2007          | Vallely and his colleagues 2017               |
| Country            | Botswana                                 | Papua New Guinea                              |
| Design             | Cross-sectional                          | Cross-sectional                               |
| Population         | Pregnant Women                           | Pregnant Women                                |
| Sample Size        | 703                                      | 765                                           |
| Prevalence         | CT: 8%, NG: 3%                           | CT: 22.9%, NG: 14.2%                          |
| Study Location     | Antenatal Clinic                         | Primary Health Facility                       |
| Index Test         | Syndromic Management (Vaginal Discharge) | Syndromic Management (Vaginal Discharge)      |
| Reference Standard | CT/NG: LCR (Ligase Chain Reaction)       | CT/NG: NAAT (Nucleic Acid Amplification Test) |

**d. Synthesis of Findings.**

Data from both studies were extracted using standard formulas, including author, year, study design, sample size, prevalence of STIs, type of syndromic management used, type of laboratory test, and diagnostic accuracy values (sensitivity, specificity, NPP, NPN). These values are summarized in **Table 6**.

Both studies—Romoren and his colleagues (2007) from Botswana and Vallely and his colleagues (2017) from Papua New Guinea—evaluated the performance of syndromic management in detecting specific sexually transmitted infections (STIs), *Chlamydia trachomatis* (CT) and *Neisseria gonorrhoeae* (NG) in pregnant women populations. Although conducted in different geographical regions, both studies employed cross-sectional designs and focused on pregnant women.

In the Romoren and his colleagues (2007) study, the sample size was 703 pregnant women with a prevalence of *Chlamydia trachomatis* (CT) of 8% and *Neisseria gonorrhoeae* (NG) of 3%. The index test was a symptom-based syndromic approach using vaginal discharge complaints, compared to a laboratory reference standard (LCR). Results showed that the symptom-based approach had sensitivity of 18% (95% CI: 13-25) and specificity of 83% (95% CI: 80-86), with a positive predictive value (NPP) of 10% (95% CI: 7-15) and a negative predictive value (NPN) of 92% (95% CI: 90-94). However, when clinical signs (objective symptoms) were evaluated, performance slightly improved: sensitivity of 45% (95% CI: 38-54), specificity of 69% (95% CI: 65-73), NPP of 13% (95% CI: 10-18), and NPN of 92% (95% CI: 90-94).

The Vallely and his colleagues (2017) study involved 765 pregnant women, with prevalence of *Chlamydia trachomatis* (CT) at 22.9% and *Neisseria gonorrhoeae* (NG) at 14.2%. The study used a symptom-based approach for vaginal discharge as the index test, with NAAT as the reference standard. Diagnostic accuracy results showed sensitivity for CT and NG of 21% (95% CI: 15-28) and 15% (95% CI: 9-23), respectively. Specificity was 80% (95% CI: 76-83) for CT and 79% (95% CI: 75-82) for NG. The positive predictive value (NPP) was relatively low, at 24% (95% CI: 17-31) for CT and 10% (95% CI: 9-16) for NG, while the negative predictive value (NPN) was 77% (95% CI: 74-81) for CT and 85% (95% CI: 82-87) for NG, which was consistent with the previous study.

**e. Answering the Research Question.**

The main research question was: How accurate is symptom-based syndromic management compared to laboratory-based etiology management in diagnosing gonorrhea and chlamydia cervicitis in pregnant women with vaginal discharge complaints? Based on the synthesis of the two studies, Romoren and his colleagues (2007) and Vallely and his colleagues (2017), it was found that syndromic management had low accuracy. Its sensitivity ranged from 18% to 45%, meaning that most infections were not detected using the clinical symptom-based approach. Although specificity was relatively high (69-83%), the low positive predictive value (10-24%) suggests that many women treated based on symptoms did not actually have *Chlamydia trachomatis* (CT) or *Neisseria gonorrhoeae* (NG).

In contrast, laboratory-based etiology management using NAAT showed much higher accuracy, as it could

detect infections even when patients showed no symptoms. Thus, it can be concluded that compared to syndromic management, laboratory-based etiology management is more accurate in diagnosing cervicitis in pregnant women with vaginal discharge.

**Table 6:** Data Extraction from Findings

| Description                     | Literature 1                             | Literature 2                                  |
|---------------------------------|------------------------------------------|-----------------------------------------------|
| Author/Year                     | Romoren and his colleagues 2007          | Vallely and his colleagues 2017               |
| Study Design                    | Cross-sectional                          | Cross-sectional                               |
| Population                      | Pregnant Women                           | Pregnant Women                                |
| Sample Size                     | 703                                      | 765                                           |
| Prevalence                      | CT: 8%, NG: 3%                           | CT: 22.9%, NG: 14.2%                          |
| Index Test                      | Syndromic Management (Vaginal Discharge) | Syndromic Management (Vaginal Discharge)      |
| Reference Standard              | CT/NG: LCR (Ligase Chain Reaction)       | CT/NG: NAAT (Nucleic Acid Amplification Test) |
| Sensitivity                     | 18% (13-25) / 45% (38-54)                | CT: 21% (15-28), NG: 15% (9-23)               |
| Specificity                     | 83% (80-86) / 69% (65-73)                | CT: 80% (76-83), NG: 79% (75-82)              |
| Positive Predictive Value (NPP) | 10% (7-15) / 13% (10-18)                 | CT: 24% (17-31), NG: 10% (9-16)               |
| Negative Predictive Value (NPN) | 92% (90-94) / 92% (90-94)                | CT: 77% (74-81), NG: 85% (82-87)              |

#### 4. Discussion

##### a. General Review of Findings

This systematic review aims to evaluate the accuracy of syndromic management compared to laboratory-based diagnosis in detecting cervicitis caused by *Neisseria gonorrhoeae* (NG) and *Chlamydia trachomatis* (CT) in pregnant women with vaginal discharge complaints. After conducting a literature search and screening process, two articles met the inclusion criteria: one by Romoren and his colleagues (2007) from Botswana [8] and another by Vallely and his colleagues (2017) from Papua New Guinea [9].

Romoren and his colleagues (2007) evaluated 703 pregnant women in Gaborone, Botswana, and found a prevalence of CT infection at 8% and NG at 3%. Syndromic management, based on the WHO "vaginal discharge syndrome" algorithm, showed very low sensitivity (18%) and moderate specificity (83%) in identifying laboratory-confirmed cervical infections [8]. Meanwhile, the study by Vallely and his colleagues (2017) involved 765 pregnant women in Papua New Guinea, revealing a CT prevalence of 22.9% and NG at 14.2%. Sensitivity of syndromic management ranged from 15% to 21%, with a low Positive Predictive Value (PPV) (10%–24%), though specificity was relatively high (79%–80%) and Negative Predictive Value (NPV) moderate (77%–85%) [9].

Both studies highlight the weaknesses of syndromic management in detecting STIs, which are mostly asymptomatic. This leads to undertreatment of undiagnosed cases and overtreatment in pregnant women without infections, potentially resulting in unnecessary antibiotic use, antimicrobial resistance, and healthcare resource wastage. Thus, more accurate diagnostic strategies are needed [8,9].

The limited number of studies found in this review can be attributed to several factors. First, the research topic is very specific, assessing the accuracy of syndromic management compared to etiology-based approaches in diagnosing cervicitis due to gonorrhea and chlamydia in pregnant women with vaginal discharge complaints. This narrow focus limits the number of relevant and available studies in scientific publications. Second, diagnostic accuracy studies are generally scarce in pregnant populations, particularly in developing countries. Whiting and his colleagues (2011) emphasized that the number of high-quality diagnostic studies is still limited, especially in vulnerable populations like pregnant women [10]. Lastly, Leeflang (2014) pointed out that the research question may be too restrictive by only including comparative studies or those reporting full accuracy parameters, thus limiting search results [11]. Therefore, the limited number of articles in this study reflects both the specificity of the topic and the limited publication of studies involving this target population.

Despite the quantitative limitation, this systematic literature review (SLR) remains valid. As stated in the *Cochrane Handbook for Systematic Reviews of Diagnostic Test Accuracy* [12], even a small number of studies can provide valuable insights, including identifying gaps in the evidence and offering recommendations for future research. Moreover, the Joanna Briggs Institute (JBI) guidelines emphasize that the quality and integrity of the evidence synthesis process are more important than the number of articles included [13].

## **b. Accuracy of Syndromic Management**

### **1) Sensitivity**

Sensitivity is the ability of a diagnostic tool to correctly identify individuals who truly have the disease. It represents the proportion of true positives (TP) among all individuals who are diseased, which has important clinical implications [14].

In this review, the sensitivity of syndromic management for detecting cervicitis due to *Chlamydia trachomatis* (CT) and *Neisseria gonorrhoeae* (NG) in pregnant women is low.

This finding is consistent with the meta-analysis updated by Wi and his colleagues (2019), which reported that the average sensitivity of syndromic management for detecting CT/NG infections ranged from 27.9% to 45%, depending on the complexity of the algorithm used and the context of the population involved [15]. This finding is reinforced by a systematic study and meta-analysis by Zemouri and his colleagues (2016), who evaluated the performance of syndromic algorithms for detecting cervical infections (including CT and NG) in women. They reported an average sensitivity of 27.9% (95% CI: 24.1–32.1) with specificity at 85.6%. In other words, only about 1 in 4 cervical infections were identified by the syndromic approach. The low sensitivity means that most women with cervical infections, particularly asymptomatic ones, do not receive the proper diagnosis or treatment, which can increase the risk of obstetric complications and vertical STI transmission [16].

This is further corroborated by clinical trials by Meena & Bansal (2016) in India, comparing syndromic management with laboratory-based etiology management in 200 women with vaginal discharge. The results showed that the recovery rate for cervicitis in the syndromic group was only 54%, much lower than the 71.4% in the etiology-based group. This indicates that, in addition to low diagnostic accuracy, syndromic management negatively impacts clinical effectiveness due to misdirected treatment [17].

The consistency of findings across various sources indicates that the syndromic approach, especially in detecting cervicitis due to CT and NG in pregnant women, has inherent limitations in sensitivity. The clinical implications of low sensitivity in syndromic management are that many pregnant women with infections remain undiagnosed and untreated, increasing the risk of complications such as preterm birth, neonatal infections, and HIV transmission. In high STI prevalence environments like Timika, this is particularly concerning as it raises the burden of hidden disease.

## 2) Specificity

Specificity is the ability of a diagnostic tool to correctly identify individuals who do not have the disease. It represents the proportion of true negatives (TN) among all healthy individuals [14]. A diagnostic tool with high specificity will produce a low number of false positives, which is valuable for confirming diagnoses to avoid unnecessary diagnosis and therapy in healthy individuals. Unlike sensitivity, this systematic literature review indicates that syndromic management for detecting cervicitis due to *Neisseria gonorrhoeae* (NG) and *Chlamydia trachomatis* (CT) in pregnant women has relatively high specificity. A systematic review by Wi and his colleagues (2019) reported that the average specificity of syndromic management for cervical infections ranged from 57% to 74%, which can be higher when the algorithm is combined with speculum examination or direct clinical sign evaluation [15].

High specificity means that most individuals without NG/CT infections are correctly identified as negative by the syndromic algorithm. Clinically, this is beneficial for reducing the likelihood of overdiagnosis and overtreatment, particularly in primary healthcare settings with limited diagnostic tools.

These findings are supported by Zemouri and his colleagues (2016), who reported an average specificity of 85.6% (95% CI: 79.7–89.9%) for syndromic management in detecting cervical infections, based on a meta-analysis of 10 studies with microbiological comparisons. This indicates that the majority of patients without infections are not unnecessarily treated. However, the authors also emphasized that high specificity does not mitigate the clinical impact of low sensitivity, which results in many infections remaining undetected [16].

Similarly, Meena & Bansal (2016) in India found that in a randomized controlled trial of 200 women with abnormal vaginal discharge, the syndromic group had a lower clinical improvement rate of 41% for vaginitis and 54% for cervicitis, compared to 76.3% and 71.4% in the etiology-based group. Although specificity was not explicitly reported, the difference in treatment success rates reflects that the syndromic approach is relatively selective, indirectly indicating better differentiation of non-infected cases (false positives) compared to non-targeted approaches [17].

However, it is important to note that high specificity does not guarantee overall clinical effectiveness, especially in populations with high STI prevalence and non-specific symptoms like vaginal discharge in pregnant women. In such settings, the risk of over-treatment remains due to low sensitivity and limited positive predictive value (PPV).

### 3) **Positive Predictive Value (PPV)**

The Positive Predictive Value (PPV) represents the proportion of individuals who are identified as positive by the syndromic approach and truly have the infection (true positives). The PPV is highly influenced by disease prevalence in the population and the specificity of the method used. In this systematic literature review, the PPV for syndromic management in detecting cervicitis due to NG and CT in pregnant women shows considerable variation, but is generally low. Zemouri and his colleagues (2016) in their meta-analysis also reported a low PPV for most syndromic management pathways, even in populations with high prevalence [16].

The low PPV has significant clinical implications. First, it supports the evidence that syndromic management has substantial limitations in distinguishing vaginal discharge caused by NG/CT infections from other more common causes, such as *Trichomonas vaginalis*, *Candida* spp., or even physiological vaginal discharge during pregnancy. Second, the low PPV increases the likelihood of unnecessary treatment in patients who do not actually need it, leading to side effects, increased costs, and contributing to antimicrobial resistance [18].

Practically, using syndromic management with a low PPV is inefficient in primary healthcare settings, particularly in regions with an uncertain or relatively low prevalence of STIs. This highlights the need for improved diagnostic accuracy through laboratory-based screening strategies, especially for high-risk groups like pregnant women.

### 4) **Negative Predictive Value (NPV)**

The Negative Predictive Value (NPV) indicates the proportion of individuals who are not identified as cases by the syndromic approach and truly do not have the infection (true negatives). This value is strongly dependent on sensitivity and the prevalence of disease in the studied population. In the context of screening for cervicitis caused by *Chlamydia trachomatis* and *Neisseria gonorrhoeae* in pregnant women, high NPV is crucial to ensure that individuals who are not treated are truly free from infection. In the study by Romoren and his colleagues (2007), the NPV for subjective vaginal discharge symptoms reached 91.3% (95% CI: 88.3–93.9%), while clinical signs of vaginal discharge through speculum examination showed slightly higher NPV at 91.9% (95% CI: 89.1–94.2%) [8]. The Vallely and his colleagues (2017) study reported similar findings, with an NPV of 87.7% for the NAAT laboratory reference standard [9]. Wi and his colleagues (2019) also concluded that NPV tends to be high, particularly in populations with better test specificity and relatively low STI prevalence [15].

While the NPV appears high in general, it should be noted that NPV is greatly influenced by the low prevalence of NG/CT in the pregnant populations studied, and therefore may not fully reflect the test's performance in groups with higher prevalence. Furthermore, many CT and NG infections in women are asymptomatic.

According to a meta-analysis by Fortas and his colleagues (2024), approximately 60.7% of CT infections and 53.3% of NG infections in women are asymptomatic. This indicates that, although the NPV seems high, there is a risk that infections are missed because asymptomatic patients are not identified by the algorithm. This highlights that a high NPV does not guarantee the safety of the syndromic approach, especially in areas with high prevalence and the risk of serious complications, such as Papua [19].

## 5) **Alternative Diagnostic Tools**

One of the key findings from this systematic review is the presence of alternative, more accurate diagnostic tests compared to syndromic management, specifically laboratory-based etiology testing and point-of-care testing (POCT) [18]. In the study by Vallely and his colleagues (2017) in Papua New Guinea, the syndromic approach was directly compared to molecular NAAT testing as the gold standard, using Cepheid GeneXpert for detecting *Chlamydia trachomatis* and *Neisseria gonorrhoeae*. The use of GeneXpert as a POCT showed advantages in terms of sensitivity, turnaround time, and feasibility for implementation in primary healthcare facilities in developing countries. Vallely and his colleagues (2017) noted that POCT based on NAAT has the potential to improve the detection of asymptomatic STIs and reduce unnecessary treatment, as treatment can be given only to patients with positive test results [9].

Other studies support the use of etiology-based approaches as an alternative to syndromic management. For example, Wi and his colleagues (2019) in their global review mentioned that POCTs like GeneXpert CT/NG and OSOM Trichomonas Rapid Test demonstrated high sensitivity and specificity (>90%) and are suitable for application in developing countries, provided they are supported by appropriate implementation strategies [15].

In addition to NAAT, some studies have evaluated the use of speculum and simple microscopic examination to improve diagnostic accuracy. In the study by Romoren and his colleagues (2007), speculum examination that showed clinical signs of cervicitis (such as mucopurulent discharge or easy bleeding when touched) had slightly better sensitivity than relying solely on subjective complaints [8]. Similarly, the study by Meena & Bansal (2016) in India concluded that laboratory-based approaches (wet mount, Gram stain, antigen test) provided better recovery rates and diagnostic accuracy than syndromic management, especially for cervicitis cases [17].

Therefore, alternative diagnostic methods such as NAAT-based POCT and clinical inspections using speculum can offer a more effective strategy for detecting and managing STIs, especially in pregnant women in resource-limited areas, compared to the conventional syndromic approach based solely on vaginal discharge complaints.

## 6) **Limitations of the Study**

This systematic literature review has several limitations that should be considered when interpreting the results and drawing conclusions. First, only two articles met all the inclusion and exclusion criteria, limiting the generalizability of the findings. Although both studies were conducted in regions with characteristics similar to Indonesia, particularly in terms of STI burden, resource limitations, and primary healthcare services relying on syndromic approaches (Romoren and his colleagues 2007), the limited number of articles reflects the scarcity of primary studies specifically investigating the accuracy of syndromic management in pregnant women in

developing countries [8].

Second, although this review evaluates the accuracy of syndromic management based on parameters such as sensitivity, specificity, PPV, and NPV, it does not include other aspects of the effectiveness of syndromic management, such as its role in overall clinical decision-making, including cost, patient satisfaction, and healthcare provider satisfaction. Thus, the findings of this review should not be directly interpreted as evidence of the overall effectiveness of syndromic management, but rather are limited to diagnostic accuracy. A comprehensive evaluation of the clinical utility of any diagnostic approach requires additional research with broader designs [20].

Recognizing these limitations, the results of this study should be used as a starting point for improving diagnosis and management of STIs in primary healthcare services, while encouraging further, more comprehensive, and context-specific research in Indonesia, particularly in Papua.

#### **7) Application of Findings in Timika and Papua**

The findings from this systematic review are highly relevant for application in Papua, especially in Timika, a region with a high HIV infection burden in pregnant women, but where routine surveillance data shows low cases of other STIs like gonorrhea and chlamydia. This disparity likely reflects weaknesses in detecting non-HIV STIs, which still heavily rely on syndromic management without laboratory support.

In this context, the findings of Romoren and his colleagues (2007) in Botswana are crucial. They found that using a combination of symptoms and clinical signs (such as abnormal vaginal discharge and speculum findings) could increase the sensitivity of syndromic management from 18% (based on subjective symptoms alone) to 45%. Such a strategy could be considered a viable initial approach for regions like Timika, where laboratory capacity remains a challenge, but HIV prevalence is sufficiently high to warrant the detection of other STIs to prevent co-transmission [8].

The application of a symptom-based algorithm, supported by clinical signs, is also consistent with the disease burden profile in Papua, where most cases of HIV in pregnant women are identified through routine screening, but other STIs are often missed due to limited etiology testing (PJ Program HIV AIDS-IMS Dinkes Mimika, 2024). In this situation, increasing healthcare providers' ability to recognize clinical signs such as mucopurulent discharge, cervical erosion, or bleeding on touch can improve early detection of gonorrhea or chlamydia cervicitis [21].

However, since most STIs are asymptomatic, particularly in pregnant women, using clinical algorithms still carries the risk of missing many cases. Therefore, this review also highlights the need to increase access to etiology-based tests like point-of-care testing (POCT) or simple NAAT tests such as GeneXpert, which could be developed for the detection of other STIs (Vallely and his colleagues 2017) since this method has already been introduced for TB and HIV detection in Papua [9].

From a policy perspective, the findings from this review can inform strategies to strengthen the detection and

management of vaginal discharge in pregnant women at primary healthcare facilities in Papua. One strategic approach could be advocating for the enhancement of vaginal discharge management protocols at community health centers (Puskesmas), encouraging routine speculum examination as part of standard care, particularly during antenatal visits for pregnant women with vaginal discharge complaints or at risk for STIs, alongside monitoring of case reporting and documentation.

Moreover, improving the capacity of primary healthcare providers through regular training is crucial to support their ability to recognize clinical signs of cervicitis. This can improve sensitivity in detecting infections, even without advanced laboratory support.

Additionally, integrating POCT-based STI screening into existing HIV prevention programs for mother-to-child transmission in various regions of Papua becomes a strategic and efficient approach. By using ANC visits as a coordinated screening moment, STIs like chlamydia and gonorrhea could be detected alongside standard HIV and syphilis screening

## **5. Conclusion**

- a. Syndromic management has lower accuracy compared to laboratory management in diagnosing cervicitis caused by gonorrhea and chlamydia in pregnant women with vaginal discharge complaints.
- b. The sensitivity of syndromic management is low, ranging from 18%–45%, leading to the risk of undetected cases (undertreatment).
- c. The specificity of syndromic management tends to be moderate to high (79%–83%), reducing the risk of treatment in pregnant women who are not infected. However, due to the low sensitivity and positive predictive value of syndromic management, there is still a risk of overtreatment in pregnant women who are not infected.
- d. The positive predictive value of syndromic management is low (9%–13%), indicating that most pregnant women diagnosed with the syndrome are actually not infected.
- e. The negative predictive value of syndromic management is quite high (90%–91%), showing that most patients who are declared negative are truly uninfected, but this is not sufficient to guarantee clinical safety, especially in pregnant populations in areas with high STI and HIV prevalence.

## **6. Recommendations**

### **a. For Policy Makers and Health Departments:**

It is recommended that policy makers and health departments revise national and local guidelines on the management of vaginal discharge in pregnant women, with an emphasis on the use of clinical examination components such as speculum examination. Furthermore, integrating point-of-care testing (POCT) for gonorrhea and chlamydia into primary healthcare strategies should be encouraged, especially during routine antenatal visits and in conjunction with HIV-STI control programs. Additionally, prioritizing the procurement of sensitive, specific POCT that meets WHO criteria, particularly for areas with high STI and HIV burden like Papua, is necessary. Finally, there should be an increase in supervision of the recording and reporting of STI

cases to ensure accurate epidemiological data is available for targeted program planning.

**b. For Healthcare Providers in Primary Care Services:**

Healthcare providers in primary care services are advised to improve their skills in speculum examination and clinical sign identification for cervicitis. They should deepen their understanding of the syndromic management algorithm to improve diagnostic accuracy. A risk-based and clinical sign-based approach should be implemented as a transitional strategy before affordable etiology testing becomes available. Systematic recording and reporting of cases should be carried out to support STI case monitoring. Regular training and supervision should be pursued to ensure the quality and consistency of vaginal discharge management in pregnant women.

**c. For the Community (Pregnant Women and Families):**

The community, particularly pregnant women and their families, is advised to increase awareness of vaginal discharge as a potential sign of infection that should be medically consulted. They should not ignore complaints of vaginal discharge, even if the symptoms are mild, and should seek medical attention promptly at healthcare facilities.

**d. For Future Researchers:**

Future researchers are encouraged to study the prevalence of non-HIV STIs at the local level to obtain more accurate epidemiological data. They may also conduct implementation studies on POCT or symptom and clinical sign-based algorithms within the context of primary care for pregnant women. Additionally, evaluating the effectiveness or clinical utility of syndromic management, including cost-efficiency, patient acceptance, and user satisfaction (both patients and healthcare providers), is recommended.

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