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Beyond Diagnostic Delay in Endometriosis: Consequences for Women's Quality of Life and Opportunities for Earlier Detection

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Abstract

Background: Endometriosis is a chronic, estrogen-dependent disorder with neuroinflammatory mechanisms, that affects approximately 10% of individuals assigned female at birth globally [11,26,27]. Despite its high prevalence and the severity of its symptoms—ranging from debilitating pelvic pain to infertility—the disease is characterized by a persistent and profound diagnostic delay [2,7,9]. This latency period consistently ranges from 4 to 12 years across diverse geographical regions and has shown minimal improvement over the last several decades [4,7,9].

Objectives: The primary objective of this review was to identify and synthesize the multifactorial contributors to diagnostic delay, evaluate the subsequent clinical and socioeconomic consequences, and outline evidence-based strategies for facilitating earlier detection.

Methods: This review was a comprehensive search of electronic databases, including PubMed, MEDLINE, EMBASE, and PsycINFO, performed for primary research published from inception to 2025, with a primary focus on the last decade [4,7,11]. Eligible studies included those providing quantitative or qualitative data on diagnosis times for physician-confirmed endometriosis cases [7]. Data synthesis categorized delay phases into patient-related, primary care, and secondary care latencies [4,7].

Results: The average global diagnostic delay was found to be approximately 6.8 years, with significant variations based on the leading symptom; for instance, patients presenting with dysmenorrhea often experience median delays of 12 years, compared to 3 years for those

presenting with infertility [9]. Contributing factors include individual behaviors such as the normalization of debilitating menstrual pain and societal stigma [2-4]. Physician-related factors, including clinical knowledge gaps and the misattribution of symptoms to gastrointestinal or psychological disorders, represent a critical bottleneck in primary care [3,5,14]. Furthermore, the traditional reliance on invasive laparoscopy as the diagnostic "gold standard" acts as a major institutional hurdle [3,13,14,26]. The consequences of this delay are severe, facilitating disease progression to deep infiltrating endometriosis (DIE), central sensitization of the nervous system leading to chronic nociplastic pain, and a massive socioeconomic burden driven by lost productivity [4,10,17,26].
Conclusions: Addressing the diagnostic gap requires a fundamental paradigm shift toward a "clinical diagnosis" model based on detailed patient history, specialized physical examination, and advanced non-invasive imaging such as expert-performed transvaginal ultrasound (eTVUS) and MRI [11,15,18,26]. Emerging research into molecular biomarkers, including serum microRNA panels and Galectin-1, offers promising "rule-in" capabilities for non-specialized settings [12,15,21,23]. Implementing mandatory educational initiatives for primary care providers is essential to reduce symptom normalization and ensure timely specialist intervention [3,5].
Keywords: Endometriosis, Diagnostic delay, time to diagnosis, Early detection

1. Introduction

1.1. Overview of Endometriosis

Endometriosis is a chronic, estrogen-dependent inflammatory disorder characterized by the presence of endometrial-like tissue outside the uterine cavity. The disease is associated with chronic pelvic pain, dysmenorrhea, dyspareunia, infertility, and substantial impairment in quality of life [1,22,26]. It is one of the most common gynecological disorders worldwide, affecting approximately 10% of women and individuals assigned female at birth during their reproductive years [22,25,26]. Although the exact pathogenesis remains incompletely understood, current evidence suggests that endometriosis results from a complex interaction among retrograde menstruation, genetic susceptibility, immune dysregulation, hormonal factors, and inflammatory mechanisms [1,22,27]. The disease exhibits considerable clinical heterogeneity, ranging from asymptomatic superficial peritoneal lesions to severe deep infiltrating endometriosis (DIE) involving multiple pelvic and extra-pelvic organs [1,13,22].

Recent epidemiological studies estimate a pooled global prevalence of approximately 5% (95% CI: 2–9%) in the general female population [6,25]. However, prevalence varies substantially according to population characteristics and diagnostic methods. Among women experiencing infertility, prevalence rates approach 38%, while estimates among individuals presenting with chronic pelvic pain range from 18% to 42% [6,22].

The global burden of endometriosis remains substantial. According to the Global Burden of Disease Study 2021, approximately 22.3 million prevalent cases and 2.05 million disability-adjusted life years (DALYs) were attributable to endometriosis worldwide [25]. Although age-standardized prevalence rates have remained relatively stable in recent years, the absolute number of affected individuals is expected to increase through 2050 because of population growth and demographic changes [25].

Despite its high prevalence and considerable impact on physical, reproductive, psychological, and socioeconomic well-being, endometriosis remains substantially underdiagnosed worldwide [3–5,7]. One of the most characteristic and concerning features of the disease is the prolonged interval between symptom onset and definitive diagnosis, commonly referred to as diagnostic delay [3–5,7].

1.2. The Problem of Diagnostic Delay

Diagnostic delay in endometriosis represents a persistent global healthcare challenge. It is generally defined as the period between the onset of symptoms and the establishment of a definitive diagnosis through clinical assessment, imaging, or surgical confirmation [5,7,19]. Comparisons across studies remain difficult because definitions of diagnostic delay, study populations, healthcare systems, and diagnostic pathways vary considerably [5,7].

Nevertheless, evidence consistently demonstrates that the interval between symptom onset and diagnosis commonly ranges from 4 to 12 years across different healthcare settings worldwide [5,6,7,9]. This prolonged latency period is multifactorial and can be divided into several stages, including patient delay, primary care delay, and secondary care delay [5,7,8].

Patient delay refers to the time between symptom onset and the first healthcare consultation. Primary care delay encompasses the interval between the initial consultation and referral to a specialist or recognition of endometriosis as a potential diagnosis. Secondary care delay represents the period between specialist referral and confirmation of the diagnosis [5,7,8].

Several factors contribute to these delays. At the individual level, severe menstrual pain is frequently normalized by patients, family members, and society, resulting in delayed help-seeking behavior [2,4,6]. Menstrual stigma and social expectations surrounding menstruation

may further discourage individuals from discussing symptoms openly with healthcare providers [2,4].

Clinician-related factors also contribute substantially to delayed diagnosis. Many healthcare professionals continue to associate endometriosis primarily with infertility, resulting in under-recognition of non-classical presentations [5,7,14,19]. Symptoms are frequently attributed to alternative conditions, including irritable bowel syndrome, pelvic inflammatory disease, urinary tract disorders, or psychological causes [5,7,14,19]. Consequently, many patients undergo multiple consultations before receiving an appropriate referral for specialist assessment [5,14].

Healthcare system barriers further compound these challenges. Historically, laparoscopic visualization with histopathological confirmation has been regarded as the diagnostic gold standard, creating a substantial barrier to timely diagnosis because clinicians may hesitate to pursue invasive investigations, particularly in adolescents and young adults [1,7,18]. In addition, fragmented referral pathways, limited access to specialist services, insufficient use of advanced imaging techniques, and prolonged waiting times contribute to diagnostic latency [7,16,19].

The consequences of delayed diagnosis are considerable. Continued disease progression may result in the development of extensive pelvic adhesions, fibrosis, and deep infiltrating endometriosis, which represents the most severe form of the disease [1,22,27]. Persistent inflammation and repeated nociceptive stimulation may also induce central sensitization of the nervous system, facilitating the transition from cyclic menstrual pain to chronic nociplastic pain syndromes that are significantly more difficult to manage [8,17,22].

Beyond physical morbidity, diagnostic delay is associated with impaired fertility, adverse reproductive outcomes, psychological distress, reduced quality of life, and substantial socioeconomic costs [6,8,13,14]. Increased healthcare utilization, repeated consultations, work absenteeism, and reduced workplace productivity contribute significantly to the economic burden associated with endometriosis [6,14].

Given these substantial consequences, reducing diagnostic delay has become a major priority in contemporary endometriosis research, clinical practice, and public health policy [4,7,19].

1.3. Aim of the Work

The aim of this review was to evaluate the extent of diagnostic delay in endometriosis, identify patient-, physician-, and healthcare system-related factors contributing to delayed diagnosis, assess the clinical and socioeconomic consequences of diagnostic latency, and summarize current and emerging strategies that may facilitate earlier detection and diagnosis of the disease.

2. Materials and Methods

2.1. Study Design

This review was conducted to evaluate the magnitude of diagnostic delay in endometriosis and to synthesize current evidence regarding its determinants, clinical consequences, and potential strategies for earlier diagnosis. The review incorporated both quantitative and qualitative studies to provide a comprehensive assessment of factors influencing the diagnostic pathway.

2.2. Search Strategy

A comprehensive literature search was performed using PubMed, MEDLINE, EMBASE and PsycINFO. The search strategy was developed using the SPIDER (Sample, Phenomenon of Interest, Design, Evaluation, Research Type) framework to optimize identification of studies examining diagnostic delay in endometriosis.

Search terms included combinations of Medical Subject Headings (MeSH) and free-text keywords such as "endometriosis," "diagnostic delay," "time to diagnosis," "delayed diagnosis," "diagnostic latency," "early detection," "clinical diagnosis," and "time to confirmed diagnosis." Boolean operators ("AND" and "OR") were applied as appropriate to maximize sensitivity and specificity.

The primary search focused on studies published between January 2016 and February 2026 to capture contemporary evidence reflecting current diagnostic practices, advances in imaging techniques, and emerging biomarker research. Earlier landmark publications were additionally

reviewed when necessary to provide historical context and support interpretation of current findings.

2.3. Eligibility Criteria

Studies were considered eligible for inclusion if they met predefined inclusion criteria addressing diagnostic delay in endometriosis and factors influencing the diagnostic process.

Inclusion Criteria

Studies were included if they:

- Reported original quantitative or qualitative data on diagnostic delay in endometriosis.
- Examined the interval between symptom onset and definitive diagnosis.
- Investigated patient-, physician-, or healthcare system-related determinants of delayed diagnosis.
- Evaluated clinical, reproductive, psychological, socioeconomic, or healthcare-related consequences of diagnostic latency.
- Assessed strategies aimed at facilitating earlier diagnosis, including clinical diagnostic pathways, imaging techniques, biomarkers, educational interventions, or healthcare policy initiatives.
- Included participants with physician-confirmed endometriosis diagnosed by laparoscopy, histopathological examination, magnetic resonance imaging (MRI), or expert-performed transvaginal ultrasonography (TVUS).
- Employed randomized controlled trial, cohort, case-control, cross-sectional, mixed-methods, or qualitative study designs.

Exclusion Criteria

Studies were excluded if they:

- Were case reports or case series involving fewer than ten participants.
- Consisted of narrative reviews, editorials, letters, commentaries, conference abstracts, or expert opinions without primary data.
- Represented unpublished theses, dissertations, or other forms of grey literature.
- Focused exclusively on animal models or in vitro experimental studies.
- Were not available in English.

- Did not provide sufficient information regarding diagnostic timelines, contributing factors, or outcomes associated with delayed diagnosis.

2.4. Study Selection

All records identified through database searches were imported into a reference management software package, and duplicate records were removed. Titles and abstracts were screened for relevance according to the predefined eligibility criteria. Studies considered potentially eligible underwent full-text review.

During full-text assessment, articles were evaluated for methodological suitability, population characteristics, diagnostic confirmation methods, and relevance to the study objectives. Disagreements regarding eligibility were resolved through discussion and consensus.

Particular emphasis was placed on studies reporting quantitative measures of diagnostic delay, including patient delay, primary care delay, secondary care delay, and total time to diagnosis. Qualitative studies exploring patient experiences, healthcare professional perspectives, and barriers to diagnosis were also included to provide a comprehensive understanding of the diagnostic journey.

2.5. Data Extraction

Data were extracted using a standardized data collection form developed specifically for this review. The following information was collected from each included study:

- First author and year of publication.
- Country and healthcare setting.
- Study design.
- Sample size and participant characteristics.
- Diagnostic criteria used to confirm endometriosis.
- Mean or median diagnostic delay.
- Duration of patient, primary care, and secondary care delays.
- Factors associated with delayed diagnosis.
- Clinical consequences of diagnostic latency.

- Reproductive outcomes.
- Psychological and quality-of-life outcomes.
- Socioeconomic impacts.
- Diagnostic interventions or strategies proposed to reduce delay.

When available, measures of statistical dispersion, including standard deviations, interquartile ranges, confidence intervals, and reported ranges, were also extracted.

2.6. Quality Assessment

Methodological quality was assessed according to the design of each included study. Particular consideration was given to:

- Adequacy of sample size.
- Representativeness of the study population.
- Methods used to confirm endometriosis diagnosis.
- Risk of selection bias.
- Potential recall bias.
- Reporting quality.
- Appropriateness of statistical analyses.

Studies relying solely on self-reported diagnoses without physician confirmation were interpreted cautiously because of the increased risk of diagnostic misclassification and reporting bias.

2.7. Data Synthesis

Given the substantial heterogeneity among included studies with respect to study design, patient populations, healthcare systems, definitions of diagnostic delay, and reported outcomes, quantitative meta-analysis was not considered appropriate.

Consequently, a narrative synthesis approach was adopted. Findings were grouped into four major thematic domains:

1. Magnitude and duration of diagnostic delay.
2. Factors contributing to delayed diagnosis.
3. Clinical and socioeconomic consequences of diagnostic latency.
4. Current and emerging strategies for earlier detection and diagnosis.

A socio-ecological framework was used to facilitate interpretation of the multifactorial determinants of diagnostic delay across patient, clinician, healthcare system, and societal levels.

2.8. Ethical Considerations

As this review was based exclusively on previously published literature and did not involve direct patient participation or access to identifiable personal data, formal ethical approval and informed consent were not required.

3. Results

3.1. Study Characteristics

The literature search identified studies investigating diagnostic delay in endometriosis across a broad range of healthcare settings, populations, and methodological approaches. Included studies comprised reviews, retrospective and prospective cohort studies, cross-sectional surveys, mixed-methods investigations, and qualitative research. Collectively, these studies evaluated diagnostic pathways, determinants of delayed diagnosis, patient experiences, healthcare professional perspectives, and emerging diagnostic technologies [3–25].

Most studies originated from Europe, North America, and Australia, with comparatively fewer investigations conducted in low- and middle-income countries [4,6,7]. Consequently, current evidence predominantly reflects healthcare systems within high-income settings, highlighting an important gap in the global understanding of diagnostic delay [4,25].

The included studies varied substantially in sample size, diagnostic criteria, and methods used to measure diagnostic latency. While many investigations relied on surgically confirmed diagnoses, more recent studies increasingly incorporated diagnoses established through advanced imaging modalities, including MRI and expert-performed transvaginal ultrasonography [11,16,18,20].

3.2. Magnitude of Diagnostic Delay

Overall Duration of Diagnostic Delay

The available evidence consistently demonstrates that diagnostic delay remains a major challenge in the management of endometriosis despite increased awareness and advances in diagnostic technologies [3–10].

Across international studies, the average interval between symptom onset and definitive diagnosis generally ranges from 4 to 12 years [5–9]. A review of diagnostic delay reported a mean delay of approximately 6.8 years, with individual studies demonstrating delays ranging from 1.5 to 11.4 years depending on population characteristics and healthcare system factors [3].

More recent analyses indicate that improvements in diagnostic timelines have been modest, suggesting that substantial barriers to timely diagnosis persist despite advances in imaging and growing recognition of the disease [5,7,9].

Geographic Variation

Considerable regional variation exists in the duration of diagnostic delay. National cohort studies from several European countries have reported median delays of approximately 6–8 years [5,9]. Similar findings have been observed in other high-income settings, indicating that prolonged diagnostic latency remains a widespread international phenomenon [6,7].

Differences in healthcare organization, referral pathways, specialist availability, reimbursement systems, and provider awareness likely contribute to observed geographical variation [4,5,19].

3.3. Components of Diagnostic Delay

To better understand where delays occur, many studies divide the diagnostic pathway into three distinct phases: patient delay, primary care delay, and secondary care delay [5,7,8].

Patient Delay

Patient delay refers to the interval between symptom onset and the first healthcare consultation. Across studies, this period typically ranges from 1 to 4 years [5,9].

Several factors contribute to delayed healthcare-seeking behavior, including normalization of menstrual pain, lack of awareness regarding endometriosis, cultural stigma surrounding menstruation, and misconceptions regarding what constitutes a normal menstrual experience [2–6].

In Dutch population-based research, the median patient delay was approximately 1 year, indicating that many individuals experience symptoms for prolonged periods before seeking medical advice [5].

Primary Care Delay

Primary care delay encompasses the interval between the first healthcare consultation and referral to an appropriate specialist or establishment of a diagnosis [5,7].

This stage frequently represents the longest component of the diagnostic pathway. Reported delays range from approximately 0.3 to 8.6 years [5,7]. Studies from the United Kingdom and the Netherlands reported median primary care delays of approximately 1 year; however, substantial variation exists, with some patients remaining undiagnosed for many years following their first presentation to healthcare services [5,9].

Common contributors to primary care delay include symptom misattribution, repeated consultations without specialist referral, insufficient awareness among healthcare professionals, and the heterogeneous clinical presentation of endometriosis [5,7,14,19].

Secondary Care Delay

Secondary care delay refers to the interval between referral to a specialist and establishment of a definitive diagnosis. Compared with patient and primary care delays, this phase is generally shorter and is often reported as less than one year [5,7].

Despite its relatively shorter duration, secondary care delay remains clinically significant. Delays may arise because of prolonged waiting times for specialist consultations, restricted

access to advanced imaging modalities, variability in specialist expertise, and continued reliance on surgical confirmation in selected cases [7,16,18,20].

Historically, diagnostic pathways frequently culminated in laparoscopic visualization with histopathological confirmation, which was considered the diagnostic gold standard [18]. Although contemporary guidelines increasingly support clinical diagnosis based on symptoms and imaging findings, historical dependence on surgery has contributed substantially to diagnostic latency [1,16,18,19].

Recent advances in expert-performed transvaginal ultrasonography (eTVUS) and magnetic resonance imaging (MRI) have improved preoperative diagnostic accuracy, particularly for ovarian endometriomas and deep infiltrating endometriosis (DIE) [11,16,20]. Nevertheless, access to these specialized diagnostic services remains uneven across healthcare systems, contributing to continued variation in secondary care delay [7,19].

3.4. High-Risk Groups for Prolonged Diagnostic Delay

Several patient populations experience substantially longer diagnostic delays than the general population. Adolescents represent one of the most vulnerable groups [3,7].

Early symptoms of endometriosis frequently begin during adolescence, yet severe dysmenorrhea and chronic pelvic pain are often dismissed as normal features of puberty and menstrual development [3,5]. Consequently, young patients may experience prolonged periods of unmanaged symptoms before referral to specialist care [3,5,7].

Some studies have reported average delays approaching 14.8 years among adolescents, substantially exceeding those observed in adult populations [3]. In extreme cases, delays of more than 30 years have been documented [7].

Symptom profile also influences diagnostic timing. Patients presenting with infertility often receive earlier specialist referral and diagnostic investigation than those presenting primarily with pain symptoms [7]. Reported median diagnostic delays have been approximately 3 years among infertility patients compared with approximately 12 years among individuals whose primary symptom is dysmenorrhea [7].

These findings suggest that reproductive concerns may be perceived by healthcare providers as more clinically significant than chronic pain symptoms, contributing to delayed recognition of pain-dominant disease presentations [4,5].

3.5. Contributing Factors to Diagnostic Delay

The evidence indicates that diagnostic delay in endometriosis is a multifactorial phenomenon arising from interactions among patient-related, physician-related, healthcare system-related, and societal factors [4,5,7]. A socio-ecological framework provides a useful model for understanding how barriers at multiple levels collectively contribute to prolonged diagnostic pathways [4].

Patient-Related Factors

Normalization of Menstrual Pain. One of the most consistently reported contributors to delayed diagnosis is the normalization of severe menstrual pain [2–5]. Many individuals perceive dysmenorrhea as an inevitable component of menstruation rather than a potential symptom of underlying pathology [2,4].

Family members, peers, and even healthcare professionals may reinforce the belief that severe pain is a normal aspect of the menstrual experience [2,4,5]. As a result, affected individuals frequently delay seeking medical advice despite experiencing symptoms that significantly impair daily functioning [2,4].

Menstrual Stigma and Social Barriers. Menstrual stigma remains a significant barrier to timely diagnosis [2,4,6]. Social norms surrounding menstruation often discourage open discussion of symptoms, particularly those involving pelvic pain, bowel dysfunction, urinary symptoms, or dyspareunia [2].

Qualitative studies have demonstrated that many individuals feel embarrassed discussing menstrual symptoms and may intentionally conceal the severity of their symptoms from family members, educators, employers, and healthcare professionals [2,4]. This reluctance contributes to delayed presentation and reduced opportunities for early intervention [2,4,6].

Limited Health Literacy. Insufficient awareness regarding endometriosis among the general population further contributes to delayed diagnosis [3,4]. Many individuals are unable to distinguish between physiological menstrual discomfort and symptoms suggestive of underlying disease [3].

Educational deficiencies regarding menstrual health are particularly evident among adolescents, who may lack the knowledge necessary to recognize symptoms requiring medical evaluation [3,4]. Consequently, symptom onset frequently precedes healthcare-seeking behavior by several years [3].

Physician-Related Factors

Limited Awareness and Knowledge Gaps. Knowledge gaps among healthcare professionals represent one of the most important contributors to clinical delay [5,7,14,19].

Endometriosis exhibits considerable heterogeneity in symptom presentation, making diagnosis challenging, particularly in primary care settings [19,22]. While some patients present with classic symptoms such as dysmenorrhea and infertility, others experience gastrointestinal, urinary, musculoskeletal, or non-cyclic pain symptoms that may obscure recognition of the disease [13,19,22].

Several studies have demonstrated that healthcare professionals frequently underestimate the prevalence and complexity of endometriosis, particularly among younger patients [5,14,15]. As a result, clinicians may fail to consider endometriosis early in the diagnostic process [5,14].

Symptom Misattribution and Misdiagnosis. Misattribution of symptoms to alternative diagnoses is a common cause of diagnostic delay [5,7,14]. Patients are frequently diagnosed with irritable bowel syndrome, inflammatory bowel disorders, urinary tract conditions, pelvic inflammatory disease, musculoskeletal disorders, or psychological conditions before endometriosis is considered [5,7,14,19].

The overlap between gastrointestinal, urological, and gynecological symptoms further complicates diagnosis and may lead to referrals across multiple specialties before appropriate gynecological assessment is obtained [4,14].

Symptom Dismissal. Many patients report feeling that their symptoms were minimized or dismissed during healthcare consultations [4,5,15].

Qualitative investigations have revealed that individuals often attend numerous consultations before their symptoms are taken seriously and specialist referral is initiated [5,15]. Persistent dismissal can contribute not only to delayed diagnosis but also to reduced trust in healthcare providers and worsening psychological distress [4,15].

A particularly concerning finding identified in qualitative research is the so-called "power of the witness" phenomenon, whereby patients reported that the presence of a partner or family member during consultations increased the likelihood that their symptoms would be regarded as credible [4,14]. This observation highlights the influence of gender-related biases that may continue to affect the assessment of chronic pain conditions [4].

Healthcare System-Related Factors

Healthcare system barriers frequently reinforce delays generated at patient and clinician levels [4,5,19].

One of the most important systemic contributors has been the historical reliance on laparoscopy as the diagnostic gold standard [18,19]. Although surgical confirmation provides high diagnostic certainty, concerns regarding procedural risks, costs, and invasiveness may discourage timely referral and investigation [1,18].

Additionally, routine pelvic ultrasonography may fail to identify superficial peritoneal disease, potentially generating false reassurance and delaying further evaluation [18,20]. Limited access to specialist imaging services and expert sonographers further compounds this challenge [11,16,20].

Short consultation times in primary care settings may also limit opportunities to obtain detailed menstrual, pain, and symptom histories [5]. Consequently, cyclical symptom patterns characteristic of endometriosis may remain unrecognized [5,19].

Fragmentation of care represents another significant barrier. Patients are frequently referred between multiple specialties, including gastroenterology, urology, pain medicine, and mental health services, before receiving specialist gynecological assessment [4,5,14]. This phenomenon has been described as a "diagnostic odyssey" and contributes substantially to prolonged diagnostic latency [4].

3.6. Clinical Consequences of Diagnostic Delay

The consequences of delayed diagnosis extend far beyond prolonged symptom duration and affect multiple dimensions of health and well-being [6,8,10,12].

Disease Progression and Anatomical Damage

Because endometriosis is a chronic and potentially progressive disease, prolonged diagnostic latency allows ongoing lesion growth and disease advancement [1,10,22,27].

Continued disease activity may result in the formation of extensive pelvic adhesions, fibrosis, ovarian endometriomas, and deep infiltrating endometriosis [1,22]. Deep infiltrating endometriosis represents the most severe disease phenotype and is associated with greater symptom burden, surgical complexity, and risk of organ dysfunction [10,22].

Central Sensitization and Chronic Pain

One of the most important consequences of delayed diagnosis is the transition from cyclical pain symptoms to chronic pain syndromes [10,12,22]. Prolonged exposure to recurrent inflammation, repeated tissue injury, and ongoing nociceptive stimulation may induce central sensitization, a process in which the central nervous system becomes increasingly responsive to pain signals [17,22].

Central sensitization involves neuroplastic changes within the spinal cord and brain that amplify pain perception and reduce pain thresholds [17,22]. As a result, patients may experience pain that persists independently of menstrual cycles and disease activity [17,22].

This phenomenon contributes to the development of chronic pelvic pain syndromes that are substantially more difficult to manage than cyclic dysmenorrhea alone [17,22].

Furthermore, central sensitization may lead to widespread pain manifestations extending beyond the pelvis. Patients frequently report bladder pain, bowel pain, lower back pain, fatigue, and generalized hypersensitivity to stimuli [10,22]. Once established, these nociplastic pain mechanisms may persist despite adequate treatment of endometriotic lesions, highlighting the importance of early diagnosis and intervention [8,17,22].

Reproductive Consequences

Delayed diagnosis can significantly affect reproductive health and fertility outcomes [6,22]. Endometriosis is estimated to affect approximately 30–50% of women experiencing infertility [22]. The mechanisms linking endometriosis and infertility are multifactorial and include chronic inflammation, distortion of pelvic anatomy, impaired tubal function, altered folliculogenesis, reduced oocyte quality, and impaired endometrial receptivity [22,26].

Prolonged disease progression before diagnosis may allow the development of extensive adhesions and advanced-stage disease, potentially reducing natural fertility and complicating future treatment [10,22]. Delayed intervention may also decrease the effectiveness of fertility-preserving therapeutic strategies [17].

Several studies have demonstrated that women diagnosed during fertility treatment frequently require multiple assisted reproductive technology (ART) cycles before achieving pregnancy [6]. Endometriosis has also been associated with lower cumulative pregnancy rates and increased treatment burden among women undergoing in vitro fertilization (IVF) [6,22].

In addition to infertility, endometriosis has been associated with adverse obstetric outcomes. Evidence suggests increased risks of miscarriage, ectopic pregnancy, placenta previa, preterm birth, and other pregnancy-related complications among affected individuals [22]. Early diagnosis and appropriate management may therefore have implications not only for fertility but also for long-term reproductive outcomes [22].

Psychological Impact and Quality of Life

The psychological burden associated with delayed diagnosis is substantial and frequently underestimated [2,6,13].

Patients often describe their diagnostic journey as characterized by frustration, uncertainty, invalidation, and repeated dismissal of symptoms by healthcare professionals [4,15]. The prolonged period between symptom onset and diagnosis may contribute to feelings of helplessness, isolation, and mistrust toward healthcare systems [4].

Chronic pain, uncertainty regarding future fertility, and disruption of daily activities contribute significantly to reduced quality of life [6]. Numerous studies have reported elevated rates of anxiety and depression among individuals with endometriosis compared with the general population [2,6].

Persistent symptoms may also affect interpersonal relationships, educational attainment, and occupational functioning [6,13]. Dyspareunia and chronic pain frequently impair intimate relationships, while repeated absences from school or work may limit educational and professional opportunities [6].

Pain catastrophizing, defined as an exaggerated negative response to actual or anticipated pain, has been identified as an important mediator of psychological distress and poorer health outcomes among patients with endometriosis [22]. Delayed diagnosis may reinforce these maladaptive coping mechanisms by prolonging exposure to unmanaged symptoms and uncertainty [12].

Socioeconomic Burden

The socioeconomic consequences of diagnostic delay extend beyond individual patients and impose a substantial burden on healthcare systems and society [6,14].

Before receiving a definitive diagnosis, many patients undergo repeated consultations, emergency department visits, specialist referrals, diagnostic procedures, and empirical treatments [5,14]. This prolonged diagnostic process results in considerable healthcare expenditures and inefficient utilization of healthcare resources [14].

The economic burden is further amplified by indirect costs associated with reduced productivity [6,14]. Chronic pain and fatigue frequently result in absenteeism, defined as time missed from work or education, and presenteeism, defined as reduced productivity while present at work [6].

A recent economic analysis estimated annual pre-diagnostic costs approaching US$16,970 per affected individual when direct medical expenses and productivity losses were combined [6]. These findings underscore the substantial financial implications of delayed diagnosis for both individuals and healthcare systems.

The cumulative socioeconomic burden of endometriosis has been compared with that of other major chronic diseases, including Crohn's disease and rheumatoid arthritis [6,14]. Consequently, reducing diagnostic delay has the potential to generate significant clinical, psychological, and economic benefits [6].

4. Discussion

The findings of this review demonstrate that diagnostic delay remains one of the most significant unresolved challenges in the management of endometriosis. Despite substantial advances in understanding disease pathophysiology, imaging technology, and clinical management, the interval between symptom onset and definitive diagnosis continues to range from approximately 4 to 12 years in most healthcare settings [5–9].

The persistence of such prolonged delays suggests that diagnostic latency cannot be attributed to a single failure within the healthcare pathway. Rather, it reflects the cumulative impact of barriers operating at patient, clinician, healthcare system, and societal levels [4,5]. The socio-ecological framework provides a useful perspective for understanding how these interacting factors collectively contribute to delayed diagnosis [4].

One of the most consistent findings across the literature is the normalization of menstrual pain [2–5]. Severe dysmenorrhea is frequently regarded by patients, family members, educators, and healthcare professionals as a normal component of menstruation rather than a potential

manifestation of disease [2,4]. This normalization delays healthcare-seeking behavior and may also influence clinical decision-making when patients do present for assessment [4,5].

Clinician-related factors represent another major contributor to diagnostic latency. The heterogeneous presentation of endometriosis continues to challenge diagnostic recognition, particularly in primary care settings where consultation times are limited and competing diagnoses are frequently considered [5,14,19]. Symptoms are often attributed to gastrointestinal, urinary, musculoskeletal, or psychological conditions before endometriosis is suspected [5,7,14].

A particularly important observation emerging from qualitative studies is the phenomenon described as the "power of the witness," whereby patients report that the presence of a partner or family member increases the likelihood that their symptoms will be taken seriously [4,14]. This finding raises concerns regarding potential gender biases in the assessment of chronic pain and highlights the need for improved clinician awareness regarding the lived experiences of individuals with endometriosis [4].

The review also highlights the substantial consequences of diagnostic delay. Prolonged disease progression may facilitate the development of deep infiltrating endometriosis, pelvic adhesions, fibrosis, and chronic pain syndromes mediated by central sensitization [10,12,22]. Once nociplastic pain mechanisms become established, symptom control becomes increasingly challenging even when disease-specific treatment is subsequently initiated [10,12].

Reproductive consequences are similarly important. Delayed diagnosis may reduce opportunities for early intervention and fertility preservation while increasing the likelihood of advanced-stage disease [6,22]. Given that infertility frequently serves as a trigger for specialist referral, the findings suggest that reproductive concerns may receive greater clinical attention than pain-related symptoms, potentially contributing to inequities in diagnostic pathways [7].

The psychological and socioeconomic consequences identified in this review further emphasize the importance of earlier diagnosis. Chronic pain, repeated healthcare encounters, uncertainty regarding fertility, and perceived dismissal by healthcare professionals contribute

to substantial reductions in quality of life and increased rates of anxiety and depression [2,6,13]. At the societal level, diagnostic delay generates significant healthcare costs and productivity losses, highlighting its relevance as both a clinical and public health issue [6,14].

4.1. Transition from Surgical to Clinical Diagnosis

One of the most important developments in contemporary endometriosis care is the transition from a predominantly surgical diagnostic paradigm toward a clinical diagnosis model [1,16,18,19]. Historically, laparoscopic visualization with histopathological confirmation was regarded as the diagnostic gold standard, resulting in prolonged periods of observation before definitive investigation was undertaken [18]. While laparoscopy remains valuable in selected cases, increasing evidence suggests that excessive reliance on surgical confirmation may contribute to unnecessary diagnostic delay and postponement of treatment initiation [1,18].

Current evidence supports a diagnostic approach based on a combination of symptom assessment, physical examination, and advanced imaging techniques [16,19,20]. This paradigm allows clinicians to initiate treatment based on a high degree of diagnostic certainty without requiring immediate surgical confirmation in every patient [16,18]. Earlier implementation of empirical therapy may reduce disease progression, alleviate symptoms, and improve quality of life while avoiding the risks associated with unnecessary surgery [17].

The findings of this review therefore support the growing consensus that endometriosis should increasingly be regarded as a clinically diagnosable condition rather than a disease that necessarily requires surgical confirmation before treatment can begin [16,18,19].

4.2. Role of Advanced Imaging

Recent advances in imaging have significantly improved the non-invasive diagnosis of endometriosis and represent one of the most promising strategies for reducing diagnostic delay [11,16,20].

Expert-performed transvaginal ultrasonography (eTVUS) has demonstrated high diagnostic accuracy for ovarian endometriomas and deep infiltrating endometriosis [11,20]. The implementation of standardized assessment protocols, including the International Deep

Endometriosis Analysis (IDEA) consensus recommendations, has further improved diagnostic performance and reproducibility [11].

The IDEA approach incorporates systematic evaluation of pelvic anatomy and dynamic sonographic maneuvers, including assessment of organ mobility and the uterine sliding sign, enabling detection of adhesions and obliteration of the pouch of Douglas [11,16]. Such techniques have substantially enhanced the ability of ultrasound to identify advanced disease before surgery [11].

Magnetic resonance imaging also plays an important role in the assessment of deep infiltrating lesions and complex anatomical involvement [16,20]. MRI provides detailed preoperative mapping and may facilitate surgical planning in patients with extensive disease [16]. Together, advanced ultrasound and MRI have reduced reliance on diagnostic laparoscopy and facilitated earlier recognition of clinically significant endometriosis [16,20].

Despite these advances, access to specialist imaging remains limited in many healthcare systems [19]. Diagnostic accuracy remains highly dependent on operator expertise, highlighting the need for broader implementation of standardized training programs [11,16].

4.3. Emerging Biomarkers

The development of reliable non-invasive biomarkers represents a major research priority in endometriosis diagnostics [15,21,23]. An ideal biomarker could facilitate earlier diagnosis, improve risk stratification, and reduce dependence on invasive procedures [15].

Among the most promising candidates are circulating microRNAs (miRNAs), which regulate gene expression and appear to be differentially expressed in patients with endometriosis [21]. Several studies have identified specific miRNA signatures, including miR-125b-5p, miR-150-5p, miR-342-3p, and miR-451a, that may distinguish individuals with endometriosis from healthy controls with high diagnostic accuracy [21].

Additional biomarker candidates include Brain-Derived Neurotrophic Factor (BDNF), inflammatory mediators, and serum Galectin-1 [15,23]. A recent prospective longitudinal study demonstrated promising diagnostic performance for serum Galectin-1, suggesting a potential future role in non-invasive diagnostic algorithms [23].

Emerging research has also explored menstrual blood-based diagnostics. Lipidomic analysis of menstrual blood has identified several candidate biomarkers, including cardiolipin species that may differentiate patients with endometriosis from unaffected individuals [24]. Such approaches offer the possibility of inexpensive, decentralized screening strategies suitable for primary care settings [24].

Although these findings are encouraging, most biomarker candidates remain investigational and require external validation in larger, ethnically diverse populations before widespread clinical implementation can be recommended [15,21,23].

4.4. Artificial Intelligence and Future Diagnostic Technologies

Artificial intelligence (AI) is increasingly being explored as a tool to improve diagnostic accuracy and reduce variability in imaging interpretation [16].

Machine learning and deep learning algorithms have demonstrated promising performance in detecting imaging features associated with endometriosis, including deep infiltrating lesions, adhesions, and obliteration of the pouch of Douglas [16]. Automated image analysis may enhance diagnostic consistency and reduce dependence on highly specialized operators [16].

AI-assisted diagnostic systems may be particularly valuable in regions where access to expert sonographers and specialist gynecologists is limited [16]. By improving the sensitivity and standardization of imaging interpretation, such technologies could facilitate earlier referral and treatment [16].

Beyond imaging, AI-based approaches may eventually integrate clinical symptoms, laboratory biomarkers, imaging findings, and patient-reported outcomes into comprehensive diagnostic prediction models [16]. Such multimodal systems have the potential to transform endometriosis diagnosis from a reactive process into a proactive screening strategy [16].

4.5. Limitations of the Current Evidence

Several limitations of the current evidence base should be acknowledged. First, substantial heterogeneity exists among studies regarding definitions of diagnostic delay, diagnostic criteria, study populations, and healthcare settings [5,7]. This variability complicates direct comparisons across studies and limits the ability to generate pooled estimates [7].

Second, many studies rely on retrospective data collection and patient recall of symptom onset, introducing the possibility of recall bias [3,5,7]. Because symptoms often begin years before diagnosis, accurate recollection of timelines may be challenging [5].

Third, the majority of available evidence originates from high-income countries, particularly Europe, North America, and Australia [4,6]. Consequently, current knowledge may not adequately reflect diagnostic pathways in low- and middle-income settings where healthcare access, cultural perceptions, and resource availability differ substantially [4].

Fourth, some investigations rely on self-reported diagnoses or patient-reported outcomes, increasing the risk of selection bias and diagnostic misclassification [5]. Additionally, publication bias may favor studies reporting particularly long or clinically significant delays [5].

Finally, many emerging diagnostic technologies remain at an early stage of development. While advances in imaging, biomarkers, and artificial intelligence appear promising, further validation studies are required before these approaches can be routinely incorporated into clinical practice [11,15,16,21].

4.6. Implications for Clinical Practice and Public Health

The findings of this review highlight the need for a comprehensive, multidisciplinary approach to reducing diagnostic delay. Educational interventions targeting both the public and healthcare professionals are essential to improve recognition of pathological menstrual symptoms and reduce normalization of pain [2–5].

Within primary care, greater emphasis should be placed on obtaining detailed menstrual histories and recognizing cyclical symptom patterns suggestive of endometriosis [5,19]. Earlier referral pathways and wider access to specialist imaging services may further reduce delays and facilitate timely intervention [11,16,20].

At a policy level, endometriosis should be recognized as a significant public health issue requiring coordinated strategies encompassing education, clinical training, healthcare resource allocation, and research investment [4,25]. Earlier diagnosis has the potential not only to improve patient outcomes but also to reduce the substantial economic burden associated with prolonged disease progression [6,14].

4.7. Future Directions

The future of endometriosis diagnosis lies in the continued development of non-invasive, accessible, and accurate diagnostic strategies capable of identifying disease at earlier stages [15,16,21]. A central goal of future research should be the establishment of reliable clinical diagnostic pathways that allow prompt treatment initiation without mandatory surgical confirmation [16,18].

Advances in biomarker research are likely to play a pivotal role in this transition. Continued investigation of circulating microRNAs, Galectin-1, BDNF, inflammatory mediators, and menstrual blood lipidomics may facilitate the development of clinically useful diagnostic panels [21,23,24]. Future studies should prioritize large-scale validation across diverse populations and healthcare settings [15].

Further refinement of imaging technologies is also expected to improve diagnostic accuracy. Wider implementation of the IDEA consensus protocol and standardized training programs may reduce operator-dependent variability and improve detection of deep infiltrating disease [11,16]. Integration of AI-assisted image analysis may further enhance diagnostic performance and accessibility [16].

Public health initiatives should focus on improving menstrual health literacy and reducing stigma surrounding menstrual symptoms. Educational programs targeting adolescents may be particularly effective in promoting earlier symptom recognition and healthcare-seeking behavior [2–4]. Similarly, continuing professional education programs are needed to improve awareness among primary care providers and reduce diagnostic bias [5,15].

Future research should also address global disparities in diagnosis by investigating diagnostic pathways in low- and middle-income countries and among underserved populations [4,25]. Improved understanding of socioeconomic, cultural, and healthcare system factors

influencing diagnostic delay will be essential for developing equitable diagnostic strategies worldwide [4].

5. Summary and Conclusions

Endometriosis is a chronic, estrogen-dependent inflammatory disease that affects approximately 10% of women and individuals assigned female at birth during their reproductive years and remains one of the leading causes of chronic pelvic pain and infertility worldwide [1,22,26,27]. Despite substantial advances in understanding its pathophysiology and clinical manifestations, diagnostic delay continues to represent a major global healthcare challenge [3–10].

This review demonstrates that the interval between symptom onset and definitive diagnosis consistently ranges from approximately 4 to 12 years across diverse healthcare settings [3,5–10]. Although modest improvements have been reported in some countries, diagnostic latency remains largely unchanged over recent decades, indicating persistent deficiencies in current diagnostic pathways [5,9].

The findings confirm that diagnostic delay is a multifactorial phenomenon arising from the interaction of patient-related, clinician-related, healthcare system-related, and societal factors [4,5]. At the patient level, normalization of severe menstrual pain, inadequate menstrual health literacy, and stigma surrounding menstruation contribute to delayed healthcare-seeking behavior [2–6]. At the clinician level, insufficient awareness of the heterogeneous presentation of endometriosis, symptom misattribution, and dismissal of patient concerns frequently delay specialist referral and diagnostic investigation [5,7,14,15,19]. Healthcare system barriers, including historical reliance on laparoscopic confirmation, limited access to specialist imaging, fragmented care pathways, and prolonged waiting times, further contribute to diagnostic latency [1,5,16,18–20].

The consequences of delayed diagnosis are substantial and extend beyond symptom persistence [6,10,12]. Prolonged diagnostic latency permits disease progression, resulting in the development of deep infiltrating endometriosis, extensive adhesions, fibrosis, and chronic pelvic pain syndromes [1,10,22]. Furthermore, repeated exposure to inflammatory and nociceptive stimuli may induce central sensitization, transforming cyclical pain into chronic

nociplastic pain that is significantly more difficult to manage [10,12]. Delayed diagnosis is also associated with impaired fertility, adverse reproductive outcomes, reduced quality of life, increased rates of anxiety and depression, and substantial socioeconomic costs arising from healthcare utilization and productivity losses [2,6,12–14,22].

The evidence reviewed supports a paradigm shift from a purely surgical diagnostic model toward a clinical diagnosis framework based on symptom recognition, physical examination, and advanced imaging techniques [16,18,19]. Expert-performed transvaginal ultrasonography and magnetic resonance imaging have demonstrated high diagnostic accuracy for ovarian endometriomas and deep infiltrating lesions, reducing reliance on invasive diagnostic procedures [11,16,20]. In parallel, emerging diagnostic technologies, including circulating microRNA panels, serum Galectin-1, menstrual blood lipidomics, and artificial intelligence-assisted imaging analysis, offer promising opportunities for earlier and less invasive detection [15,16,21,23,24].

Nevertheless, important knowledge gaps remain [4,25]. Much of the available evidence originates from high-income countries, limiting the generalizability of findings to low- and middle-income settings [4,6]. Future research should prioritize validation of non-invasive diagnostic tools, assessment of diagnostic pathways across diverse populations, and development of equitable healthcare strategies aimed at reducing disparities in access to care [4,15,16].

In conclusion, diagnostic delay in endometriosis remains an important and largely unresolved public health problem with significant clinical, psychological, reproductive, and economic consequences [5–10]. Earlier recognition of symptoms, improved clinician education, wider implementation of advanced imaging, development of reliable non-invasive biomarkers, and integration of innovative technologies such as artificial intelligence may collectively reduce diagnostic latency and improve patient outcomes [11,15,16,21]. Achieving these goals will require coordinated efforts involving clinicians, researchers, policymakers, educators, and patient advocacy organizations to ensure timely diagnosis and optimal care for individuals affected by endometriosis [2,4,5,25].

Declarations

Disclosure

Author Contributions: Conceptualization: Weronika Wrzosek [WW], Natalia Fidut [NF], Weronika Zarzycka [WZ] Methodology: Weronika Wrzosek [WW], Kamila Zioło [KZ], Mateusz Zugaj [MZ] Software: not applicable Check: Maciej Kisielewski [MK], Martyna Grzywacz [MG], Jakub Skrzypek [JS] Formal analysis: Weronika Wrzosek [WW], Bartosz Okliński [BO], Mateusz Zugaj [MZ] Investigation: Weronika Wrzosek [WW], Natalia Fidut [NF], Karol Szyprowski [KS] Resources: Maciej Kisielewski [MK], Weronika Zarzycka [WZ], Kamila Zioło [KZ] Data curation: Martyna Grzywacz [MG], Mateusz Zugaj [MZ], Jakub Skrzypek [JS] Writing - rough preparation: Weronika Wrzosek [WW], Bartosz Okliński [BO], Kamila Zioło [KZ] Writing - review and editing: Jakub Skrzypek [JS], Weronika Zarzycka [WZ], Martyna Grzywacz [MG] Visualization: not applicable Supervision: Weronika Wrzosek [WW] Project administration: Natalia Fidut [NF], Maciej Kisielewski [MK] Receiving funding: not applicable

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