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Early detection of cervical cancer: analysis comparing HPV DNA testing and Pap smear testing in women in the screening age range.

Early detection of cervical cancer: analysis between HPV-DNA testing and Pap smear in women at screening age.

Early detection of uterine cancer: comparative analysis between the HPV DNA test and cytology in women at the age of childhood.

Rebecca Gomes Magalhães da Silva1
Rafaela Miriam Cardoso2
Maria Antônia Pulu Campos da Cruz3
Maria Clara dos Santos Rodrigues4
Ligia Canongia by Abreu Cardoso Duarte5

1- Student of Biomedicine at the Higher Education Institute of Brasília – IESB.
2- Professor with a PhD in Biomedicine from the Higher Education Institute of Brasília - IESB.

SUMMARY

Introduction: Cervical cancer is one of the neoplasms with the greatest impact on women's health, which makes Periodic screening is the main strategy for reducing mortality. This study aimed to analyze the relevance of HPV-DNA and Papanicolaou tests in the early identification of the disease in women in the screening age range, highlighting their importance for diagnosis.
Methodology: This is an integrative literature review conducted between August 2025 and June 2026 in the SciELO, PubMed, and Google Scholar databases. After applying the inclusion and exclusion criteria, 10 articles were selected for analysis. Results: The evidence demonstrates that the HPV-DNA test has superior sensitivity compared to the Papanicolaou test.
It was observed that molecular biology allows for the identification of infection before the occurrence of visible cellular changes, enabling cytology to act in a complementary and strategic way in screening positive cases. The biomedical professional was identified as a key player in the operation of these technologies and in ensuring diagnostic reliability. Furthermore, self-collection emerged as a tool to expand screening coverage within the Brazilian Unified Health System (SUS). Conclusion: The transition to molecular screening, integrated with the leading role of the biomedical professional, is confirmed as the most effective strategy for early identification, ensuring greater safety and equity in the control of cervical cancer in Brazil.

Descriptors: Uterine Cervical Neoplasm, Human Papillomavirus DNA test, Papanicolaou Test, Cervical Cancer, and Early Detection of Cancer.

1 INTRODUCTION

Cervical cancer, also called cancer of the cervix, is one of the most common types of cancer. Common among women worldwide. A large proportion of deaths related to this disease occur in developing countries, which highlights the influence of geographical factors on its evolution. This variation is related to both the prevalence of infection with Human Papillomavirus (HPV), the main cause of cervical cancer, in terms of access to and quality of prevention services and available diagnostics (Taneja et al., 2021).

HPV is one of the most common and easily transmitted sexually transmitted infections. transmission. It is a DNA virus belonging to the *Papillomaviridae family,* which has

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It has an affinity for epithelial tissues and can cause various alterations in the skin and mucous membranes. In large
In some cases, the infection is asymptomatic and tends to disappear spontaneously; however,
When it persists, it can cause cellular changes that evolve into precursor lesions, which, in
Without adequate intervention, they can progress to cervical cancer (de Carvalho et al., 2021).

In this context, periodic screening plays a key role in prevention and
in the early diagnosis of cervical cancer. Among the main methods used, the following stand out:
if the Papanicolaou test, also known as cervical cytology, is widely used
to identify cellular changes that may indicate precancerous lesions. Because it is a
a low-cost, simple-to-perform test that is widely available in health services, the
The Pap smear has become one of the main prevention strategies, enabling detection.
early detection of changes in the cervical epithelium, contributing significantly to the reduction of
morbidity and mortality associated with cervical cancer (Ortega et al., 2023).

In addition to the Pap smear, the HPV DNA test has stood out as a
An important tool in cervical cancer screening. This test is performed using...
The test examines cells from the cervix and aims to detect the presence of HPV types associated with...
cervical cancer, allowing for the direct identification of the virus's genetic material. In this way,
It allows for the detection of infection even before visible cellular changes occur.
(Okunade, 2020). Studies indicate that the test has high sensitivity in identifying
persistent infections with oncogenic types of HPV, contributing to early diagnosis and the
improving disease screening strategies (Rodrigues et al., 2024).

Given this scenario, the study aims to analyze the relevance of DNA testing.
HPV and Pap smear in the early identification of cervical cancer in women in the age range of
screening, highlighting its importance for diagnosing the disease.

2 METHODOLOGY

This study consisted of an integrative literature review. The survey
A bibliographic review was conducted between August 2025 and June 2026, using a structured search.
in the SciELO, PubMed, and Google Scholar databases, without language restrictions, considering
articles published in the last six years. The following descriptors were used, obtained from
Descriptors in Health Sciences (DeCS): *“Uterine Cervical Neoplasm”, “Human*
PapillomaVirus DNA test”, “Papanicolaou Test”, “Cervical Cancer” and “Early Detection of
The terms “Cancer” were combined using the connectors “AND” and “OR”. For the article search, the following was adopted:
The following strategy, structured in the databases: “Uterine Cervical Neoplasm” OR “Cervical

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Cancer” AND “Human Papillomavirus DNA Test” OR “HPV DNA Test” AND “Papanicolaou Test” AND “Early Detection of Cancer”.

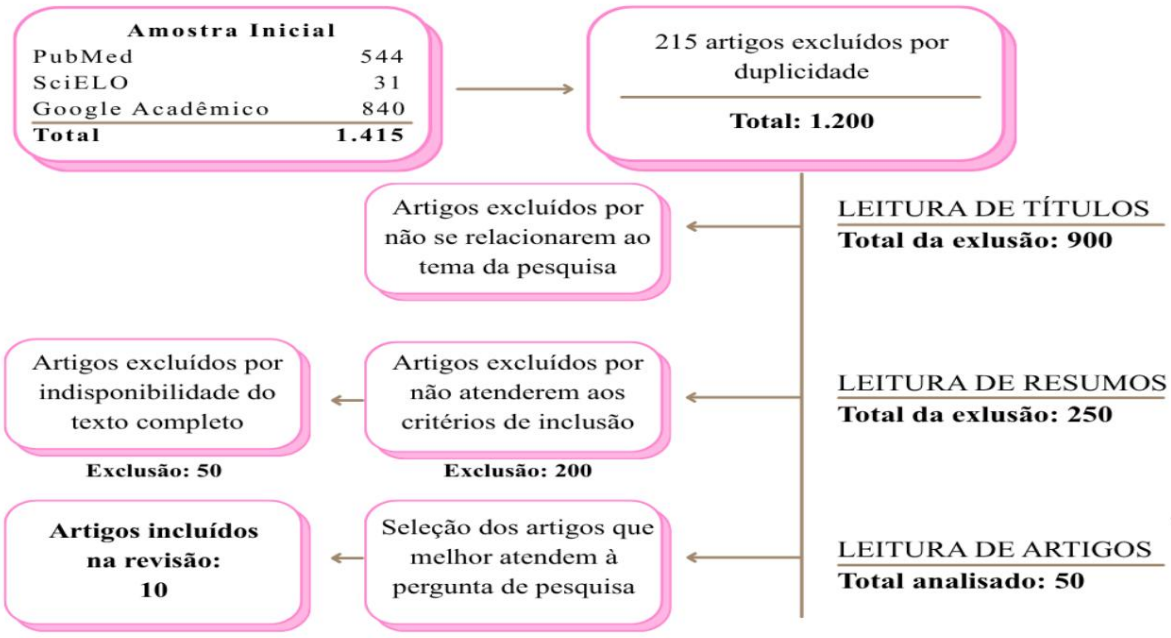
Studies related to cervical cancer in women were considered for inclusion. age range for screening; studies that addressed HPV-DNA testing and/or examination of Papanicolaou test; and studies on the early detection of cervical cancer.

Studies conducted solely on animal models were not considered; studies that that addressed other diseases or infections, such as HIV; duplicate studies in the databases; and Works without the full text available.

3 RESULTS

Based on a structured search conducted in the PubMed, SciELO, and Google databases. Academically, 1,415 studies were identified. Of these, 215 articles were excluded due to duplication. That leaves 1,200 studies for analysis. After reading the titles, 900 articles were excluded because they did not meet the criteria. related to the proposed theme. In the abstract reading stage, 250 studies were excluded because did not meet the inclusion criteria or the full text was unavailable, totaling 50. Articles for full reading. After complete reading, 10 articles were selected as the best. They answered the research question, forming the final corpus of the analysis (Figure 1).

Figure 1. Flowchart for article selection, 2026.



Source: Author's own work, 2026.

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Among the 10 articles selected for this review, the scientific evidence was examined. Regarding the early detection of cervical cancer, a survey was conducted on employment. of the HPV DNA test and the Papanicolaou cytopathological examination in women in the age range of tracking. The main points investigated involved the diagnostic effectiveness of the tests. molecular factors, the technical limitations and subjectivity of conventional cytology, as well as the Overview of the technological transition in the Brazilian healthcare system. The main characteristics of Selected studies, as well as their objectives and outcomes, are presented in Table 1.

Table 1. Characteristics of the selected scientific articles, according to title, authors, year of publication, objective and results, 2026.

Title	Authors	Year	Objective	Results
The detection of specific types of HPV in screening and management of cervical cancer.	Rodrigues et al.	2024	Analyze the importance of identifying specific HPV genotypes in screening and clinical management.	HPV DNA genotyping allows for the identification of infections with high-risk oncogenic types, providing more precise and safer clinical management for patients.
The role of biomedical professionals in cervical cancer screening.	Ortega et al.	2023	Describe the role of the biomedical professional in cervical cancer screening and the importance of cytological and molecular diagnoses.	The biomedical professional's technical expertise is crucial for the quality of screening; molecular biology complements cytology, reducing diagnostic error margins.
Cervical cancer	Tewari, Krishnansu S.	2025	Review the epidemiology, primary and secondary prevention methods, and current clinical management of cervical cancer.	The effectiveness of vaccination, combined with molecular screening, demonstrates that strategies based on HPV detection are cornerstones for the elimination of the disease.
Cervical cancer screening with DNA-HPV testing and precancerous lesions detection: a Brazilian population-based demonstration study	Teixeira et al.	2023	Evaluating the performance of the HPV-DNA test in cervical cancer screening in the Brazilian population.	The HPV-DNA test shows significantly higher sensitivity in detecting precursor lesions, which validates... Its effectiveness as a tracking strategy in the national context.
Cervical Cancer Screening with HPV testing:	Carvalho et al.	2022	Reassessing the Brazilian recommendations on the use of tests HPV-DNA no	HPV-based screening is more effective, recommending longer intervals between tests (5

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Updates on the recommendation			Cervical cancer screening based on recent evidence.	years) and highlighting the need for clear protocols to reduce overtreatment.
Cervical cancer screening: a review	Perkins et al.	2023	Review the evidence Current information on screening strategies, including new primary testing protocols for HPV.	The transition to HPV-based methods highlights that primary testing and co-testing offer greater protection against cervical cancer than cytology alone.
Human Papillomavirus and cervical Cancer	Okunade, Kehide Sharafadeen.	2020	Analyze the epidemiology of HPV and screening strategies.	The HPV DNA test has significantly higher sensitivity than cytology in detecting high-grade lesions.
Past, present and future of cancer screening Cervical cancer in Brazil: lessons learned?	Migowski, Arn.	2025	Evaluate the technological and organizational transition of cervical cancer screening in Brazil, focusing on the new CONITEC guidelines.	The incorporation of HPV DNA testing should be accompanied by a shift towards organized screening, aiming to reduce regional inequalities and achieve the WHO's goal of eliminating the disease.
Cervical cancer screening in Brazil: Challenges in cytology and the transition to DNA testing. HPV	Guimarães et al.	2025	Analyze the performance of Brazilian screening, considering the limitations of cytology and the implementation of the HPV-DNA test as the primary method.	The low sensitivity of cytology suggests that the introduction of molecular testing into the Brazilian public health system (SUS) will increase early detection, allowing for 5-year intervals and expanding access in vulnerable regions.
Cervical cancer screening by HPV-DNA	Lima et al.	2023	To elucidate current strategies for the prevention of cervical cancer, focusing on the use of HPV DNA testing for screening and risk stratification.	The HPV DNA test has greater sensitivity compared to cytology, with a tendency towards... use as a primary screening tool and its impact on detection early.

Source: Author's own work, 2026.

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4. DISCUSSION

Diagnostic efficacy: The HPV DNA test versus cytopathological examination.

The results summarized in Table 1 demonstrate a paradigm shift in Cervical cancer screening, highlighting the transition from conventional cytology to digital platforms. molecular. Authors such as Okunade (2020) and Perkins et al. (2023) agree that the test The HPV-DNA test shows superior sensitivity in detecting precursor lesions compared to... with cytopathological examination. Both studies emphasize the importance of age in screening, suggesting that, although cytology is still widely used from the age of 21, the test of HPV-DNA infection is gaining prominence in women between 25 and 30 years old due to the increased risk of... Viral persistence and cancer development in this age group.

In this sense, the data presented by Tewari (2025) corroborate the technical superiority. from molecular biology. While the sensitivity of the Papanicolaou test for detecting dysplasias The rate of severe cases is around 55.4%, while the HPV DNA test reaches 94.1%. This numerical disparity is crucial for answering the research question, as it demonstrates that the use of the molecular method This significantly reduces diagnostic errors and, consequently, mortality, as observed. in population studies cited by the author. In contrast, the discussion about the periodicity of screening is further explored by Carvalho et al. (2022), who emphasize the high diagnostic reliability of HPV allows for longer intervals between exams without compromising a woman's health.

The transition to HPV screening in the Brazilian context.

When analyzing the applicability of these technologies in the national context, Teixeira's studies et al. (2023) and de Guimarães et al. (2025) offer a detailed view of the technological transition in course in Brazil. Teixeira et al. (2023) highlight that the replacement of an opportunistic screening based In cytology, an organized program with HPV DNA testing resulted in a significant increase. in the detection of precursor lesions in the short term. A relevant finding observed by the author is that Women under 30 years of age showed higher rates of positivity and referral. for colposcopy, highlighting the high sensitivity of the molecular method in identifying Early detection of changes that might go unnoticed using conventional methods.

Complementing this analysis, Guimarães et al. (2025) contextualize that, although the Although the Papanicolaou test was the cornerstone of Brazilian screening for decades, the limitations arising from Variability in professional interpretation and insufficient coverage in remote regions.

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The new guidelines from the Ministry of Health were driven by this. The introduction of the molecular test produced Nationally, the Fiocruz project, initiated in 2025 with expansion planned for 2026, represents a milestone. for Brazilian public health. According to the author, this strategy not only increases diagnostic sensitivity but also promotes equity in the Unified Health System (SUS), allowing that women from different socioeconomic backgrounds have access to a more accurate examination and to The convenience of an extended screening interval of 5 years.

The role of the biomedical scientist in ensuring analytical and molecular quality.

Given the technical complexity involved in transitioning to molecular methods, the figure The role of the biomedical professional emerges as a fundamental element for the reliability of the screening. According to As Ortega et al. (2023) point out, the competence of this professional is not limited to the execution of tests, but it also encompasses the critical interpretation of the results, which is essential for guiding clinical practice. and monitoring HPV infection. This specialized knowledge, resulting from training in In clinical pathology and molecular techniques, this ensures the diagnostic precision necessary for to reduce the false negative rates previously mentioned by Tewari (2025).

Specialization in Oncotic Cytology allows Biomedical professionals to work on the front lines of... prevention programs, using their analytical vision to integrate cytological diagnosis into molecular diagnosis. According to Ortega et al. (2023), this professional plays a role strategic when operating highly complex equipment and conducting molecular biology tests, pillars of the new SUS tracking strategy, detailed by Guimarães et al. (2025). In this way, the Biomedical professional's role mitigates "professional weaknesses" and "variability in..." "interpretation" mentioned by Guimarães as limitations of the traditional model.

Future perspectives and challenges for the control of cervical cancer.

Analysis of the methods shows that the HPV DNA test is the most effective tool. for early diagnosis, which answers the question of this research positively. However, the Literature warns that technological change, in isolation, is not a "magic solution." Migowski (2025) warns that, despite technical superiority, the success of screening in Brazil depends on a An organized program that avoids unnecessary co-testing and focuses on the transition. for a five-year periodicity.

In this context, the limitations observed by Rodrigues et al. (2024) regarding the lower HPV-DNA specificity – which can generate positive results even in women without lesions.

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Neoplastic conditions require conventional cytology to assume a new strategic role. As suggested
According to Migowski (2025), cytopathological examination ceases to be the primary screening tool and becomes a
A fundamental screening tool after a positive HPV DNA test. Finally, convergence
Among the authors Lima et al. (2023) and Guimarães et al. (2025) indicates that the future of cancer control
In Brazil, cervical cancer prevention relies on a combined approach: primary prevention through vaccination and...
Secondary prevention through standardized molecular screening, ensuring technical rigor and
patient safety.

Strategies for consolidating molecular tracking in Brazil

Analysis of the data and experiences discussed reveals that the effectiveness of screening does not depend not only technological superiority, but also a strategic restructuring that integrates
Molecular biology applied to the reality of the Brazilian Unified Health System (SUS). In this sense, the transition to biochemical methods
standardized methods, as advocated by Lima et al. (2023), allow us to overcome the subjectivity of cytology and
to enable innovative proposals, such as encouraging self-collection. This strategy, based on
Migowski (2025) as a turning point for expanding coverage in hard-to-reach regions,
Like the North and Northeast regions, it directly addresses the need to reduce geographical barriers.
and cultural factors that have historically limited the reach of the Pap smear.

However, for this innovation to be sustainable, the Biomedical professional, as a specialist in
In terms of diagnosis, the role involves not only working in the lab but also managing these programs, providing assistance.
in the proper screening of positive patients. This strategic action, as reinforced by Ortega et al.
al. (2023), is fundamental to guiding clinical conduct and preventing the system from being overloaded.
due to unnecessary procedures resulting from the high sensitivity of the HPV DNA Test. Therefore,
The convergence between molecular technology and the supervision of qualified professionals outlines the
The most promising path for controlling cervical cancer in Brazil to cease being a challenge...
public health and become a real achievement for the survival of Brazilian women.

FINAL CONSIDERATIONS

This study has shown that the transition to molecular platforms in
Cervical cancer screening represents an indispensable strategic advancement for healthcare.
public. When analyzing the relevance of HPV DNA and Pap smear tests, it became evident that
Both play a fundamental, though distinct, role in the early identification of the disease.
Molecular testing overcomes the limitations of conventional cytology, offering a more accurate diagnosis.

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Safer and more sensitive in detecting precursor lesions.

Thus, the initial hypothesis was confirmed: molecular biology is the most effective tool.
for primary screening, allowing the Pap smear to act in a complementary way in
screening of positive cases. This new dynamic optimizes the resources of the SUS (Brazilian Public Health System) and increases the safety of...
patients, enabling longer and more reliable screening intervals, as well as reducing
Inequalities in access can be addressed through strategies such as self-collection.

In the professional sphere, the study reinforces the leading role of the Biomedical professional in management and in...
Performing precision diagnostics. The analysis carried out demonstrates the importance of this.
Professionalism lies in the ability to integrate the rigor of cytology with the precision of molecular biology.
ensuring the reliability necessary for the control of cervical cancer. The research validates the
The relevance of scientific innovation as a means of ensuring equity and protecting women's health.

Finally, although the results are promising, future research is suggested that...
monitor the practical implementation of these technologies on a large scale in the Brazilian context. (Conclusion)
I understand that, by prioritizing highly sensitive methods for early identification, the country is moving towards a
A reality in which cervical cancer can be effectively controlled, consolidating progress.
of laboratory diagnosis in Brazil.

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