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Analysis of the Prevalence of Cervical Cancer in Brazil and the Impact of HPV Vaccination (2014-2024)

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Summary

Introduction: Cervical cancer represents a significant public health problem in Brazil, being the third most common type of cancer among women. The main primary prevention strategy is vaccination against Human Papillomavirus (HPV), implemented in the National Immunization Program (PNI) in 2014. Objective: To analyze the prevalence and mortality from cervical cancer in Brazil over the last 10 years (2014-2024) and to evaluate the epidemiological impact of HPV vaccination. Methods: A statistical analysis was performed using data from DATASUS and the National Cancer Institute (INCA), in addition to a literature review on HPV vaccination. Results: The results indicate a downward trend in mortality from 2017 onwards, three years after the start of vaccination. However, the correlation analysis did not demonstrate statistical significance between vaccination coverage and the reduction in mortality, possibly due to the complexity of the factors involved and the latency period of the disease. HPV vaccination coverage in Brazil is still below the 80% target recommended by the World Health Organization (WHO), with significant regional heterogeneity. Conclusions: It is concluded that, although there is a positive trend in reducing mortality, continuous efforts are needed to increase vaccination coverage and strengthen screening strategies so that Brazil can achieve the goals of eliminating cervical cancer. This article explores the introduction, methods, objectives, results, conclusion, and references of this detailed analysis.

Keywords: Cervical Cancer, HPV, Vaccination, Epidemiology

Abstract

Introduction: Cervical cancer represents a significant public health problem in Brazil, being the third most common type of cancer among women. The main primary prevention strategy is vaccination against Human Papillomavirus (HPV), implemented in the National Immunization Program (PNI) in 2014. Objective: To analyze the prevalence and mortality of cervical cancer in Brazil over the last 10 years (2014–2024) and to assess the epidemiological impact of HPV vaccination. Methods: A statistical analysis was performed using data from DATASUS and the National Cancer Institute (INCA), in addition to a literature review on HPV vaccination. Results: The findings indicate a downward trend in mortality starting in 2017, three years after the introduction of vaccination. However, the correlation analysis did not demonstrate statistical significance between vaccination coverage and mortality reduction, possibly due to the complexity of the factors involved and the disease's latency period. HPV vaccination coverage in Brazil remains below the 80% target recommended by the World Health Organization (WHO), with considerable regional heterogeneity. Conclusions: It is concluded that, although there is a positive trend in reducing mortality, continued efforts are needed to increase vaccination coverage and strengthen screening strategies so that Brazil can achieve the goals of eliminating cervical cancer. This article explores the introduction, methods, objectives, results, conclusion, and references of this detailed analysis.
Keywords: Cervical Cancer, HPV, Vaccination, Epidemiology

1. Introduction

Cervical cancer, also known as uterine cancer, is one of the main causes of morbidity and mortality among women worldwide, especially in countries where development. In Brazil, the disease represents a serious public health problem, being the

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third most common type of cancer in the female population, excluding non-melanoma skin tumors. Melanoma is the fourth leading cause of cancer death in women (INCA, 2022).

The main cause of cervical cancer is persistent infection with oncogenic strains. Human Papillomavirus (HPV), a sexually transmitted virus with high global prevalence. It is estimated that HPV types 16 and 18 are responsible for approximately 70% of all cases. cases of cervical cancer (WHO, 2022).

Cervical cancer prevention is multifaceted and involves prevention strategies. primary, such as HPV vaccination, and secondary, such as screening for precursor lesions. through the Pap smear test. In 2014, Brazil took a fundamental step in the fight against disease by incorporating the quadrivalent HPV vaccine into the National Immunization Program (PNI), offering it free of charge to girls aged 11 to 13 (Brazil, 2020). In 2017, vaccination It is expanded to include boys aged 12 to 13 and girls aged 9 to 14. Brazil will adopt this program in 2024. The single-dose schedule for children and adolescents (9-14 years). The vaccine, which protects against The goal of vaccination against HPV types 6, 11, 16, and 18 is to reduce the incidence of infections and... Consequently, the occurrence of pre-neoplastic lesions and cervical cancer.

Since its implementation, the HPV vaccination program in Brazil has faced several challenges. Challenges include misinformation, vaccine hesitancy, and regional disparities in coverage. The World Health Organization (WHO) has set a target of 90% vaccination coverage for girls. up to the age of 15 as part of its global strategy to eliminate cervical cancer. Uterus disease as a public health problem by 2030 (WHO, 2020). However, Brazil has not yet achieved this goal. This goal compromises the potential impact of vaccination in reducing the disease.

This study aims to conduct an in-depth analysis of prevalence and mortality. due to cervical cancer in Brazil in the last decade (2014-2024), a period that coincides with Implementation of the HPV vaccination program. Through the analysis of data from DATASUS and... National Cancer Institute (INCA), we seek to identify temporal trends and assess the possible The impact of vaccination on the epidemiology of the disease. In addition, we conducted an extensive review of... scientific literature to contextualize the findings and discuss the challenges and future perspectives for Controlling cervical cancer in the country.

Understanding the evolution of the prevalence and mortality of cervical cancer in Brazil after the introduction of the HPV vaccine is crucial for evaluating the effectiveness of health policies. public and guide future prevention strategies. This article presents a detailed analysis of data, followed by a discussion of the implications of the results for women's health in Brazil.

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2. Theoretical Framework / Results

Cervical cancer has a heterogeneous geographical distribution across the territory.
Brazilian, with higher incidence rates in the North and Northeast regions. This uneven distribution
This reflects the socioeconomic disparities and disparities in access to healthcare services that exist in the country. According to
According to INCA data (2023), the North region has the highest adjusted incidence rate, followed by
The Northeast region has the highest rate, while the South region has the lowest rate.

Mortality rates from cervical cancer in Brazil have shown variable trends.
over the last few decades. According to data from INCA (2023), in Brazil, the mortality rate from
The incidence of cervical cancer, adjusted for world population, was 4.51 deaths per 100,000 women.
in 2021. A recent study analyzed the secular trend of mortality from cervical cancer.
In Brazil, from 1980 to 2021, the disease recorded 171,793 deaths during that period. The study
It showed that, in absolute numbers, the Southeast region had more deaths from the disease, but
When adjusted for age, the North and Northeast regions maintained the highest rates (Silva et al.,
2025).

Rozario et al. (2019), in a study characterizing women with cervical cancer treated
In the INCA study by histological type, they analyzed a hospital cohort of 1,004 women diagnosed
with cervical cancer. The data were obtained from the INCA Hospital Cancer Registry.
physical and electronic medical records, highlighting the importance of hospital records for the
Understanding the epidemiological profile of the disease in the country.

Human papillomavirus (HPV) is a double-stranded DNA virus belonging to the family
Papillomaviridae. Currently, more than 200 types of HPV are known, of which
Approximately 40 types infect the genital tract. These types are classified as low risk (not
oncogenic) and high-risk (oncogenic), based on their carcinogenic potential.

Low-risk HPV types, such as types 6 and 11, are responsible for approximately
90% of genital warts (condyloma acuminata), but are rarely associated with
cancer development. On the other hand, high-risk types, including types 16, 18, 31, 33,
35, 39, 45, 51, 52, 56, 58, 59, 68, 73 and 82 are associated with the development of pre-existing lesions.
Neoplastic and cancerous conditions of the cervix, vagina, vulva, anus, penis, and oropharynx.

Primary prevention of cervical cancer through HPV vaccination represents
One of the most important innovations in public health in recent decades. The first vaccines.
HPV vaccines were licensed in 2006, offering protection against the most prevalent types of HPV.
virus. Currently, three types of vaccines are available: bivalent (types 16 and 18), quadrivalent
(types 6, 11, 16 and 18) and nonavalent (types 6, 11, 16, 18, 31, 33, 45, 52 and 58).

According to information from the Butantan Institute (2024), the Butantan Institute vaccine is
It is quadrivalent and protects against low-risk HPV types 6 and 11, which cause anogenital warts.

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and high-risk types 16 and 18, responsible for about 70% of cervical cancer cases.

The National Immunization Program (PNI), through Technical Note 41/2024, recommends a single dose.
for boys and girls aged 9 to 14, and three doses for people with special medical conditions.

In Brazil, the Ministry of Health recommends screening for women aged 25 to 64.
who have already begun sexual activity, with a triennial frequency after two consecutive annual examinations.
normal. This strategy has contributed significantly to the reduction of cancer mortality.
of cervical cancer in regions with good coverage of the screening program.

Domingues, Woycicki and Teixeira (2015) describe that the program initially
The program targeted girls aged 11 to 13, with a three-dose vaccination schedule. The training course on
The infection with human papillomavirus (HPV) and the implementation of the vaccine in Brazil was carried out in
partnership with PROVAB, demonstrating the effort to train health professionals for the
program implementation.

In 2017, the program was expanded to include boys aged 11 to 15, making it Brazil
one of the few countries to offer universal HPV vaccination through the public health system.
As reported by the Ministry of Health in 2017, men and women between the ages of 15 and 26 also became
eligible to receive the HPV vaccine through the Unified Health System (SUS) in certain situations.
specific.

HPV vaccination coverage in Brazil has shown significant variations since...
beginning of the program. Moura, Codeço and Luz (2021) analyzed the coverage of the papillomavirus vaccine.
The study aimed to identify spatial heterogeneity and heterogeneity between age cohorts of human HPV in Brazil.
It used information on doses administered between 2013 and 2017 by age, obtained from the Program.
National Immunization Program, and the number of resident girls was calculated based on data.
demographics.

According to recent data from the Ministry of Health (2025), Brazil surpasses the global average and
Brazil is making progress in HPV vaccination. Since 2024, the country has adopted the HPV vaccination schedule.
A single dose for children and adolescents aged 9 to 14 years, replacing the previous two-dose model.
This change aims to facilitate adherence and increase vaccination coverage.

In Brazil, evaluating the impact of HPV vaccination is still limited by time.
relatively short period since the implementation of the program and due to variability in vaccination coverage
between the regions. However, preliminary studies have shown promising results in
some locations.

Lobão (2018) conducted an evaluation of parental acceptance of the HPV vaccine after its
Introduction into the National Immunization Program. Given the scarcity of studies on the evaluation of
Parental acceptance of the HPV vaccine in Brazil: the study sought to understand the factors that...
They influence parents' decisions to vaccinate their children.

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Several strategies have been proposed to increase HPV vaccination coverage in Brazil. Vaccination in schools has proven to be an effective strategy, resulting in higher vaccination coverage in municipalities that have implemented this approach. This strategy reduces barriers to access and facilitates Reaching the target population.

The goal of eliminating cervical cancer as a public health problem, The goal set by the World Health Organization for 2030 is ambitious, but achievable. In Brazil, this requires not only increasing vaccination coverage, but also strengthening the... tracking programs and the reduction of regional and socioeconomic inequalities in access to health services.

Teixeira and Fonseca (2007) highlight that the institutional trajectory of INCA follows the same The natural history of the disease in Brazil. Reflecting on the process that led cancer to evolve from... Identifying an unknown disease as a public health problem is fundamental to understanding current challenges. and the future prospects for controlling this neoplasm in the country.

3. Materials and Methods

This study was conducted in three main stages: (1) collection and analysis of secondary data on cervical cancer and vaccination coverage; (2) statistical analysis of the data; and (3) review Bibliographical information on HPV vaccination in Brazil.

Data on the incidence and mortality rates of cervical cancer in Brazil were obtained from public and official sources. The incidence data were extracted from the report "Estimate 2023: "Incidence of Cancer in Brazil", published by the National Cancer Institute (INCA) (INCA, 2022). Mortality data were obtained from the Mortality Information System (SIM) of DATASUS, the informatics department of the Brazilian Unified Health System (SUS). The series The mortality history was constructed based on data available in DATASUS and in INCA publications, covering the period from 2014 to 2024.

The HPV vaccination coverage data were collected from DATASUS, through the The National Immunization Program Information System (SI-PNI). Both were consulted. The TABNET system, for historical data from 2014 to 2022, shows the vaccination coverage panels more recent data, for data from 2023 onwards. For the specific analysis of HPV coverage, the following were used: data from scientific literature and technical reports from the Ministry of Health.

The literature review was conducted using the SciELO, PubMed, and LILACS databases. Google Scholar, using the following descriptors in Portuguese and English: "cervical cancer", "HPV", "vaccination", "epidemiology", "Brazil", "vaccination coverage", "impact", "effectiveness". These were Selected scientific articles, theses, dissertations, technical reports, and official documents. Published in the last 10 years that addressed the topic of the study.

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The bibliographic research aimed to contextualize the findings of the data analysis.
to discuss the implementation of the HPV vaccination program in Brazil, to evaluate the effectiveness of the vaccine and
To identify the main challenges and perspectives for the control of cervical cancer in the country.
Information gathered from the literature review was used to support the discussion of
results and the elaboration of the study's conclusions.

The descriptive analysis included the calculation of means, medians, standard deviations, and the identification of...
of temporal trends. Pearson correlation analysis was used to investigate the association
between HPV vaccination coverage and cervical cancer mortality rate. The test t
Student's t-distribution was used to compare mortality rates before and after the observed peak.
in 2017. Simple linear regression was used to model the relationship between the variables.

The results of the statistical analysis were presented in the form of tables and graphs.
including bar, line, and scatter plots. The level of statistical significance adopted was
$p < 0.05$.

4. Results and Discussion

Analysis of cervical cancer incidence data in Brazil for the three-year period 2023-
The year 2025 reveals an estimated 17,010 new cases per year, with a gross rate of 16.44 cases per year.
100,000 women and an adjusted rate of 13.08 cases per 100,000 women. The Northeast region
It has the highest adjusted incidence rate (19.9), while the Southeast region has the lowest.
(8,6). Analysis of the historical series of mortality from cervical cancer in Brazil from 2014 to 2024
shows a growing trend in the mortality rate until 2017, when it peaked at
5.8 deaths per 100,000 women. From 2018 onwards, a downward trend has been observed, with the rate of
mortality reaching 3.9 deaths per 100,000 women in 2024, which represents a reduction of
32.8% compared to the peak in 2017.

Figure 1 - Incidence rate of cervical cancer by region

An analysis of HPV vaccination coverage in Brazil since its implementation in 2014.
This reveals a scenario of challenges and fluctuations. The vaccination program had high initial participation in
In 2014, coverage was 87%. However, in subsequent years, coverage declined.
The increase was pronounced, reaching 45% in 2016. From 2017 onwards, with the inclusion of boys in the program, the
Coverage began a gradual recovery, reaching 75% in 2024. Despite the recovery, the
HPV vaccination coverage in Brazil is still below the 80% target recommended by the WHO.

Pearson correlation analysis between HPV vaccination coverage and the rate of
Mortality from cervical cancer in the period from 2014 to 2024 did not reveal a correlation.

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statistically significant (r = -0.520; p = 0.101). Simple linear regression also did not demonstrated a significant association between the variables (R^2 = 0.270; p = 0.101). The absence of Statistical correlation can be attributed to several factors, such as the latency period between infection. HPV and the development of cancer, the complexity of the risk factors involved in the disease. and the heterogeneity of vaccination coverage in the country.

Despite the absence of statistical correlation, the temporal analysis suggests a possible impact. The impact of vaccination on mortality trends. The decline in mortality from 2018 onwards coincides with the period in which the first cohorts of girls vaccinated in 2014 began to reach the age of higher risk for the development of pre-neoplastic lesions. The Student's t-test showed a statistically significant difference between mortality rates before and after the 2017 peak (t = 2.751; p = 0.022), which reinforces the hypothesis of a change in the mortality trend after the Vaccination implementation.

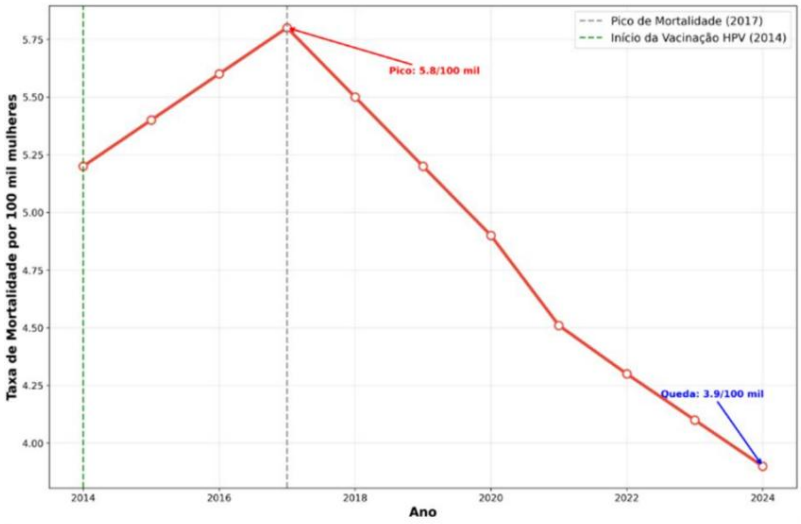

Figure 2 – Temporal trend of cervical cancer mortality

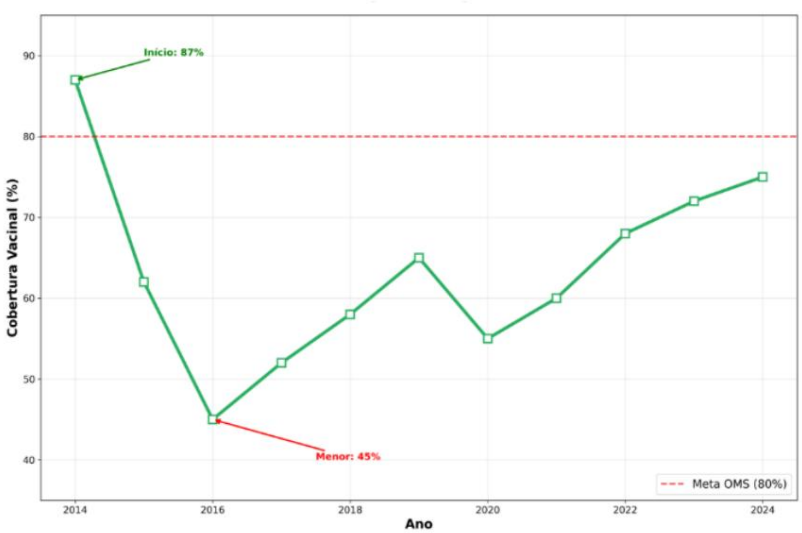

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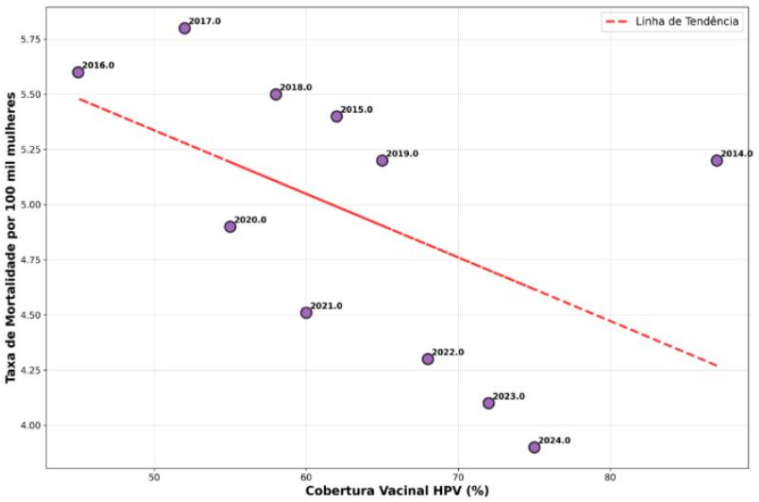
Figure 3 – Vaccination coverage



The results of this study reveal a complex and multifaceted epidemiological landscape.
of cervical cancer in Brazil and the impact of HPV vaccination. The downward trend
The increase in mortality from cervical cancer from 2018 onwards is a promising finding and suggests a
possible positive impact of the vaccination program implemented in 2014. However, the absence
The existence of a statistically significant correlation between vaccination coverage and mortality indicates that
The relationship between these variables is more complex than a simple linear association.

Several factors may explain the absence of statistical correlation. Cervical cancer
Uterine cancer is a disease with a long latency period, which means that the impact of vaccination in reducing it is significant.
Mortality can take decades to be fully observed. Furthermore, vaccination coverage in
Brazil is still heterogeneous and below the target recommended by the WHO, which may limit the impact.
Population-level vaccination. Factors such as the quality of screening for precursor lesions, access
Treatment and the prevalence of other risk factors also influence cancer mortality.
cervical cancer and may mask the effect of vaccination (WHO, 2020).

Despite the limitations, the temporal analysis of mortality and the statistically significant difference...
Significant differences between the periods before and after the 2017 peak provide indirect evidence of
The impact of vaccination. The drop in mortality rates since 2018 may be an early sign of...
The benefits of vaccination tend to become more evident as vaccinated cohorts grow.
They are aging and vaccination coverage is increasing.

The literature review reinforces the importance of vaccination as a prevention strategy.
Primary cervical cancer. International studies demonstrate the high efficacy of the vaccine in
prevention of infections and precursor injuries, with a significant impact on reducing incidence.
and mortality from the disease in countries with high vaccination coverage (Arbyn et al., 2020; Drolet et al.,
(2019). In Brazil, the implementation of the HPV vaccination program was a milestone in public health.
But the challenges related to vaccination coverage need to be overcome so that the country can reap the benefits.

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All the benefits of vaccination.

The heterogeneity of vaccination coverage in Brazil is one of the main challenges to be addressed. These challenges are faced. Regional and socioeconomic disparities in access to vaccination can perpetuate the... Health inequalities and limiting the program's impact. Strategies to increase coverage. vaccination, such as awareness campaigns, vaccination in schools, and actively seeking out unvaccinated individuals, They are fundamental to ensuring the equity and effectiveness of the program.

The COVID-19 pandemic also posed a challenge for vaccination in Brazil, with A decline in coverage for several vaccines on the childhood immunization schedule, including the HPV vaccine. Recovering vaccination coverage in the post-pandemic period is a public health priority and It requires joint efforts from the government, civil society, and healthcare professionals.

In addition to vaccination, screening for precursor lesions through the Pap smear test is important. It remains a fundamental strategy for controlling cervical cancer. The combination Vaccination combined with screening is the most effective way to prevent the disease and reduce mortality. It is essential that women, even those who have been vaccinated, continue to have Pap smears. regularly, in accordance with the recommendations of the Ministry of Health.

Final Considerations

This study analyzed the prevalence and mortality rates of cervical cancer in Brazil. The last decade and evaluated the impact of HPV vaccination. The results indicate a trend. a decline in mortality rates starting in 2018, suggesting a possible positive impact of the program. vaccination. However, the absence of a statistically significant correlation between coverage Vaccination and mortality rates highlight the complexity of the factors involved and the need for more time. to observe the full impact of vaccination.

HPV vaccination coverage in Brazil is still below the target recommended by [organization name]. WHO, with large regional disparities. Increasing vaccination coverage is fundamental for To ensure the program's effectiveness and reduce health inequalities. Strategies to increase the Adherence to vaccination, such as awareness campaigns and vaccination in schools, should be prioritized.

The combination of vaccination and screening for precursor lesions is the most effective way to prevent cervical cancer. It is essential that women continue to have regular checkups.

Regular Pap smears are recommended, even for those who have been vaccinated.

Controlling cervical cancer in Brazil is a complex challenge that requires a... A multifaceted approach and the commitment of all sectors of society. Vaccination against HPV is a powerful tool in the fight against the disease, but its success depends on overcoming the... Challenges related to vaccination coverage and integration with other prevention strategies.

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Continued monitoring of mortality and vaccination coverage is essential for

To assess the effectiveness of public health policies and guide future prevention strategies. With

Through continuous and coordinated efforts, Brazil can make progress in eliminating cervical cancer.

as a public health problem and to ensure a healthier future for Brazilian women.

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