Coverage of pap smear and mortality from cervical cancer in Brazil from 2006 to 2014

Cobertura dos exames de colpocitologia oncótica e mortalidade por câncer do colo de útero no Brasil no período de 2006 a 2014

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ABSTRACT

Introduction: Despite the widespread programs of prevention and screening of cervix cancer in Brazil, the country still remains in the third position of the most malignant neoplasm and the third cause of female death due to cancer. The Human papillomavirus vaccine is a recent addition to the National Immunization Program. Due to its short time of implementation, it is still insufficient to evaluate the reduction of this disease. Screening and treatment of precancerous lesions through oncotic colpocytology have significantly reduced the incidence and mortality of cervix cancer. However, so that it occurs, a high population coverage is required, which is not the case of Brazil. **Objective:** To analyze the number of Pap smear obtained from January 2006 to December 2014 in the Brazilian female population by the public health system, comparing it to the number of cervix neoplasia deaths during the same period. **Methods:** A cross-sectional study evaluating the number of Pap smear and mortality due to cervix cancer in the female population aged 25 to 64 years. The number of Pap smear carried out was obtained through the Cervix Cancer Information System, and the population statistics was provided by the Brazilian Institute of Geography and Statistics (IBGE). The number of deaths was obtained through the Mortality Information System developed by the Health Ministry. **Results:** The coverage by Pap smear in Brazil was shown to be declining during the analyzed period. The Brazilian region with the lowest average coverage was the Northern (14.58%), and it is also the region with the highest number of deaths from cervix cancer (average of 12.58 deaths per 100,000 women). The region with the highest average coverage was the Southeast (17.14%), which presented the lowest rates of death from this neoplasm (average of 5.28 deaths per 100,000 women). The highest number of deaths from cervix cancer during the period from 2006 to 2014 occurred in the 50 to 54 age group. **Conclusion:** Brazilian Pap smear coverage remains very low and the mortality rates are high and constant over the last years.
Keywords: pap smear; neoplasia; cervix; mortality.

RESUMO

Introdução: Apesar de já conhecidos os métodos de prevenção e rastreio, o câncer de colo de útero ocupou no Brasil, em 2016, a terceira posição nas neoplasias femininas mais incidentes e a terceira causa de óbito por câncer nas mulheres. A vacina contra o Papilomavírus humano foi recentemente introduzida no Programa Nacional de Imunizações, mas o tempo ainda é insuficiente para avaliar a redução dessa doença. O rastreamento e o tratamento das lesões pré-cancerosas por meio da colpocitologia oncótica têm demonstrado reduzir significativamente a incidência e a mortalidade do câncer do colo de útero. No entanto, para que isso ocorra, é necessária alta cobertura populacional, o que não acontece no Brasil. **Objetivo:** Analisar a quantidade de exames citopatológicos do colo uterino coletados entre janeiro de 2006 a dezembro de 2014 na população feminina brasileira pelo Sistema Único de Saúde (SUS), comparando-o ao número de óbitos por neoplasia cervical nesse mesmo período. **Métodos:** Estudo transversal avaliando o número de colpocitologias oncóticas e mortalidade por câncer de colo de útero na população feminina dos 25 aos 64 anos. O número de citopatologias foi obtido por intermédio do Sistema de Informação do Câncer do Colo do Útero e os dados populacionais por estimativas censitárias fornecidas pelo Instituto Brasileiro de Geografia e Estatística (IBGE). O número de óbitos foi obtido pelo Sistema de Informações sobre Mortalidade do Ministério da Saúde. **Resultados:** A cobertura pelo exame citopatológico no Brasil mostrou-se decrescente ao longo dos anos analisados. A região brasileira com menor cobertura média foi a Norte (14,58%), também sendo a com maior número de óbitos por câncer de colo uterino (média de 12,58 óbitos por 100 mil mulheres). A região com maior cobertura média foi a Sudeste (17,14%), que obteve as menores taxas de morte dessa neoplasia (média de 5,28 óbitos por 100 mil mulheres). A faixa etária que mais apresentou óbitos no Brasil, de 2006 a 2014, foi a de 50 a 54 anos. **Conclusão:** A cobertura nacional pela colpocitologia oncótica permanece muito baixa e com altas e constantes taxas de mortalidade nos últimos anos.
Palavras-chave: teste de papanicolaou; neoplasia; colo do útero; coeficiente de mortalidade.

INTRODUCTION

Cervix cancer is the third cause of cancer in Brazilian women, not considering non-melanoma skin cancer[1]. Nowadays, it is known that the Human Papillomavirus (HPV) is responsible for the development of this neoplasm in almost 100% of the cases[2].

The prevention of contact with HPV, through the routine use of condoms[3], is one of the ways to avoid this neoplasia. Vaccination[4] and early diagnosis of precancerous changes, i.e., the cervix intraepithelial neoplasia (CIN), should be added.

Pap smear (PS) of the cervix, also known as papanicolaou, is the most widely used method in the trace of the cervix cancer worldwide and a great way of prevention, as long as there is an excellent coverage between women[5]. Several countries in the world have observed an important decrease of this cancer since a national organized program has been adopted and achieved a high coverage of women tracked[6,7].

Although PS is implemented as a screening method for more than half a century in the Brazilian and world female population[6], the incidence and mortality from cervix cancer still remain high[5,8]. In 2016, it was the fourth most common female neoplasm and the fourth cause of women death in the world[9].

In Brazil, it still persists as the third most common female neoplasm in incidence, only following the colorectal and breast cancers[1]. Its incidence rate also varies according to the Brazilian region. In the North region, it is the most incident female neoplasia (estimated 23.97 per 100,000 women in 2016)[8], statistically compared to what is observed in countries like India (20.2 per 100,000 women

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in 2012)[10]. On the other hand, the South region has the lowest incidence rates (estimated 15.17 per 100,000 women in 2016)[8], holding the fourth position.

Concerning Brazilian mortality, it represents the third cause of death from cancer, following only breast and bronchial/lung cancers[11]. In 2014, the highest rates were found in the Northern region of the country (14 deaths per 100,000 women) and the lowest ones in the Southeast (4.95 per 100,000 women)[12].

OBJECTIVE

To analyze the number of PS observed in the Brazilian female population aged 25 to 64 from January 2006 to December 2014 by the Public Health System (Sistema Único de Sáude — SUS), and compare it with mortality due to this type of cancer in the same period.

METHODS

This is a cross-sectional design study, whose objective is to review the amount of PS of the female population of Brazil, from January 2006 to December 2014, compared to the female population according to the age group in this same period. Cervix cancer deaths rates were also evaluated in women in the 25 to 64 age group during this period.

The time interval evaluated was 2006 to 2014, whenever the information was completed, through the Information System of Cervix Cancer (Sistema de Informação do Câncer do Colo do Útero — SISCOLO), in the Informatics Department of the SUS (DATASUS), on the Ministry of Health website[13].

The age group chosen for the study variables was 25 to 64, as it represents the age determined by the National Cancer Institute (Instituto Nacional de Câncer José Alencar Gomes da Silva — INCA) in its final recommendation (2016) to screening with Pap smear in Brazil[7].

To estimate the female population, the Projection of the Union Population by Sex and Age Groups 2000–2030, a platform of the Brazilian Institute of Geography and Statistics (IBGE), a component of DATASUS, was used through the *25 to 64 years old* age filter[14].

The number of deaths by cervix cancer in women in the 25 to 64 age group was obtained through the database of the Mortality Information System (SIM) of the Ministry of Health[12].

Statistical analysis of the data was performed through Microsoft Excel 2010 software.

To evaluate the national PS coverage, the quotient between the absolute value of exams was carried out each year in the 25 to 64 age group, and the female population estimate in this same age group every year was multiplied by the constant 100.

The specific mortality coefficient for cervix cancer has been obtained by the division of the number of deaths from cervix cancer of women from 25 to 64 years old, and the population estimate of this same age group every year was multiplied by the constant 100,000.

The number of deaths from cervix cancer was also computed in intervals of age groups every four years, starting at age 15 and ending at age 79.

The SISCOLO data are close to real values, since this system was created to control the coverage of population surveys and follow-up of women with altered tests[15]. The data concerning the number of PS of the SISCOLO platform and mortality from cervix cancer were obtained from the DATASUS website, and therefore in the public domain.

RESULTS

From January 2006 to December 2014, 66,132,790 PS among women between the ages 25 to 64 was obtained from the SUS base. The year showing the highest number of collections was 2009 (8,493,656 tests), and 2014 the lowest (3,082,765 tests) (**Table 1**).

There was a progressive increase of the female population in the age group studied, with a maximum population growth rate of 2.41%/year (2006 to 2007) and a minimum of 1.59%/year (from 2013 to 2014), totaling the increase of 17.81% in the female population from 2006 to 2014.

Over the years, the percentage of the Brazilian PS coverage kept a decreasing linear trend, despite the variations occurred in the period (**Figure 1**).

The comparative evaluation between PS coverage in five Brazilian regions over the nine years of the study shows that, except for 2014, the region with the lowest population coverage was the Northern one, with the average of 14.58%, and always below the Brazilian average, of 16.09%. The Southeast region showed the best coverage, with 17.14% (**Figure 2**).

The regions with the highest PS coverage were led from 2006 to 2008 by the Northeast region (18.24 and 17.59% variation). Between

Table 1 – Pap smear annual coverage[1] of female population aged 25 to 64 from 2006 to 2014.

Year	Pap smear numbers	Female Brazilian population (25 to 64 years of age)	Annual coverage (%)
2006	7,373,121	45,330,817	16.26
2007	7,854,856	46,454,770	16.91
2008	7,989,372	47,584,598	16.79
2009	8,493,656	48,684,881	17.45
2010	8,268,155	49,732,496	16.62
2011	8,041,393	50,728,309	15.85
2012	7,986,381	51,667,784	15.46
2013	7,043,091	52,556,386	13.40
2014	3,082,765	53,407,458	5.77
Total	66,132,790		

[1]Number of PS/ Female population of the mentioned year.
Source: Cervix Cancer Information System[13] and Brazilian Institute of Geography and Statistics[14].

2009 and 2010, the leadership of coverage occurred in the South region (ranging from 19.55 and 17.46%). In 2011, the Southeast region obtained maximum coverage among the five regions (17.02%). In 2012 and 2013, the South region led the coverage again (ranging from 16.49 to 14.37%), as shown in **Figure 3**. Data of 2014 show the North region with the highest coverage (7.39%), and the Southern region with the lowest (2.08%).

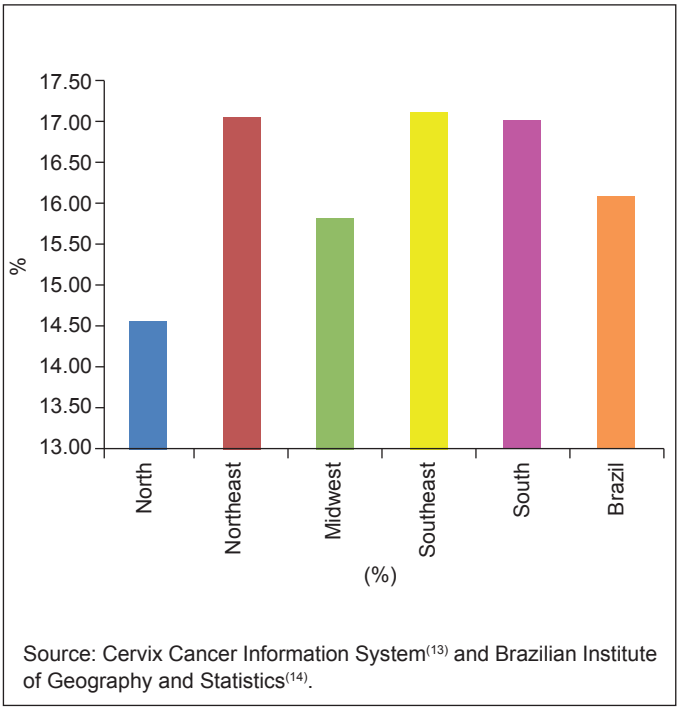
In the period between January 2006 and December 2014, 30,456 cervix cancer deaths were registered in the Brazilian female population aged 25–64 years (**Table 2**).

There was an absolute increase in the total number of deaths from this kind of neoplasia: from 3,059 deaths, in 2006, to 3,651 deaths in 2014 (19.35%) (**Figure 4**).

It is observed that the specific mortality coefficient in Brazil showed an increasing tendency between 2006 and 2014 (**Figure 5**).

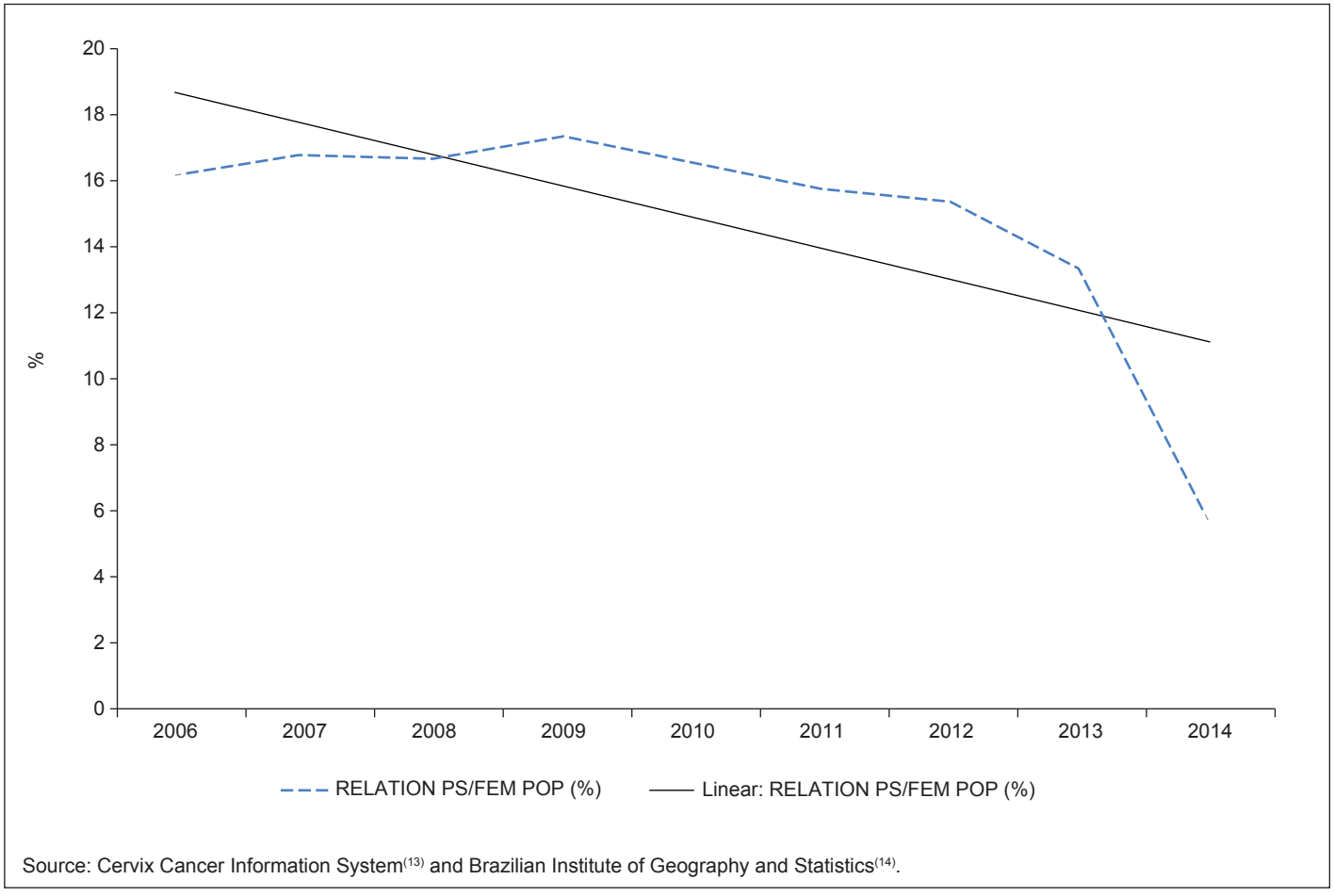
When all cervix cancer deaths between 2006 and 2014 are added and distributed according to the age group, the highest percentage of deaths from this neoplasia is concentrated in age group 50 to 54, totaling 11.62% of the total deaths (45,509 deaths). The lowest percentage was found in age groups below 25 years, accounting for 0.61% of total deaths (**Figure 6**).

The comparison of the number of cervix cancer deaths in the population among all the five regions of Brazil over the nine years of study shows that the Northern region had the highest number of deaths, with the gradual increase tendency. Although the chart does not make it



Source: Cervix Cancer Information System[13] and Brazilian Institute of Geography and Statistics[14].

Figure 2 – Comparison between the average coverage by Pap smear (PS) among the five regions of Brazil and the Brazilian average between 2006 and 2014.



Source: Cervix Cancer Information System[13] and Brazilian Institute of Geography and Statistics[14].

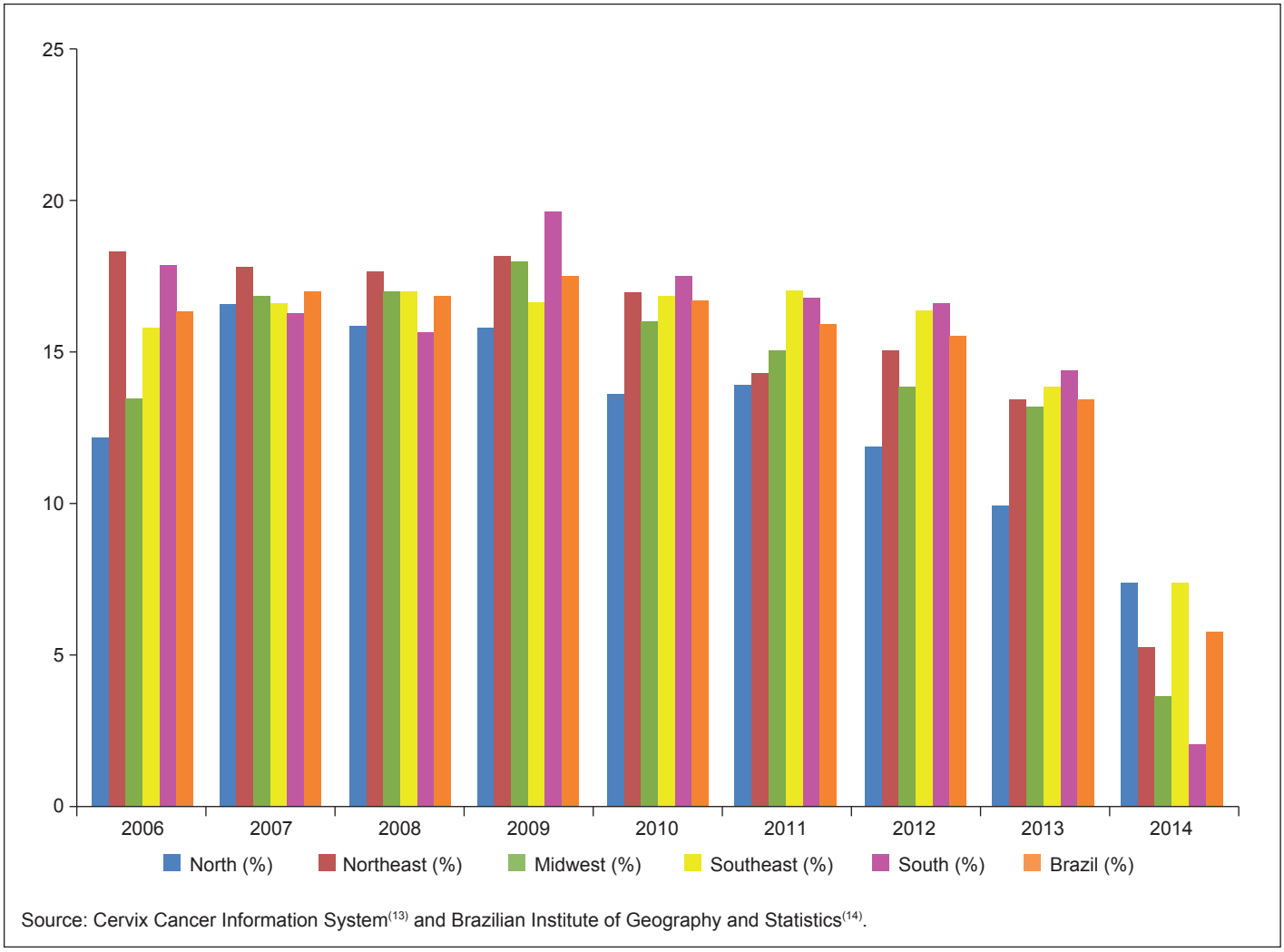
Figure 1 – Relation between the number of Pap smear (PS) and the female population (fem pop) aged 25 to 64 in Brazil from 2006 to 2014.

clear, the Northeastern region also showed a linear trend of increase of specific mortality rates, differently from the Midwest, Southeast and South regions, which kept linear decreasing trends (**Figure 7**).

By comparing the same mortality coefficient of cervix cancer in Brazil (**Figure 5**) with the one from other regions (**Figure 7**), it is graphically observed a lower national variation in relation to other regions with a tendency to stability.

DISCUSSION

The cervix cancer, as a slowly advancing disease, with the average of 10 to 15 years between infection by high-risk oncogenic HPV and the development of invasive cancer[16], allows the diagnosis of precursor lesions and its treatment, preventing the consequent invasion. Based on that finding, the periodical preventive examination



Source: Cervix Cancer Information System[13] and Brazilian Institute of Geography and Statistics[14].

Figure 3 – Coverage by PS of the five Brazilian regions and Brazil between 2006 and 2014.

Table 2 – Mortality coefficients of cervix cancer in the Brazilian female population aged 25 to 64 from 2006 to 2014.

Year	Number of deaths from cervix cancer	Brazilian female population	Specific mortality coefficient (100,000)
2006	3,059	45,330,817	6.748168691
2007	3,112	46,454,770	6.698989146
2008	3,287	47,584,598	6.907697318
2009	3,366	48,684,881	6.913850729
2010	3,384	49,732,496	6.804404106
2011	3,461	50,728,309	6.822620482
2012	3,520	51,667,784	6.812755894
2013	3,616	52,556,386	6.88022955
2014	3,651	53,407,458	6.836123899
Total	30,456		

Source: Mortality Information System[12] and Brazilian Institute of Geography and Statistics[14].

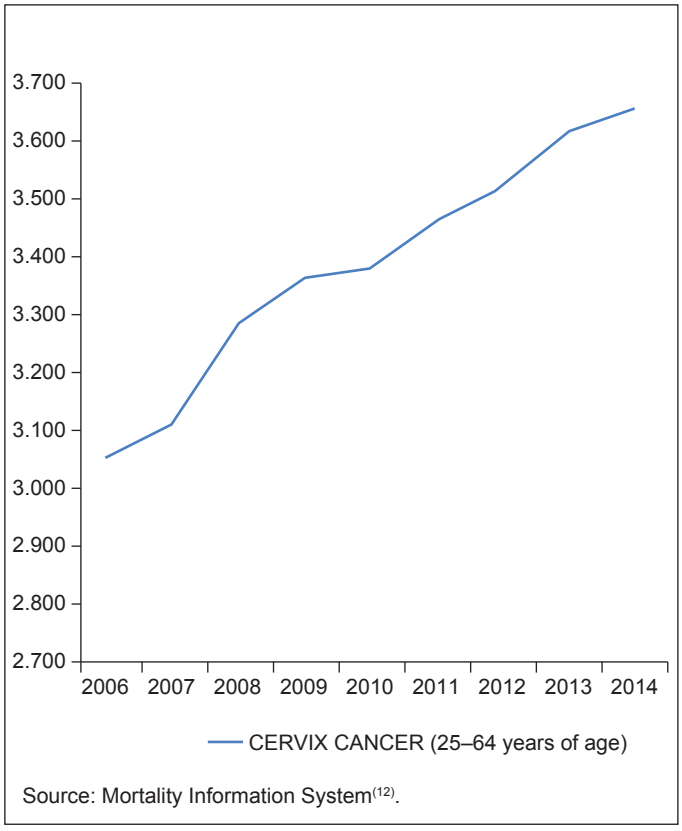


Figure 4 – Absolute number of deaths from cervix cancer of Brazilian female population aged 25 to 64 in Brazil from 2006 to 2014.

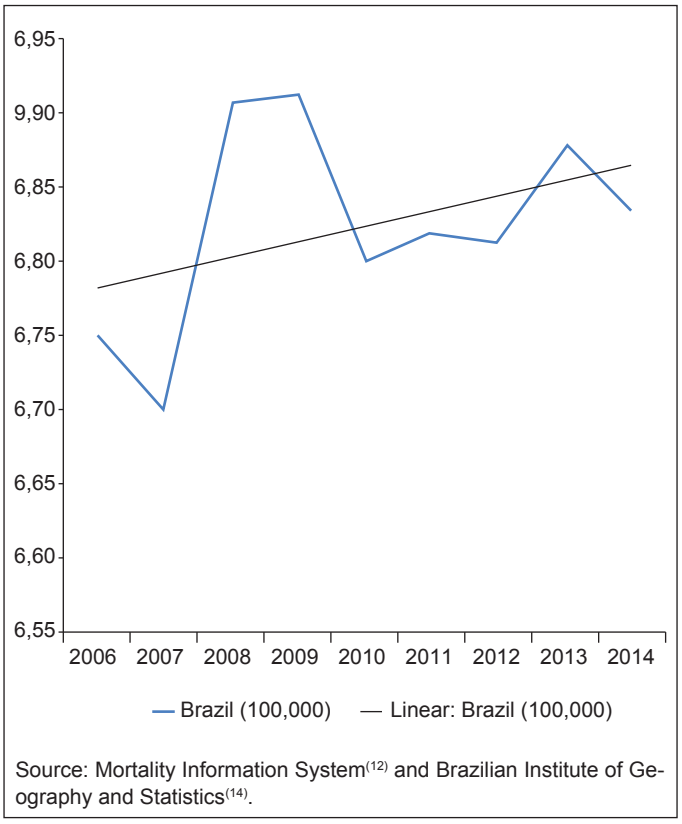


Figure 5 – Specific mortality coefficient from cervix cancer in Brazil of women aged 25 to 64 from 2006 to 2014 per 100,000 women.

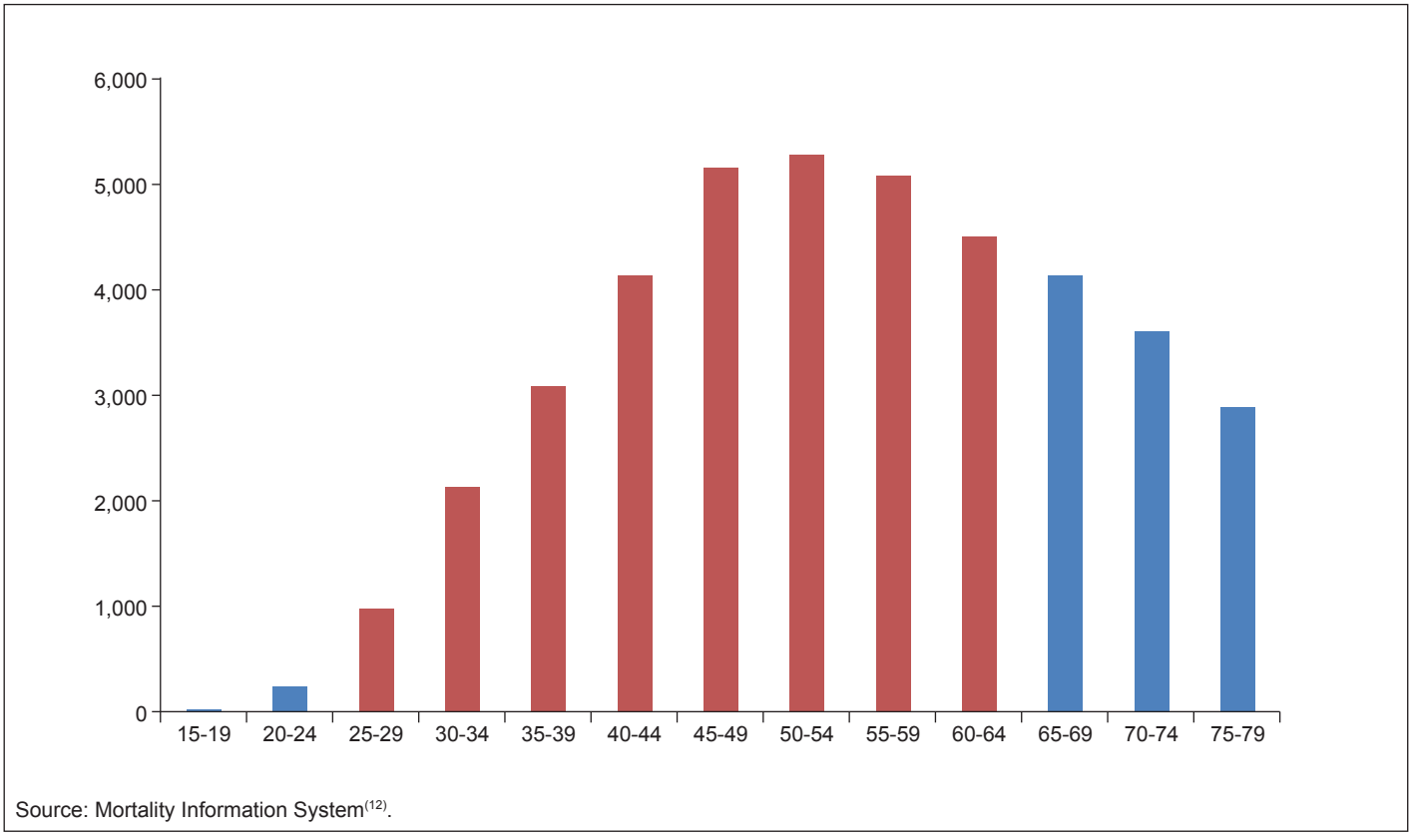


Figure 6 – Total number of deaths from cervix cancer in Brazil, from 2006 to 2014, distributed according to the age group.

(or Pap Smear) has been an extremely useful tool in reducing cervix cancer in countries where its use is carried out in a systematic and organized way[6,7].

According to the 2016 Brazilian Guidelines for the Trace of the Cervix manual[7], the beginning of the PS collection should happen at the age of 25 for sexually active women, avoiding the screening before that age. In 1986, a study conducted by the International Agency for Research on Cancer (IARC) estimated that PS examination at the age of 20 would result in the reduction of less than 1% of the cumulative incidence of cervix cancer in the studied population[17]. Other investigations carried out later, including in Brazil, corroborated the previous IARC's study and demonstrated that the screening in women under 24 years oldnot only loses effectiveness in preventing future cancers, but can also result in unnecessary expenses, over-treatment, social stigmatization and anxiety for patients[7,18]. Women with no history of invasive neoplasia and who have had two negative results in the last five years can discontinue the screening at the age of 64, because there is little risk of HPV infection and cancer progression[19].

Generally, countries that can achieve coverage by PS screening performed every three to five years and exceeding 50% of the population have the mortality rate of less than three per 100,000 women per year. If the coverage is above 70%, mortality rates are reduced to 2 deaths or less per 100,000 women for every year[20]. In terms of coverage, Brazil is still far from this scenario, since according to SISCOLO analysis[13] the number of PS performed in the Brazilian female population in the 25–64 age group shows that the average coverage in Brazil in nine years of study was of 16.09%. Even if different women performed the exam annually, the coverage would be of 48.27% in three years. In addition, a SISCOLO's data analysis noted that more than 80% of women underwent a PS in recent years, revealing that probably the same group of women was being screened, keeping a portion of the female population excluded from the screening process, which would justify the high number of cases of cervix cancer occurring in Brazil today[13].

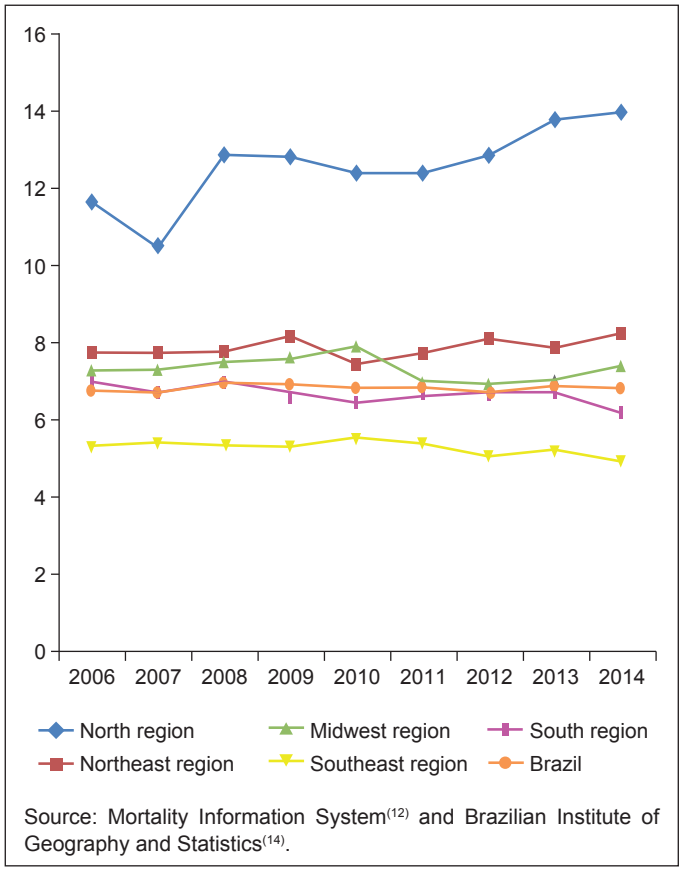


Figure 7 – Comparison of specific mortality coefficient by cervix cancer among the five Brazilian regions and Brazil over nine years (2006 to 2014) per 100,000 women.

Contrary to the expected world trend, the Brazilian PS coverage decreased over the nine years of study, not following even the population growth. In an interregional comparison, disparities in coverage for exams were also observed: the lowest coverage rates were found in the Northern region of the country (average of 14.58%), where the incidence of cervix cancer is the first among the cases of cancer in women, excluding non-melanoma skin cancer[8].

There are three critical assessments of the data collected for analysis. First of all, data were extracted from the SISCOLO platform[13], a virtual database fed exclusively by public services offered by SUS. Thus, the percentage of tests conducted over the network or private health supplement, which corresponds to 24%[21], is not accounted for. Secondly, as only the collected exams number is registered, and not the number of women who were attended, it is possible that some women have collected more than one exam in the same year or have collected tests annually, not respecting the interval of three years of each collection, which would overestimate the coverage by the PS exam. Thirdly, although the data in the study were used for the year 2014, caution is required when interpreting the data from this year, because coverage by PS showed extremely reduced in all states and may be associated with incomplete filling on the SISCOLO platform.

In addition, it is important to point out that if all women within the age group recommended for screening were to undergo PS by SUS, there would possibly be no physical structure nowadays in Brazil to support the demand[22].

In an attempt to minimize these biases, the study also evaluated death rates from cervix cancer, i.e., a parameter whose data are restrict to public source, taken from the death certificate and fed into the SIM[12]. The rates of death from this neoplasia remained virtually constant in the nine years of study, from 6.75 deaths per 100,000 women, in 2006, to 6.84 in 2014, indicating that the current coverage for PS in Brazil is insufficient to change the profile of the mortality from this neoplasia. Extremes of mortality from cervix cancer are observed in the world: in 2012, the East African countries presented a mortality of 27.6 per 100,000 women. On the other hand, countries like Australia and New Zealand reported rates of 1.5 death per 100,000 women in the same period[23].

The specific mortality from cervix cancer varied according to the Brazilian region, showing the highest rates in the Northern region of the country (average of 12.58 deaths per 100,000 women from 2006 to 2014), an expected result, since a region with the lowest coverage for PS generates vulnerability in the population health. These values are close to those ones of underdeveloped countries, such as India (mortality of 12.4 per 100,000 women)[10].

The concentration of the highest mortality rate from cervix cancer between 50 and 54 years of age (11.62% of the total number of deaths) during the nine years of the study reflects data already found in the literature. In Taiwan, in 2011, the two highest concentrations of deaths were women between 45 and 54 years of age (14.4%) and over 55 (18.1%)[24]. In Ireland, the average age of diagnosis of this neoplasm was 46 years old, while the average mortality occurred at 56 years of age[25].

In a completely preventable disease such as cervix cancer, it is unacceptable that such high levels of Brazilian mortality remain in the last nine years. It is necessary that the country takes over a screening program through oncotic colpocytology in a very organized way, modifying the current infrastructure or, therefore, adopts new prevention strategies. Among these new modalities, it is suggested the vaccination against HPV[26], already available in the basic health network for girls and boys up to 14 years of age[27]. In addition, changes in the ways of screening are also valid, using HPV DNA testing[28], a more sensitive and self-collecting methodology accessible to many Brazilian regions that are difficult to access in the current forms of screening[29]. According to Ronco et al.[28], protection afforded by the HPV DNA testing adds about 60 to 70% efficacy in screening for high-grade neoplasms compared to traditional cytopathology.

In countries like Mexico, it is possible to find an innovative prevention and screening program, which consists of vaccinating women from 12 to 16 years, cytology in women aged 24 to 34, and screening women over 35 years for HPV DNA with later follow-up for cytology in women with positive HPV DNA[30]. The American Cancer Society, in conjunction with the American Society for Colposcopy and Cervical Pathology and the American Society of Screening for Prevention and Early Detection of Cancer, in the latest 2012 newsletter[31], recommended that no screening by any method should be performed under 21 years of age, keeping only vaccination. From 21 to 29 years of age, isolated cytology should be carried out every three years, and there is no evidence of safety at longer intervals. In the age group 30 to 65, cytology can be maintained every three years, or accompanied by HPV DNA testing every five years. Studies indicate that the frequency could be safely reduced by performing the exam every five years, rather than the three years of cytopathology, making a more rational use of financial resources in each nation[28].

CONCLUSION

Brazil has remained in the last nine years with extremely low coverage of oncotic colpocytology and a constant mortality rate, demonstrating the urgent need to change the strategy for cervix cancer prevention in our country.

Conflict of interests

The authors declare no conflict of interests.

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