

## **Vaccination as a strategy to face human papillomavirus and its associations**

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**Abstract: Objective:** To verify the effectiveness of vaccination coverage against human papillomavirus in girls and its association with socioeconomic indicators.

**Methods:** Quantitative study in the municipalities of Minas Gerais, based on the variables available through the Department of Informatics of the Brazilian Unified Health System (Data-SUS) and the Social Responsibility Index of Minas Gerais: vaccination coverage rate, mortality rate on cervical cancer, the proportion of the population assisted by the Family Health Program, municipal health expenditures, the existence of active health councils, income and the index of the general quality of education.

**Results:** The average rate of vaccination coverage between 2014 and 2015, as well as the general average of municipalities did not reach the coverage rate of 80% of the target public, proposed by the Ministry of Health, with

discrepancies between vaccination coverage among municipalities. Only the general quality index of education showed a significant association.

**Conclusion:** Developing government strategies for the implementation of vaccination campaigns against human papillomavirus is necessary, to raise awareness of the population on the importance of prevention, followed by educational actions, prioritizing clear information for the target population and those responsible. Whereas the general quality of education index was significantly associated with vaccination coverage rate, this should be prioritized as a factor that influences the population's ability to access services for health promotion and prevention.

**Keywords:** Papillomaviridae, prevention, health promotion, vaccination.

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### **1. Introduction**

According to the Pan American Health Organization (PAHO), cervical cancer is one of the leading causes of death in women worldwide, with a large proportion of these deaths occurring in low to medium developing countries. This organization points out that among the infections acquired through unprotected sexual intercourse, papillomavirus (HPV) has the highest contamination rates, being the main originator of cervical-uterine cancer. Worldwide, about 266,000 women die each year from cervical cancer<sup>(1)</sup>.

Thus, the fact that HPV infection is still a public health problem bases on the absence of organized and effective programs of access to prevention and health promotion, early diagnosis and appropriate treatment, qualified and timely. That is, without these actions, the predictions on death rates due to cervical cancer have been increasing<sup>(1)</sup>.

Among the identified difficulties for lower incidence of HPV, are women's lack of knowledge about cancer; low schooling level and lack of knowledge on the body; shame and fear of taking the exam, which includes the fear of results; lack of privacy in the exams; dehumanization in care and professional desensitization for routine examinations; and low priority of professionals in the integral care of women<sup>(2)</sup>.

When analyzing the concept of health promotion, it refers to a range of values that encompass quality of life, health, solidarity, equity, democracy, citizenship, development, participation and partnership, among others.<sup>(3)</sup>

Health promotion was instituted through the Ottawa Charter, with a combination of actions: State, through the creation of healthy public policies; community, with the reinforcement of community action and popular participation; individuals, in the development of personal skills; and health system, through its reorientation and formation of intersectoral partnerships. Consequently, with a conception of collective responsibility<sup>(3)</sup>.

In relation to the promotion actions, these seek to act directly on the social determinants of the health-disease process, aiming to provide quality of life, which are fundamental elements to improve the population's health and the control of the diseases and their aggravations<sup>(4)</sup>.

The concept of health promotion is broader than prevention, since it deals with actions not restricted to a specific disease; but concerns the raising of the general health and well-being of the population. Their strategies aim at transforming the living and working conditions that permeate the basis of health problems, necessitating a dialogue between the various sectors of public policies<sup>(4)</sup>.

Therefore, Primary Health Care (PHC) includes both prevention and health promotion actions. Primary health care is a key element for a population to reach a level of health that enables them a socially and economically productive life. This level of care represents the gateway to individuals, family and community contact with the national health system. Primary health care must address the main health problems of the community, providing protection, prevention, cure and rehabilitation services according to their needs<sup>(5)</sup>.

Therefore, the study aimed to verify the efficacy of vaccination coverage against human papillomavirus in girls in the municipalities of the state of Minas Gerais from 2014 to 2015 and its association with socioeconomic indicators, which are mortality rate on cervical cancer, proportion of the population assisted by the Family Health Program, municipal health expenditures, existence of active health councils, income, and overall quality of education index.

## 2. Methods:

The used a quantitative research in all the municipalities of the state of Minas Gerais based on data available by the Data-SUS, which is responsible for managing health information, providing important information, which may serve to support objective analysis of the health situation, evidence-based decision-making, and development of health action programs<sup>(6)</sup>. Simultaneously, we used the data of the Social Responsibility Index of Minas Gerais (IMRS), which provides socioeconomic indicators, information on public policies and characteristics of municipal management in all municipalities of Minas Gerais<sup>(7)</sup>.

This study aimed to verify the possible association between HPV vaccination coverage and cervical cancer mortality rates in the female population; proportion of the population assisted by the Family Health Program; index of general quality of education; municipal health expenditures and the existence of active health councils<sup>(7)</sup>. In addition, we tried to examine whether the vaccination coverage rate changed from 2014 to 2015 and whether the goal of covering at least 80% of the target population.

As regards vaccination coverage rates against HPV in girls, in the state of Minas Gerais, extracted from the electronic portal of Data-SUS, we found 853 municipalities and sought to verify the notification during the analyzed period. In 2014, vaccination coverage occurred in girls from 9 to 14 age; in 2015, notification of vaccination was for girls from 9 to 12 years. The choice of vaccination coverage in 2014 and 2015 according to Data-SUS was due to data accomplishment in those years, in addition to being the most up-to-date.

The IMRS database provided index data of general quality of education in 2013; the existence of active municipal health councils in 2014; municipal health expenditures in 2013; mortality rate due to cervical cancer in the female population in 2013; family income per capita up to ½ minimum wage in 2014; in addition to the proportion of the population assisted by the Family Health Program (FHP) in 2013. Regarding the data years, we considered the most current ones.

In spite of being an essentially cross-section study, Data-SUS and IMRS systems did not have data available of the same years; we needed to combine data from the closest periods these systems offered.

We used the software for statistical analysis on data matrices. The T test aimed to evaluate whether the vaccination rates increased or decreased from one year to the next and whether the municipalities reached the coverage rate proposed by the Ministry of Health, which corresponds to 80% of the target population.

The T test of independent sample was applied to compare means between two different groups and at equal periods, including vaccination coverage for 2014 and the existence of active municipal health councils for the same year. The third test refers to the bivariate correlations, which involves the analysis of two variables, with the proposal to verify the empirical relationship between them. The study comprises the vaccination coverage for 2014 with each of the other explanatory variables mentioned above, considering a 5% level of significance.

After the statistical tests, we selected the municipalities with the lowest and highest vaccination coverage rates against HPV in 2014 and 2015, highlighting the possible hypotheses for the discrepancies.

## RESULTS:

Table I shows the results of the average of the vaccination coverage rate for HPV in girls, in the municipalities of Minas Gerais, referring to 2014 and 2015.

Table I - Average vaccination coverage rate for HPV, Minas Gerais, Brazil, 2014 and 2015.

	95% Confidence interval							
	Mean	Standard Deviation	Error	Lower	Higher	T	df	Sig.
Coverage 2014-2015	24.71	34.48	1.18	22.40	27.03	20.94	852	.000
Coverage 2014	78.47	33.71	1.15					
Coverage 2015	53.75	20.65	.71					

Source: Research Data (2017).

The T-test for paired samples pointed to a significant decrease, p-value 0.000, in the average rate of vaccination coverage from 2014 to 2015, since in 2014 the coverage average was 78.47%, while in 2015 the average fell to 53.75%. The average coverage for 2014 and 2015 refers to 24.71%.

Table II shows the evaluation of the association between the HPV vaccination coverage rate and the existence of active municipal health councils.

Table II - Association of the HPV vaccination coverage rate and the existence of active municipal health councils. Minas Gerais, Brazil, 2014.

	Council	N	Mean	Standard Deviation	Error					
Coverage 2014	Yes	844	78.51	33.74	1.16					
	No	8	72.22	34.38	12.16					
	Levene's Test		t-Test for Equal Means				95% confidence interval			
	F	Sig.	T	Df	Sig.	Dif. of Mean	Error	Inferior	Superior	
Cobertura	,04	,847	,53	850,00	,599	6,30	11,99	-17,23	29,82	
2014			,52	7,13	,622	6,30	12,21	-22,47	35,07	

Source: Research Data (2017).

The T test of independent sample showed that municipalities with active councils obtained an average of 78.51% vaccination coverage. However, municipalities with no active health councils reached an average of 72.22% vaccination coverage.

When examining the vaccination coverage rate, with the level of effectiveness of primary care services, that is, with the proportion of the population assisted by the Family Health Program, the bivariate correlation test showed no significant association between these two variables, with p-value 0.664.

Regarding the association of the vaccination coverage rate with the cervical cancer mortality rate in the female population, the bivariate correlation found no significant association between these two variables, with p-value 0.985.

The result was similar when associating the vaccination coverage rate and the per capita family income level up to ½ minimum wage, since the bivariate correlation, with a p-value equivalent to 0.378, was not significantly associated. Regarding the association of HPV vaccination coverage rate with municipal health expenditures, the results also indicated a non-significant association between these variables, with a p-value of 0.783.

On the other hand, in relation to the association analysis between HPV vaccination coverage rate and the general quality of education index, the data found a significant association between these two variables, with a p-value of 0.004.

Table III shows the municipalities with the lowest HPV vaccination coverage rate in 2015 and 2014.

Table III - Lower HPV vaccination coverage rate in Minas Gerais, Brazil, in 2014 and 2015.

<b>Municipalities 2015</b>	<b>%</b>
Acaiaca	0
Cristiano Ottoni	0
Joaquim Felício	0
Pedra Dourada	0
Santa Cruz de Salinas	0
<b>Municipalities 2014</b>	<b>%</b>
Cristiano Ottoni	0
Arantina	0
Santa Rita de Minas	0
Itambé do Mato Dentro	0
Jose Gonçalves de Minas	0
São Sebastião do Rio Preto	0

Source: Research Data (2017).

Data show that at least five municipalities reported 0% vaccination in each year; in 2014, the municipalities were Cristiano Ottoni, Arantina, Santa Rita de Minas, Itambé do Mato Dentro, Jose Gonçalves de Minas and São Sebastião do Rio Preto; in 2015, the municipalities were Acaiaca, Cristiano Ottoni, Joaquim Felício, Pedra Dourada and Santa Cruz de Salinas.

When examining the municipalities with the highest rates of HPV vaccination coverage in 2014 and 2015, data in Table IV show that at least five municipalities reported more than 100% vaccination in each year.

In 2014, the municipalities with the highest HPV vaccination coverage rate were Diogo Vasconcelos, Oratórios, Conceição de Ipanema, Bom Jesus do Amparo and Entre Folhas. On the other hand, in 2015, the following places stood out: Doradoquara, Doresopolis, Senador Modestino Gonçalves, Rio Acima and Rio Novo.

Table IV- Lower HPV vaccination coverage rates in Minas Gerais, Brazil, in 2014 and 2015

<b>Municipalities 2015</b>	<b>%</b>
Doradoquara	127.9
Doresopolis	130.9
Senador Modestino Gonçalves	134.1
Rio Acima	136.8
Rio Novo	152.3
<b>Municipalities 2014</b>	<b>%</b>
Diogo de Vasconcelos	201.9
Oratórios	209.7
Conceição de Ipanema	218.7
Bom Jesus do Amparo	245.0
Entre Folhas	278.1

Source: Research Data

### Discussion

In 2014, the Ministry of Health, through the National Immunization Program (NIP), started the vaccine calendar against HPV, which was the main prevention strategy against virus infection, through the tetravalent vaccine. It was initially intended for girls, but in 2017 it was also aimed for boys. The program aims to achieve the vaccination rate of at least 80% of the target population<sup>(8)</sup>.

Vaccination coverage rates are important indicators of health and quality of care offered by primary care services. Vaccination coverage is determined by the ratio between the number of given doses and the number of registered or estimated target audiences in the coverage area of a given program<sup>(9)</sup>.

The results indicate that the general average of municipalities did not reach the coverage rate proposed by the Ministry of Health, which corresponds to 80% of the target population. These results highlight the importance of examining the possible factors that may be responsible for the non-adherence of the young women to the HPV vaccine.

Studies on non-adherence to the HPV vaccination service are still incipient in Brazil. However, in the pioneer countries in immunization actions, research points to important factors that may be involved in non-compliance with vaccine coverage goals, such as: a) population's difficulty in reaching health education information on HPV, due to the lack of preparation of healthcare professionals and the use of methodologies not appropriate for the target population; b) parents' lack of knowledge regarding HPV and its association with cervical cancer; c) parents' reluctance to discuss sexuality issues with adolescents and the fear that daughters, who have been vaccinated, can initiate sexual life early<sup>(10)</sup>.

Adopting the broad concept of health in agreement to the UHS determination is fundamental, considering not only the biological causes of the disease, but also the influence of social determinants on the occurrence of health problems and their risk factors in the population, such as lack of basic sanitation, inadequate housing conditions, famine, lack of schooling and various determinants of living and working conditions of the population. Despite advances, there has not yet been a complete break with the traditional care model, centered on disease and medical-hospital care<sup>(11)</sup>.

The importance of vaccination campaigns and the fight against certain diseases must be considered, as well as research incentive combined with the advancement of new technologies in the health field, and the development of new drugs and equipment, which help in the life expectancy of individuals. However, all these actions need to be intercalated with the health promotion and education practices, as well as with the professionals' work focused on the social health determinants, for directly affecting the health conditions of a given population<sup>(11)</sup>.

According to Abreu et al.,<sup>(12)</sup> there is still a lack of knowledge about HPV, benefiting misperceptions about HPV. Still, according to these authors, the general population needs the minimum knowledge that HPV is transmitted especially through sexual intercourse, that can cause cancer and that HPV can be prevented through vaccine and the use of preservative in sexual intercourse. In addition, they should be aware that the Pap smear test diagnoses the disease.

Considering that the health-disease process has an individual and collective dimension, not restricted to a merely biological aspect, but also includes cultural, environmental, subjective, collective and socioeconomic factors, it is important to point out that individuals and groups of society are differently subject to risk and protection factors, considering that there is an inequality in production and access to social resources, as determinants in this process<sup>(13)</sup>.

The World Health Organization (WHO) determines that, in order for health promotion to take place, programs, policies and activities must be structured in accordance with the principles of holistic conception, intersectoriality, empowerment, social participation, equity, multi-strategy and sustainability actions<sup>(14)</sup>.

Considering social participation as one of the health promotion principles, the test did not point to a significant association between the existence of active municipal health councils and vaccination coverage rates. The absence of association can be explained by the fragility still present in the roots of social control and participatory management.

Empowerment and social participation through councils are paramount for health promotion. Empowerment is closely related to the promotion of personal skills through the education and dissemination of information, understood as tools that raise the range of healthy and conscious choices<sup>(14)</sup>.

Concerning the possible associations of this fact with the socioeconomic indicators, health councils are permanent and deliberative, consisting of collegiate bodies composed of government representatives, service providers, healthcare professionals and users, who act in the creation of strategies and control of the implementation of health policy in its corresponding instance. Health councils are important tools in the process of restructuring health care, especially in relation to the Family Health Program. Thus, in general, the better structured primary care, the greater the access and adherence to health promotion and prevention services<sup>(15)</sup>.

Regarding the guidelines established by the Family Health Strategy, they design a way of health care based on actions directed by social health determinants, observing the subject within their family scenario as part of groups and cultural communities, including important strategies in the Health Surveillance and Health Promotion areas<sup>(16)</sup>.

Vaccination is a preventive action closely related to primary healthcare, since it is developed by this complexity level<sup>(17)</sup>. Thus, even with the lack of significant association pointed out by the test, this component deserves attention because the Family Health Program is the gateway to the health system and prevention and health promotion are one of its main actions.

Therefore, it is important to emphasize the need for action by health managers, with a view to monitoring and evaluating basic healthcare, aiming at a better quality of services provided to the population, especially regarding their relationship with HPV prevention actions.

Therefore, actions aimed at strengthening and qualifying prevention and health promotion actions in the family health strategy are fundamental to construct an integrated and participative agenda, in order to foment

women's action in cervical cancer prevention<sup>(18)</sup>. That is, it is of fundamental importance that the health services at the various levels of care, especially with regard to prevention and health promotion actions, especially vaccination against HPV, prioritizing the dissemination of information and expanding access to health services. These elements must be implemented through intersectoral actions, through a quality and universal public health system, with full access of the population to information qualified and adapted to the different cultures of each territory<sup>(18)</sup>.

The National Health Promotion Policy proposes new ways of organizing, planning, carrying out, analyzing and evaluating the actions carried out in the health area, having, as a structuring basis the indispensability of constituting a relationship with the various public policies in the society<sup>(19)</sup>.

Several reasons can generate a process of illness, as in the case of cervical cancer. However, when diagnosed in its initial phase, it has good possibilities for rehabilitation, thus it is fundamental the development of actions directed to prevention and promotion, recommending the population's access to qualified information and dissemination of knowledge<sup>(20)</sup>.

With regard to the mortality rate due to cervical cancer in the female population, the effective implantation of vaccination actions against HPV is of fundamental importance for contributing to the prevention of malignant and benign tumors of cervical cancer, which are caused by subtypes of the HPV virus, affecting several women worldwide, which can lead to death<sup>(21)</sup>.

Within 10-20 years there should be a reduction in the incidence rates of precursor cervical cancer lesions. For this reason, it is possible to explain this non-association, since the results are long-term, for vaccination effectiveness<sup>(21)</sup>.

Starting from another socioeconomic indicator, which is income, it probably influences individuals' health, considering that the greater the access to income, the better the health, housing and education conditions, as well as the greater access to health goods and services<sup>(22)</sup>.

Peace, housing, education, feeding, income, stable environment, sustainable resources, social justice and equity have been defined by the Ottawa Charter report as the basis for health. The same document defines that health is permeated by social, economic, cultural, environmental, behavioral and biological determinants. Thus, the possibility of individuals having access to social determinants of health directly implies health promotion promotion<sup>(14)</sup>.

Despite the lack of a significant association between the vaccination coverage rate and the income rate, although health services are universal, the most deprived individuals may not have access to preventive and health recovery services, resulting in a poorer health condition. Thus, individuals with more access to income have a better chance of having access to medical consultations, medications, screenings, among others<sup>(22)</sup>.

With UHS implementation, there was a greater participation of municipalities in health financing. The form of financing of the Brazilian health system is operationalized through a mixed modality of budget allocation to municipalities, in which the resource comes essentially from direct transfers to the Municipal Health Fund. A second amount is directly spent on service providers, according to productivity indexes, respecting the amounts established through the standardized chart of procedures of the Unified Health System (UHS). Finally, there is a third amount corresponding to direct employment of the municipalities relative to a minimum percentage coming from their own resources<sup>(23)</sup>.

Nevertheless, with the lack of a significant association with municipal health expenditures, as pointed out by the bivariate correlation, it is estimated that the higher the municipal health expenditures, the better and more comprehensive the services offered should be.

Regarding the accountability of the municipality for the implementation of health services and actions, through the Organic Health Law and the Federal Constitution of 1988, it is necessary for the local manager to allocate resources according to short, medium and long term planning, so that these resources are invested primarily in basic health care services and in the promotion of prevention and promotion actions.

Broader and higher quality access to education services is strongly associated with better living conditions and increased social opportunities in people's daily lives. That is, education, when made available universally and with high quality indices, has the potential to develop individual capacities and enable the full citizenship exercise<sup>(24)</sup>. The significant association corroborates with research on health inequalities, which recurrently attribute their relation to the schooling-education variable.

Schooling level directly influences the way of life and health attitudes. Education represents the most significant dimension of human capital, and its connection with health concerns its attribution in enabling: a) better economic conditions, employment and income; b) greater access to health goods and services and c) ease of access and understanding of health prevention and recovery actions<sup>(25)</sup>.

The relationship between education and health implies that the low schooling condition has a negative influence on health indexes. Therefore, health promotion and intersectoriality should foster the process of social inclusion towards the implementation of equity in public policies<sup>(14)</sup>.

For that matter, the higher the educational level and the better the quality, the better the subjects' ability to have actions related to self-care, as well as their greater involvement in health prevention and recovery programs. On the other hand, low schooling and quality of education relate to unhealthy behaviors, early morbidity and mortality.

For an immunization program to be effective, it is necessary to monitor vaccination coverage, equity of the target population's access to prevention actions. Program's professionals should have clear guidelines and take into account the characteristics of the population of its territory<sup>(26)</sup>.

We raided the following justifications for the highest rates of HPV vaccination coverage in 2014 and 2015: For municipalities that achieved more than 100% of the vaccination coverage rate, the explanation could relate to an error in the target population; or vaccination of girls from other municipalities could have occurred, surpassing the target population in that particular territory. For municipalities with 0% vaccination coverage, this could be justified by a lack of notification in the National Immunization Program (NIP) system or even by the fact that there were no vaccines against HPV in those municipalities.

This fact may associate to regional, cultural, economic development and quality of coverage of primary health services, as well as to the error in raising the target population and non-compliance with the principle of territorialization foreseen by UHS.

Territorialisation is a responsibility of the Family Health Program as one of the UHS principles, developed through the Basic Health Units. It is a fundamental strategy in the sense of diagnosing social, economic and environmental aspects for the planning of effective practices for the population. It can also verify vulnerable localities and/or populations, providing health promotion, prevention and recovery activities<sup>(27)</sup>.

Although the literature points to an association between HPV vaccination coverage rate and cervical cancer mortality rates in the female population, the proportion of the population served assisted by the Family Health Program, municipal health expenditures, existence of active health advice and income, statistical data did not show a significant association between these variables. Only the index of general quality of education showed an association, corroborating with the existing literature, which shows the strong influence of education on the way of life and attitudes regarding health, as well as on access and adherence to health promotion and prevention services.

### **Final Remarks:**

The scenario shows that, although the National Immunization Program is a public policy based on the universality principle and, in the case of vaccination against HPV, be available in sufficient numbers for all its target population, through health services in all municipalities in the state of Minas Gerais, it is still possible to perceive discrepancies of vaccination coverage among municipalities.

Several actions attempt to respond to the challenges posed by HPV vaccination coverage, so that, given the decrease in the average adherence to vaccination in the 2014/2015 period, in the municipalities of Minas Gerais, future HPV vaccination campaigns should be accompanied by educational actions, prioritizing clear information for the target audience and those responsible, respecting regional differences, as well as the factors that influence the possibility of the population having access to services directed to promotion and prevention.

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