

**METHODOLOGY**  
**TO CALCULATE**  
**HPV Vaccine Coverage**  
**in the Region of the**  
**Americas**

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Methodology to calculate HPV Vaccine Coverage in the Region of the Americas  
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Washington, D.C.  
2019

This document  
focuses on  
monitoring  
**HPV vaccine  
coverage  
data** using  
administrative  
data



# Methodology to Calculate HPV Vaccine Coverage in the Region of the Americas

## I. Background

The introduction of the human papillomavirus (HPV) vaccine in the Expanded Program on Immunization (EPI) of the Americas started in 2006 (in the United States). As of June 2019, 40 countries and territories have this vaccine in their national vaccination schedules. The vaccine used most frequently is the quadrivalent (31/40), followed by the bivalent (7/40); and only two countries have used the nonavalent.

Calculating and monitoring vaccination coverage is highly relevant in immunization programs to show achievements and problems, analyze their causes and take effective measures to attain expected results. This document focuses on the monitoring of HPV vaccine coverage data using administrative data. Countries may also conduct on-site follow-ups through rapid coverage monitoring or by taking more in-depth surveys; these two strategies are not covered herein.

Monitoring and following up on HPV vaccination present greater challenges compared to traditional vaccination regimens because, since the introduction of the vaccine in national vaccination schedules, countries have used different vaccination alternatives:

- Vaccination at schools, health facilities, or during campaigns.
- Two- or three-dose schedules.
- The use of first and subsequent doses in different calendar years.
- Different target population: one or more cohorts of girls selected by age at vaccination or by grade in school; vaccination of only girls or of boys and girls (gender neutral).
- Data on target population not always available or updated.

During its July 2017 meeting in Panama, PAHO's Technical Advisory Group (TAG) on Vaccine-preventable Diseases requested that PAHO support countries and territories of the Region in their efforts to document HPV vaccination coverage better at the subnational and national level and in

seeking how these data can be used to define better strategies and attain optimal coverage in target groups for the full vaccination series.

In October 2017, PAHO held a workshop in Antigua, Guatemala with participation from 24 countries in the Region to share experiences with introducing the HPV vaccine. During this meeting, data from the countries available in the joint reporting form (JRF) for PAHO/WHO and UNICEF on immunization for 2016 were analyzed to calculate HPV vaccination coverage. Some of the conclusions from this analysis were the following:

- Some countries do not report the doses administered, but rather only coverage.
- Some countries do not report the target population.
- Some countries have only considered the girls enrolled for vaccination as the target population to receive the first dose.
- Some countries consider the girls enrolled for the first dose as the target population to receive the second dose.
- Some countries do not consider cohort data and report more girls vaccinated with the second dose than with the first.

Additionally, it was concluded that the countries have had difficulty reaching the target population to be vaccinated, that vaccination at school is the strategy shown to be easiest to enroll the target population; and that it has been challenging to consistently report on HPV vaccination coverage.

At the end of the regional workshop, PAHO agreed to develop guidelines to standardize the calculation of HPV vaccination coverage in the Americas.

Given the context, in which the countries have had different vaccination strategies and models at the global level, the World Health Organization (WHO) estimates HPV vaccination coverage for girls at age 15 considering the doses administered at 9 years of age for a given cohort, using data from the United Nations<sup>1</sup> (UN) population estimates as the denominator. This calculation methodology responds to the need to have a method that enables comparing coverage among the different countries.

<sup>1</sup> <http://www.un.org/en/development/desa/population/publications/database/index.shtml>

## II. Objectives

Establish a standard methodology to follow up on vaccine recipients and calculate HPV vaccine coverage in the Americas, allowing to:

- Measure progress on vaccination of the target population selected by country, as well as define strategies to reach pertinent and equitable coverage.
- Compare coverage levels obtained by different countries in the Region and from countries in other regions.
- Compare regional coverage with that of other regions in the world.

## III. Methodology

For these calculations, the following information from the immunization information registry system is required:

- Vaccination dates.
- Age in years at vaccination with a given dose (birth cohort), even if vaccination takes place during a specific grade in school.
- Dose administered (first and second dose, or third if applicable). It is important to ensure that every dose is recorded and consolidated, regardless of the strategy used (intramural or extramural) or the provider (public, private or other).
- Sex of the person vaccinated, stating whether the person is a boy or girl, if the vaccination strategy is for boys and girls.

The country should consider analyzing the indicators proposed in this methodology by place: national, subnational, local, health provider, school, etc.

For purposes of calculating these indicators, *a cohort is defined as the population born from January 1 through December 31 of the same year*. In addition, the country needs to consider the month and year vaccination started and the target population in the same year (a single cohort or different cohorts, that is, people with different birth years).

## Indicators

### • Access

This indicator measures the target population's access to vaccination and facilitates the identification of differences among geographical areas, types of schools, etc., to gear activities towards the areas that need them most.

Calculating the first dose over the target population has the function of **measuring access**.

$$\text{Access} = \frac{\text{Number of first doses administered to a given cohort in a determined year}}{\text{Target population of a given cohort}} \times 100$$

**Example:** In a country, 880 girls born in 2008 and who turned 9 in 2017 were vaccinated with the first dose of the HPV vaccine. According to population data, 1500 is the number of girls who turned 9 in 2017. Therefore, according to the preceding formula:

$$\text{Access} = \frac{880}{1500} \times 100 = 58.7\%$$

Access to the first dose of the HPV vaccine in this country is **58.7%**.

### • Annual coverage

Coverage is a measure of the extent to which the services offered cover potential health needs of the population. In the case of HPV vaccination, having an annual coverage calculation to conduct a follow-up on vaccination during the year in which the measurement is being taken<sup>2</sup> is proposed, as a measure of annual planning performance, as well as to define actions to improve results.

<sup>2</sup> The measurement year refers to the year being evaluated, i.e., January 1 through December 31. For example, if we are evaluating coverage for 2017, we should consider the second doses administered from January 1 to December 31, 2017.



Annual coverage is stated as a fraction where the numerator is the number of second doses of HPV vaccine administered during the year in which the measurement is being taken for a selected cohort. The denominator is the target population of the cohort selected. As mentioned previously, **annual coverage** of the HPV vaccine should be calculated with the second dose.

It is expected that many people in a given cohort will complete the vaccination schedule at different ages than the ages they were at the start of vaccination. Therefore, follow-up on each cohort should be considered.

For the calculation of coverage, population data on each cohort to be vaccinated (target population), which will be the denominator, must be available. If this data is not available, the UN population estimate may be used. Even if the country has chosen to vaccinate in a specific grade in school—for example, girls in the 5<sup>th</sup> grade, perhaps ranging in age from 9-12—coverage must be calculated by age and not by grade in school. The country also needs to consider the population that does not attend school to add that information to the data on people attending school and obtain the total denominator.

$$\text{Annual coverage} = \frac{\text{Number of second doses administered to a selected cohort in a determined year}}{\text{Target population of the selected cohort}} \times 100$$

**Example:** Continuing with the same example, 550 girls out of a cohort of 1500 received the second dose of the HPV vaccine in 2017. Therefore, according to the previous formula:

$$\text{Annual coverage} = \frac{550}{1500} \times 100$$

Annual coverage is **36.7%**.

### • Annual follow-up on cohorts

As mentioned above, coverage is an important measure of performance. For this reason, it is necessary to have an annual follow-up indicator of the cohorts that started their vaccination schedule according to the EPI national schedule in the different vaccination years and use it to estimate those not vaccinated by cohort, thereby making it possible to plan specific actions to enroll them. It is an indicator to measure and achieve maximum coverage in the population targeted for HPV vaccination.

$$\text{Annual follow-up of cohorts} = \frac{\sum \text{ of the second doses administered to a target cohort in the different vaccination years}}{\text{Target population of the selected cohort}} \times 100$$

**Example:** Brazil conducts follow-ups on cohorts of people vaccinated, including all second doses administered in the different vaccination years for each cohort. The country uses the coverage calculation approach for age cohorts in the range of 9 to 15 years. For this purpose, it uses a matrix of consolidated data with the year in the rows and the age groups in the columns, which makes it possible to calculate coverage by vaccination year and by cohort at the different administrative levels (national, subnational and local).

### • HPV vaccine coverage at 15 years of age

Given the diversity of schedules, target populations and strategies used by countries in the Region of the Americas and globally, the HPV coverage indicator at age 15 was established at the global and regional level. In other words, HPV vaccine coverage is calculated for girls who have been vaccinated with the second dose at any time between the ages of 9 and 14. This indicator is intended to measure coverage for international comparison between countries, in addition to having a cut-off indicator of the HPV vaccination strategy for study and evaluation purposes.

$$\text{HPV coverage for girls at 15 years old} = \frac{\sum \text{ of second doses administered to girls 9-14 years old from the first year of vaccination until the year prior to year of analysis}}{\text{Population of the cohort of 15 year-old girls in the year of analysis}} \times 100$$

The doses administered to each cohort should be recorded differentiated by age, year and sex. They should also be monitored to allow for the planning of specific actions to recover dropouts. An advantage of this method is that follow-up on the cohorts can be conducted over time, which will allow future analysis of the impact of vaccine use.

Each country can use as the denominator the UN population data, its census or population estimate, or other, depending on the availability of this information. It is important to emphasize that if the country uses a population other than the UN as the denominator, the calculation of coverage levels may vary somewhat when compared with the WHO calculation, that uses this UN population. Also, the coverage may differ according to a) the year of introduction of the vaccine and b) the population cohorts selected by each country. Countries that introduced the vaccine recently and with a cohort of 9-year-old girls will have to wait six years to obtain that first calculation of coverage at age 15. Those that began including the cohort of 14-year-olds could obtain this coverage calculation available the following year.

**Example:** According to the data from Brazil's template (figure 1), the population of 15-year-old girls in 2017 was 1,726,191 (the population reported by the country is being used for the purposes of this example). From 2013 (first year) through 2016 (previous year), this cohort received  $109,378+967,862+196,754+38,371$  = doses of the vaccine, which represents 76% coverage. It is important to note that doses administered to those at age 15 or over are not considered in the calculation of coverage. Therefore, in the example, the doses given in 2017 (9,940) are not considered for this analysis.

**Figure 1.**

Illustrative model to calculate vaccination coverage (two doses of HPV vaccine) for cohorts of girls from 9 to 15 years of age, 2013 - 2017

Year	Age (Years)						
	9	10	11	12	13	14	15
2017	350,327	379,435	182,990	161,206	138,637	72,186	9,940
2016	255,401	288,204	224,516	177,346	87,924	38,371	
2015	300,787	622,206	737,635	343,225	196,754		
2014	14,301	23,886	589,065	967,862			
2013	480	18,415	109,378				
<b>Total doses administered</b>	350,327	634,836	771,981	1,022,229	1,077,984	1,110,815	1,322,305
<b>Population</b>	1,590,611	1,645,204	1,705,705	1,745,525	1,752,494	1,738,274	1,726,191
<b>Coverage (%)</b>	22.0	38.6	45.3	58.6	61.5	63.9	76.0
<b>Population not vaccinated</b>	1,240,284	1,010,368	933,724	723,296	674,510	627,459	403,886

Source: Coordenação Geral do Programa Nacional de Imunizações/CGPNI/DEVIT/SVS/MS

Note: (i) The total accumulated doses in each age group represents the sum of the cells with corresponding colors (ii) Population estimated by Instituto Brasileiro de Geografia e Estatísticas (IBGE), as of 2012, last one available with sex and age distribution for the 5,570 municipalities.

## • Dropout

### Dropouts measured at 15 years old

Dropout from the HPV vaccine at 15 years old is the proportion of the target population that receives the first dose between the ages of 9 and 14 years old but does not receive the second dose between 9 and 14 years old. This indicator reflects the quality of service and facilitates analyzing failure to follow-up with the HPV vaccination schedule.

Using data on recipients of the first and second doses of the vaccine, it is possible to calculate the drop-out at 15 years old:

$$\text{Dropout at 15 years old} = \frac{(\sum \text{ of first doses administered between 9 and 14 years old} - \sum \text{ of second doses administered between 9 and 14 years old})}{\sum \text{ of first doses administered between 9 and 14 years old}} \times 100$$

### Annual dropouts

The annual dropout measure facilitates closer follow-ups of those who received the first dose but have not received the second dose within a calendar year. The second doses administered to one or more birth cohorts in a determined calendar year can be considered for the analysis. This indicator also reflects quality of service and facilitates analyzing failure to follow-up with the HPV vaccination schedule.

Using data on recipients of the first and second dose, it is possible to calculate the annual dropout:

$$\text{Annual dropouts} = \frac{(\sum \text{ of first doses administered to one or more cohorts during a calendar year} - \sum \text{ of second doses administered to one or more cohorts during a calendar year})}{\sum \text{ of first doses administered to a cohort during a calendar year}} \times 100$$

**Example:** Using the data from the example used in the Access indicator, 550 out of the 880 girls who received the first dose received the second dose in 2017. Therefore, according to the previous formula:

$$\text{Annual dropouts} = \frac{(880 - 550)}{880} \times 100 = 37.5\%$$

The annual dropout is **37.5%**.

#### IV. Conclusions and Recommendations

- 1) Vaccination monitoring and follow-up through the proposed indicators is highly relevant to the EPI, since in this way the progress of vaccination performance can be measured, and timely actions can be taken to improve the established vaccination coverage. However, HPV vaccination presents significant complexity in following up and monitoring because countries have implemented different schedules, target groups and strategies for vaccine administration.
- 2) According to the 2017 WHO position paper<sup>3</sup> and PAHO TAG recommendations on the HPV vaccine, the vaccine is recommended for people aged 9-14 years. Therefore, the calculation of coverage at age 15 can be standardized to establish a regional or global calculation, regardless of the countries' different alternatives for the target population and strategies. Due to the importance of an accurate information in conducting all the proposed analyses, the countries must strengthen their HPV vaccination information systems, incorporating or changing their registry forms to include all necessary and useful data. In addition, the quality of the data in the information system must be ensured. Examples of the forms to be used are provided in the Annex.

<sup>3</sup> <http://bit.ly/HPVWHOpositionpaper2017>

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*PAHO strongly recommends that countries prioritize HPV vaccine coverage estimates, given the limited data available, and submit the JRF annually to PAHO/WHO and UNICEF.*

*This data is used to report back to countries as part of PAHO's immunization program monitoring and reporting.*

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# Annex





1. Table available in the JRF for HPV vaccine reporting

Doses of HPV Vaccine Administered: 2017					
WOMEN					
	Vaccine administered (years of age)	A. 1 <sup>st</sup> dose	B. 2 <sup>nd</sup> dose	C. 3 <sup>rd</sup> dose*	D. Target population
4330	9				
4340	10				
4350	11				
4360	12				
4370	13				
4380	14				
4390	≥15				
4400	Age unknown				

\*WHO recommends a two-dose schedule for girls under 15 years of age (WHO position paper, May 2017). If a two-dose schedule was used, leave column C blank.

2. Example of a registry sheet for doses administered per person at the local level

District: City/Town: Health Service/School:								
ID	Name	Address and telephone	Date of birth (dd/mm/yy)	HPV1		HPV2		Comments
				Date (dd/mm/yy)	Age (years)	Date (dd/mm/yy)	Age (years)	

Source: WHO Document: "Human Papillomavirus Vaccine Coverage Monitoring Tool" (not yet published)

3. Example of a weekly consolidated\* registry sheet for doses administered at the local level

Month/Year of Reporting:	District: City/Town: Health Service/School:		No. of HPV2 doses administered												Comments:																																	
	No. of HPV1 doses administered						9 years HPV2						10 years HPV2						11 years HPV2						12 years HPV2						13 years HPV2						14 years HPV2						≥15 years HPV2					
9	9 years HPV1						9 years HPV2						10 years HPV2						11 years HPV2						12 years HPV2						13 years HPV2						14 years HPV2						≥15 years HPV2					
	Total						Total						Total						Total						Total						Total						Total						Total					
10	10 years HPV1						10 years HPV2						11 years HPV2						12 years HPV2						13 years HPV2						14 years HPV2						≥15 years HPV2											
	Total						Total						Total						Total						Total						Total						Total						Total					
11	11 years HPV1						11 years HPV2						12 years HPV2						13 years HPV2						14 years HPV2						≥15 years HPV2																	
	Total						Total						Total						Total						Total						Total						Total						Total					
12	12 years HPV1						12 years HPV2						13 years HPV2						14 years HPV2						≥15 years HPV2																							
	Total						Total						Total						Total						Total						Total						Total						Total					
13	13 years HPV1						13 years HPV2						14 years HPV2						≥15 years HPV2																													
	Total						Total						Total						Total						Total						Total						Total						Total					
14	14 years HPV1						14 years HPV2						≥15 years HPV2																																			
	Total						Total						Total						Total						Total						Total						Total						Total					
≥15**	≥15 years HPV1						≥15 years HPV2						Total																																			
	Total						Total						Total						Total						Total						Total						Total						Total					

Source: WHO Document: "Human Papillomavirus Vaccine Coverage Monitoring Tool" (not yet published)

\* If the information is consolidated weekly. Otherwise, it may be done monthly.

\*\*Countries that decide to vaccinate people aged 15 or over should adjust the registry and monitoring system for this population according to the vaccination schedule defined by the country.

4. Example of a monthly consolidated registry sheet for doses administered at the local level

Month/Year of Reporting:	District: City/Town: Health Service/School:		Comments:
	HPV1 doses administered	HPV2 doses administered	
Age (years)			
9			
10			
11			
12			
13			
14			
≥15			
<b>TOTAL</b>			

Source: WHO Document: "Human Papillomavirus Vaccine Coverage Monitoring Tool" (not yet published)

5. Example of an annual consolidated registry sheet for first doses administered at the local level

Year of Reporting	District: City/Town:												
	Health Service/School:												
	Number of HPV1 doses administered												
Age (years)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Total annual number of HPV1 doses (by age, add the doses for each month)
9													
10													
11													
12													
13													
14													
≥15													
Total number of HPV1 doses for all children and adolescents (by month, add doses for all ages each month)													

Source: WHO Document: "Human Papillomavirus Vaccine Coverage Monitoring Tool" (not yet published)

6. Example of an annual consolidated registry sheet for first and second doses administered at the national level

Year of Reporting		Country				
Age (years)	Column 1	Column 2	Column 3	Column 4	Column 5	
	Total annual doses of HPV1	Total annual doses of HPV2	Population	(Column 1 ÷ Column 3)*100 HPV1	(Column 2 ÷ Column 3)*100 HPV2	
9						
10						
11						
12						
13						
14						
≥15			Do not complete	Do not complete	Do not complete	
<b>Total doses (all girls)</b>						

Source: WHO Document: "Human Papillomavirus Vaccine Coverage Monitoring Tool" (not yet published)



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