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# Determinants of Vaccination Coverage Against Human Papillomavirus in 10-year-old Girls in 2016 in Rural Senegal

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**Abstract:** Cervical cancer is the first gynecological cancer in Senegal. As part of the cancer control plan, the Ministry of Health and Social Action conducted a pilot phase of HPV vaccination in the districts of Dakar and Mekhe between 2014 and 2016. The objective of this survey is to study the determinants of HPV vaccination coverage in 10-year-old girls in 2016 in the Mekhe health district. This is a descriptive cross-sectional epidemiological study for analytical purposes. A two-stage survey was conducted. The data were collected during an individual interview at the homes of the mothers. The compendium focused on personal characteristics, knowledge and practices on immunization. Full vaccination coverage was determined. Logistic regression was used to identify factors associated with immunization coverage. Respondents were 300 The mean age was 35 ± 9.64 years. Mothers who knew how to prevent cervical cancer were 171 or 57% [95% CI: 51.2-62.7]. Immunization coverage for girls aged 10 years was 86.3% [95% CI: 81.9-90.0]. The discontinuation between the first and second dose of the vaccine was 6.5% [95% CI: 3.9-10.1]. HPV vaccine coverage was related to the residence environment (OR = 3, 18 [95% CI: 1.34-7.56]); (OR = 22.02, [95% CI: 4.2-113.4]) and information for mothers (OR = 10.92 [95% CI: 2.93-40.64]). Vaccination against HPV is a preventive activity that requires the collaboration with the education sector and a good proximity communication.

**Keywords:** Immunization Coverage, HPV, Girl, Determinants, Senegal

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## 1. Introduction

Cervical cancer is a major public health problem. In the world, it ranges second of cancers affecting the woman [1]. This cancer is more common in sub-Saharan Africa with 75,000 new cases and nearly 50,000 deaths each year [2]. In Senegal, it comes to the first place among all cancers diagnosed at the Curie institute of Dakar [3]. Vaccination with Human Papilloma Virus (HPV) is an effective strategy for the prevention of cervical cancer [4]. However, it is not yet integrated into the vaccination program in Senegal. The assessment of acceptability in the countries where it was introduced shows varied rates depending on the country and the used strategy. For a school based approach, vaccine coverage was 82.6% in Peru, 82.9% in Uganda and 96.1% in Vietnam. As for a campaign based strategy in India,

immunization coverage was 77.2% [4], and for the monthly appointment strategy, vaccination coverage was 68.4%.

The study of the factors associated with acceptability showed that the main reason for non-vaccination was school absenteeism [4]. The authors recommend reinforcing motivations to improve acceptability. In Nigeria, the high vaccine coverage was linked mainly to the level of knowledge of mothers [6]. In Kenya, however, the barriers identified were lack of information on vaccine, school absenteeism, potential side effects and low school enrollment [7]. In Mali, the main barrier identified in this study was the poor decision-making power of the target [8].

The identification of barriers linked to immunization will make available to the health authorities evidence to make decisions with a scientific basis. These data will help develop more appropriate and better targeted strategies in order to improve vaccine coverage against HPV. The objective of this

study is to identify the factors associated with the acceptability of HPV vaccination in Senegal.

## 2. Method

### 2.1. Study Design

It is a cross-sectional, descriptive and analytical study.

### 2.2. Study Population

The study concerned girls who were born between 1 December 2005 and 30 November 2006 residing in the Mekhe health district and were 10 at the time of the survey. The campaign based vaccination in two doses for the quadrivalent HPV vaccine took place in schools, in coranic schools; and in an advanced strategy, it took place in the health posts and in the public squares in the villages where health posts and schools are not available.

$$S = \frac{\text{Total Population of villages and districts } (N)}{\text{number of cluster of the sampling}} = \frac{171646}{30} = 5722$$

A selection of the location of the clusters in the administrative units was made using a random number for the first cluster. This random number is between N and S. In each cluster, the first house was chosen at random according to the bottle method. The second house to visit was the one to the right of the first one and the evolution took place gradually from the first house until we end up with the number of children to be recruited for the cluster.

### 2.4. Data Collect

The data collection was done on the basis of an anonymous questionnaire, closed-ended, administered by an interviewer at the respondent's home. The questionnaire was administered with the verbal consent of the respondent. During the training, the translation and the way of asking the questions in local languages were clarified. The questionnaire is first tested on about 20 mothers of children after the training of the investigators. This allowed us to observe the respondents' response to the survey. The data collected included the socio-demographic characteristics of the mother and child, the mother's knowledge, the child's immunization status. The vaccination status of the child was assessed via the card and the vaccination history. A girl is considered fully vaccinated if she received two doses of the quadrivalent HPV vaccine during the HPV vaccination demonstration project.

### 2.5. Data Analysis

The data was analyzed using software R version 3.1.1. Quantitative variables were expressed by the average associated with the standard deviation and the qualitative variables as a percentage. The comparison between the dependent variable vaccination coverage and the qualitative variables was carried out using a Pearson chi-square test.

A downward logistic regression was performed. The vaccine status is the dependent variable to be modeled. All

### 2.3. Sampling

The sample size is calculated using the Schwartz formula.

$$N = [Z\alpha^2 \cdot P (1-P)] / e^2.$$

Z $\alpha$ : = 1.96: discrepancy corresponding to the risk granted ( $\alpha = 5\%$ ,  $z\alpha = 1.96$ ).

P: administrative coverage  $p = 0.92$   $q = (1-p) = 0.08$ .

E: margin of error (set at 5%).

The sample size thus calculated is 226 girls. Taking into account a non-response rate of 10%, we end up with a final size of 300 girls. The two-stage cluster sampling method was used. The first stage of sampling consisted of villages and neighborhoods, the second stage consisting of the households of the geographical areas of the study. First, we list the villages and neighborhoods with their cumulated populations. Systematic random sampling was carried out with a sampling interval marked S calculated according to the formula:

independent variables with a p less than 0.25 [9] in the bivariate analysis were included in the multivariate analysis. The comparison of the models was done by the test of the likelihood ratio with a top-down procedure. The suitability of the model was studied by the Hosmer and Lemeshow test. The association measure was the adjusted odds ratio (OR) and its 95% confidence interval.

## 3. Results

A total of 330 women were interviewed. The mean age was 35 years ( $\pm 9.64$  years). Adolescents accounted for 8.3%. Among the interviewed women, 94.0% were married, 90.0% resided in rural areas and 37.0% were educated. Women with income-generating activities accounted for 44.0%. Schooled girls were 65.1% (table 1).

*Table 1. Sociodemographic Characteristics of Interviewed.*

Characteristics	Absolute frequencies	Relative frequencies (%)
Residence		
Urban	30	10,0
Rural	270	90,0
Age (years)		
>24	275	91,7
<=44	25	8,3
interviewed Profil		
Mother	234	78,0
Guardian	66	22,0
Marital status		
married	282	94,0
Not married	18	6,0
Education		
Yes	111	37,0
No	189	63,0
Income Generating Activity		
Yes	132	44,0
No	168	56,0
Rank of the child in the siblings		

Characteristics	Absolute frequencies	Relative frequencies (%)
>5	30	6,6
<=5	270	93,4
School enrollment		
French School	190	63,3
Koranic School	90	30,0
French and Arabic School	12	4,0
No	8	2,7
Knowledge of cervical cancer		
Yes	173	57,7
No	127	42,3
Knowledge of HPV infection		
Yes	19	6,3
No	281	93,7
Knowledge Link between HPV and Cervical Cancer		
Yes	21	7
No	279	93
Knowledge of prevention means		
Yes	171	57
No	129	43

Welcoming in facilities	satisfactory	288	96
	not satisfactory	12	4
Waiting time in facilities	satisfactory	276	92
	not satisfactory	24	8
Post-Injection Event	Yes	32	11,6
	No	268	89,4
Possession of card	Yes	144	48,0
	No	156	52,0
Vaccination	Yes	259	86,3
	No	41	13,7
Place of vaccination	At school	178	59,3
	Elsewhere	41	13,7

Mothers and guardians who had knowledge about cervical cancer were 57.7%, while only 6.3% knew about HPV. The respondents who knew the link between HPV infection and cervical cancer were 7%. Nearly 90% were aware of the HPV vaccination campaign. Radio (62%) was mentioned as the most common source of information, followed by community relays (59.0%). Teachers and caregivers were

10.7% and 9.3% respectively. The message “cervical cancer is serious” was understood by 86.7% of women during the vaccination against HPV. Vaccination as the main means of prevention was understood by 17.3%.

Girls who received at least one dose of HPV vaccine were 92.3%. The possession rate of an HPV vaccination card was 57.8%. Discontinuation between the first and second dose of the vaccine was 6.5%. Immunization coverage was 86.3% including 50.0% per card and 36.3% per history. The reasons for abandoning immunization were the absence of the girl (44.4%), the absence of information (22.2%) and the parents or the daughter being on travel (30.5%). Eleven percent of the vaccinated girls experienced post-vaccination adverse effects. These were mainly pain (50.0%), fever (36.4%) and dizziness (36.4%). Self-medication was in 65.6% of the cases.

The proportion of fully vaccinated girls living in rural areas was 88.1% compared with 70.0% in urban areas ( $p = 0.011$ ). Immunization coverage for girls with adult mothers was 85.8% versus 92.0% for the others ( $p = 0.30$ ). The proportion of girls who were fully immunized was not associated with the mother's education level ( $p = 0.68$ ) (table 2). HPV vaccination coverage is not related to the practice of an income-generating activity of the mother or caregiver. Immunization coverage for schooled girls was 88% compared to 25% for girls non-schooled girls ( $p = 0.0001$ ). The level of knowledge of mothers and guardians did not influence the vaccination of girls against HPV ( $p = 0.82$ ).

Immunization coverage among girls whose mothers / guardians have knowledge of the link between HPV infection and cervical cancer was 90.5% compared to 86.0 among mothers / caregivers ( $p = 0.43$ ). HPV vaccination coverage for girls whose mothers / guardians were aware of the HPV vaccination campaign was 87.9%. This proportion was 40% for those whose mothers / caregivers were not informed (table 2).

Girls living in rural areas were three times more likely to be fully immunized than girls in urban areas. Girls whose mothers were informed about the vaccination campaign were 10 times more likely to be fully vaccinated than those whose mothers and guardians were not informed (OR = 10.92 [CI: 2, 93-40, 64]) (table 3).

**Table 2.** Distribution of Vaccination According to the Characteristics of the Respondents.

		Immunization n (%)	p
Residence	Rural	238 (88,1)	0,011 3
	Urban	21 (70,0)	
Age (years)	>24 ans	236 (85,8)	0,30
	<=44 ans	23(92,0)	
Instruction	Yes	97 (87,4)	0,68
	No	162 (85,7)	
Income Generating Activity	Yes	114 (86,4)	0,98
	No	145 (86,3)	
Rank of the child in the siblings	Rang<= 5	236 (87,1)	0,18
	Rang>5	23 (79,3)	
Scolarisation of child	Yes	202 (88,0)	0,001
	No	98 (25,0)	

		Immunization n (%)	p
Knowledge of cervical cancer	Yes	150 (86,7)	0,82
	No	109 (85,2)	
Knowledge Link between HPV and Cervical Cancer	Yes	19 (86,8)	0,43
	No	240 (82,9)	
Informations HPV vaccination	Yes	255 (87,9)	0,0006
	No	40 (40,0)	
Welcoming in facilities	Satisfactory	251 (87,2)	0,06
	No satisfactory	8 (66,7)	
Waiting time in facilities	Satisfactory	239 (86,6)	0,42
	No satisfactory	20 (83,3)	
Place of vaccination	School	232 (87,5)	0,082
	Elsewhere	27 (77,1)	
Sources informations (neighborhood godmother)	Yes	165 (92,7)	0,0001
	No	94 (77,0)	
Information channel	Proximity Communication	209 (91,3)	0,0009
	Mass media	50 (70,4)	

**Table 3.** Factors Associated with Immunization (logistic Regression).

		OR IC 95%
Residence	Rural	3, 18 [1,34-7,56]
	Urban	1
Rank of The Child in The Siblings	<= 5	1,75 (0,66-4,62)
	>5	1
Scolarisation of Child	Yes	22, 02[4,2; 113,4]
	No	1
Informations Hpv Vaccination	Oui	10,92 [2,93-40,64]
	Non	1
Welcoming in Facilities	Satisfaites	1,60 (0,32-7,85)
	Non Satisfaites	1
Place of Vaccination	School	2,08 (0,87-4,96)
	Elsewhere	1
Sources Informations (Neighborhood Godmother)	Yes	3,78, [1,86-7,65]
	No	1
Information Channel	Proximity Communication	4,38 [2,21 8,71]
	Mass Media	1

## 4. Discussions

The fully immunized girls were 86.3%. This immunization coverage was associated with the girl's area of residence, schooling, information for mothers and the source of information. In this study, The complete vaccination was documented in 50% of the children. This raises the problem of keeping the vaccination card. This aspect must be taken into account when scaling up immunized girls, otherwise it will be difficult to evaluate or monitor the progress of this intervention. Vaccination coverage was 86.3%. Similar results were found in Peru (88.9%), Vietnam (83%). A study in 21 developing countries that implemented vaccine demonstration projects against HPV showed vaccine coverage ranging from 67% in Georgia to 100% in Bolivia [10]. The differences noted are mainly due to the target and the strategies developed. This demonstrates the feasibility of vaccination against HPV in middle-income countries by adopting targeted immunization strategies in schools and health facilities and involving the community at all stages. In Rwanda [11], an active search for girls who missed their appointments was carried out systematically with the involvement of community members, the private sector and the media, achieving high coverage (93.3%).

Girls living in rural areas were three times more likely to be fully immunized than girls in urban areas. Similar findings were noted in India [6] and Tanzania [12]. The difference in coverage according to the place of residence is explained by the socialization of the populations in rural areas, the inhabitants being essentially from the same families. Thus reference to an authority is often de rigueur and favors a greater adhesion of these populations of the rural world to the programs of health especially when they are free.

Immunization coverage was also associated with girls' schooling. In Tanzania [12] and Rwanda [11] similar results have been found. Ladner et al also found a positive association between immunization coverage and girls' education [10]. These concordant findings are explained at the contextual level because these studies have been carried out in countries that have implemented HPV vaccination demonstration projects in which the girls' immunization strategy at school has been mainly adopted with the involvement of the health, education and community sectors. In addition, the enrollment rate of 80% in Senegal has enabled schoolgirls to be more accessible to immunization services, while parents have been receptive to information coming from the school.

This study did not show a very significant association between vaccination coverage and knowledge about cervical

cancer. However, girls whose mothers were informed about the vaccination campaign were more likely to be fully vaccinated. Proximity communication was significantly associated with high immunization coverage. Other studies have obtained similar results [10]. An analysis of the performance of HPV vaccination implementation programs in 21 countries has shown that the involvement of populations and communities through communication and target tracking is a positive factor associated with the completeness of HPV vaccination. However, the information must be better articulated, indeed, only 17.3% of mothers have retained "vaccination as the main means of prevention against cervical cancer".

## 5. Conclusion

The HPV vaccination project in the Mekhé district achieved vaccine coverage above the 70% target. HPV vaccination coverage is positively associated with several factors. The challenge of a high rate of girls' school attendance, information for the population and the inclusive organization of activities is a guarantee for the success of cervical cancer control through vaccination.

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