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Associated Factors with Vaccination among Girls Aged between (11) and (13) against Papillomaviruses in Koumpentoum Health District (Senegal)

El Hadji Cheikh Abdoulaye Diop[1,2*], Abdoul Aziz Ndiaye[2], Martial Coly Bop[2]

[1]District Sanitaire de Koumpentoum, Ministère de la Santé et l'Action Sociale, Koumpentoum, Sénégal
[2]Unité de Formation et de Recherche en Santé et Développement Durable, Université Alioune DIOP de Bambey, Bambey, Sénégal
Email: *docdiop82@gmail.com

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Abstract

Introduction: Cervical cancer can be prevented by early vaccination of young people against papillomaviruses and screening for precancerous lesions. After a successful pilot phase, vaccination coverage in the generalization phase is low. The aim of this study was to determine papillomavirus vaccination coverage and to identify associated factors. **Methods:** This was a cross-sectional, descriptive and analytical study conducted from (1st) to (31th) September (2020) in Koumpentoum district. After a literature review, we conducted two-stage cluster sampling and direct structured interviews. Socio-demographic characteristics, knowledge, attitudes, and practices of mothers or guardians about papillomaviruses vaccination were collected using a standardized questionnaire. Multiple logistic regression was used to estimate odds ratios. **Results:** A total of (228) mothers or guardians were interviewed. Coverage for the first dose was (44.74%) $CI_{95\%}$ (38.17 - 51.44) compared to (25.88%) $CI_{95\%}$ (19.52 - 31.17) for the second dose. Factors statistically and significantly associated with coverage of the first dose of papillomaviruses vaccine were instruction of mothers or guardians (OR = 5.62 (3.16 - 9.99); p < 0.001), schooling of the young girls (OR = 4.1 (2.23 - 7.53); p < 0.001), information on cervical cancer (OR = 18.97 (5.68 - 63.24); p < 0.001), knowledge of risks factors (OR = 8.04 (4.41 - 14.63); p < 0.001), information on papillomaviruses vaccine (ORa = 10.26 (1.69 - 62.23); p = 0.011), knowledge on vaccine target (OR = 17.11 (8.51 - 34.41); p < 0.001), knowledge of schedule vaccine (ORa = 3.67 (1.2 - 22.51); p = 0.022), knowledge of prevention methods (OR = 26.86 (12.22 - 59.05); p < 0.001), and to be favorable in expanded vaccination program in general (ORa = 18.71 (1.5 - 128.41]; p =

0.02). **Conclusion:** Vaccination of young girls against papillomaviruses in Koumpentoum health district could be improved by comprehensive interpersonal communication with mothers and guardians about cervical cancer and its prevention.

Keywords

Vaccination, Girls, Papillomavirus, Koumpentoum, Senegal

1. Introduction

Cervical cancer develops in the anatomical part of the female reproductive system that separates the vagina from the uterus. Almost all cases are due to chronic infection with the human papillomavirus (HPV), making it a preventable and curable cancer [1]. It is the (4th) most common cancer in women, with approximately (604,000) new cases. It is also the (2nd) most common female cancer in less developed regions, which accounts for (85%) of new cases. In (2020), cervical cancer caused (320,000) deaths worldwide [2]. Almost all, or 90% of these deaths, occurred in developing countries, particularly in sub-Saharan Africa, where it is steadily and markedly increasing [3] [4].

In Senegal, in (2020), cervical cancer occupies the (1st) place, with (10%) of all cancers and all sexes combined. It is also the leading female cancer with (26.8%) of cancer cases [4]. The survival rate at (1) year is (32%) and (1%) at (5) years [5]. The World Health Organization (WHO) has approved the use of bivalent vaccines against HPV (16) and (18) or quadrivalent vaccines against types (6), (11), (16) and (18). Vaccination of girls aged between (11) and (13) years against HPV should be the central element of national prevention strategies [6]. After a pilot phase (2014-2016) in the health districts of Dakar West and Mékhé, the quadrivalent HPV vaccine (Gardasil®) has been introduced in the Expanded Program on Immunization (EPI) since November (2018) at a rate of (2) doses spaced (6) months apart for girls aged (9) to (10) years. During the pilot phase, complete vaccination coverage in Dakar West was (90.5%) in (2015) and (96%) in (2016) [7]. These very satisfactory results contrast with those of the scale-up. Indeed, in (2020), for a target of (90%), national HPV vaccination coverage was (32%) for the (1st) dose and (13%) for the (2nd). The majority, (67) out of (79) districts, had not reached the (90%) target [8]. In (2020), according to administrative data, HPV vaccination coverage in the Koumpentoum health district was (45%) for the (1st) dose and (35%) for the (2nd) [8].

Caroline D *et al*. in their systematic review conducted in sub-Saharan Africa with a majority of articles from South Africa, Uganda and Kenya, found that the causes of non-vaccination against HPV were lack of information of mothers or guardians and fear of infertility associated with the disease [9].

What are the factors associated with HPV vaccination coverage in the Koumpentoum health district? The objective of this research was to determine HPV

vaccination coverage in the Koumpentoum health district among girls aged between (11) and (13) years and to identify associated factors in order to make recommendations for improvement.

2. Methodology

2.1. Study Framework

The population of the district was estimated in (2020) at (164,409) inhabitants on a surface area of (7652) km^2, or a density of (21.48) inhabitants/km^2. The town of Koumpentoum is home to the health centre, which provides reference activities and also offers primary health care (PHC). It polarizes (22) health posts that only offer PHC. The expanded program of immunization (EPI) target is accessible to (51%) in fixed and displaced fixed strategy, (35%) in advanced and (14%) in mobile [10].

2.2. Study Type and Period

This was a cross-sectional, descriptive and analytical study. Data collection period was from (1^{st}) to (30^{th}) September (2020) throughout the district.

2.3. Study Population

The study population consisted of girls aged between (11) and (13) years. However, for ethical and cultural reasons, mothers or guardians were interviewed.

2.4. Inclusion and Non-Inclusion Criteria

Mothers or guardians of girls aged between (11) and (13) years who refused to participate were absent or ill at the time of the survey were not included. Similarly, girls aged (11) to (13) years who refused to participate were absent or ill at the time of the survey were not included.

2.5. Sampling

The study target of girls aged between (11) and (13) years was (12,955) [11]. We calculated the sample size according to Schwartz's formula [12]: $N = Z^2 \times p \times (1 - p) \times d/i^2$ with p = desired full vaccination coverage estimated at (90%), q = (1) − p = (10%), i = margin of error set at (0. 05), d = (1.5) is the design effect; $N = (1.96^2) \times (0.90) \times (0.10) \times (1.5)/(0.05)^2 = (207)$, add (10%) non-responders and the final size N = (228). The sampling was stratified in two stages. The first stage corresponded to villages or neighborhoods. A simple random selection of one village or neighborhood from each area of responsibility was made. The second stage corresponded to households. To select the compound, the interviewer stood in the sociological centre of the village or neighborhood and determined a random direction by throwing a pen in the air with the tip pointing in the direction of departure, always starting with the first compound. An exhaustive census of the mother or guardians of young girls aged between (11) and (13) years was carried out.

2.6. Study Variables

The dependent variable was the uptake of the first dose of HPV vaccine by girls aged between (11) and (13) years. The independent variables were related to socio-demographics, knowledge about cervical cancer and the HPV vaccine, attitudes towards EPI and HPV vaccination and HPV vaccination practices.

2.7. Data Collection

We used an HPV vaccination data collection form and administered a closed questionnaire directly to the mothers or guardians of young girls aged between (11) and (13) years.

2.8. Pre Test

A pre-test was carried out with (30) mothers or guardians of young girls aged between (11) and (13) years in the health centre area with the administration of the survey forms and the stabilization of the data entry mask. The pre-test data were not included in the analysis.

2.9. Data Management and Analysis

Preparation of the data entry mask in Epi-info version (7.2) made it possible to constitute a database. Data analysis was carried out with the softwares Epi Info (7.25.0), SPSS version (20) and R version (4.05).

In descriptive part, the quantitative variables were described with their extremes, means and standard deviations, while the qualitative variables were described with their frequencies surrounded by their confidence intervals (CI) at (95%). In the bivariate analysis part, the Pearson's chi2 statistical test and the Fisher's test under conditions of applicability verified existence of statistically significant relationships.

Multiple logistic regression was used for the multivariate analysis. All independent variables with a $p < (0.25)$ in the bivariate analysis and those for which the literature review revealed a link with the dependent variable. A stepwise top-down approach was used to retain variables associated with vaccination at the $p < (5\%)$ threshold. These were then removed one by one with a nested model comparison by the Aikake information criterion (AIC) [13] until no improvement was found by the maximum likelihood test. The Hosmer-Lemoshow test [14] was used to check the fit of the final model. The bivariate OR and multivariate adjusted OR with their (95%) CIs were used to assess the strength of the relationship between the independent and dependent variables.

2.10. Ethical Considerations

The study protocol was submitted to the health authorities for approval. The survey was explained to the participants through an information letter read in the local language. Free consent was collected on a form and signed by mothers or guardians who consented to the survey. Data collected remained anonymous

and confidential.

3. Results

3.1. Description of the Study Population

In this study, (228) mothers or guardians were interviewed. The average age was (37.67) years (±8.59). More than two thirds of them (67.11%) were under the age of (40).The notion of living in a union was found in (92.54%) of the cases and only (7.02%) resided in urban areas. Among mothers or guardians, (41.67%) were educated, (61.91%) had young girls in school and (22.81%) were engaged in income generating activities (IGA) (Table 1).

While information on cervical cancer was found in (78.51%) of the cases, only (41.67%) knew the risk factors and (51.14%) the means of prevention. Mothers or guardians were aware of the HPV vaccine in (65.35%) of the cases, (41.67%) knew the target of the vaccine and (27.19%) the HPV vaccination schedule. The acceptability of routine EPI vaccination was (91.67%). The coverage of the (1^{st}) dose was (44.74%) and that of the (2^{nd}) dose was (25%), *i.e.* a drop-out rate of (44.11%). The main sources of information were community health workers with (34.64%) and health providers with (32.96%). The main reasons for non-vaccination were lack of knowledge (71.43%) and fear of side effects (10.32%) (Table 2).

3.2. Bivariate Analysis

In bivariate analysis, statistically and significantly factors associated with coverage of the first dose of the HPV vaccine were schooling of mothers or guardians (OR = 5.62 (3.16 - 9.99); $p < 0.001$), schooling of the young girls (OR = 4.1 (2.23 - 7.53); $p < 0.001$), information on cervical cancer (OR = 18.97(5.68 - 63.28); $p < 0.001$), knowledge of risks factors (OR = 8.04 (4.41 - 14.63); $p < 0.001$), information on HPV vaccine (OR = 16 (6.53 - 39.18); $p < 0.001$), knowledge on vaccine

Table 1. Distribution of mothers or guardians and young girls by socio-demographic characteristics, Koumpentoum, 2021.

Variables	Modalities	Absolute frequencies (n)	Relative frequencies (%)
Place of residence	Urban	16	7.02
Age group	≤40 years	153	67.11
Life in a couple	Yes	211	92.54
Instruction of mothers/guardians	Yes	95	41.67
Schooling of young girls	Yes	148	61.91
Practicing an IGA	Yes	52	22.81

Table 2. Distribution of mothers or guardians according to knowledge, attitudes, practices on cervical cancer and HPV vaccination, Koumpentoum, 2021.

Variables	Modalities	Absolute frequencies (n)	Relative frequencies (%)
		n = 228	
Information on cervical cancer	Yes	179	78.51
Knowledge of risk factors	Yes	95	41.67
Information on HPV vaccine	Yes	149	65.35
Knowledge of HPV vaccine target	Yes	125	54.82
Knowledge of HPV vaccination schedule	Yes	62	27.19
Knowledge of prevention methods	Yes	128	51.14
Favorable EPI in general	Yes	209	91.67
Take first dose	Yes	102	44.74
Take second dose	Yes	57	25
Drop out	Yes	45	44.11
	Information sources n = 179		
Community health workers	Yes	62	34.64
Health providers	Yes	59	32.96
Others	Yes	58	32.4
	Reason of non vaccination n = 126		
Lack of knowledge	Yes	90	71.43
Fear of side effects	Yes	13	10.32
Others	Yes	23	18.25

target (OR = 17.11 (8.51 - 34.41); p < 0.001), knowledge of schedule vaccine (OR = 12.06 (5.67 - 25.63); p < 0.001) , knowledge of prevention methods (OR = 26.86 (12.22 - 59.05); p < 0.001),and to be favorable in EPI in general (OR = 16.83 ([2.2 - 128.41]; p < 0.001) (Table 3).

3.3. Multi Variate Analysis

In multiple logistic regression, statistically and significantly factors associated with receiving the first dose of HPV vaccine were information about vaccination (ORa = 10.26 (1.69 - 69.23); p = 0.011), knowledge of the HPV vaccination schedule (ORa = 3.67 (1.2 - 11.51); p = 0.022), and support for EPI in general (ORa = 18.71 (1.51 - 22.23); p = 0.02) (Table 4).

3.4. Limitation of the Study

Although the target was girls aged between (11) and (13) of school age, teachers

Table 3. Identification of factors associated with taking the 1st dose of HPV vaccine in bivariate analysis, Koumpentoum, 2021.

Variables	Modalities	Respondents n = 228		P value	OR	$CI_{95\%}$
		Yes	No			
Residence	Urban	6	10	0.369	0.72	[0.25 - 2.06]
	Rural	96	116			
Age group	≤40 years	72	81	0.159	1.33	[0.76 - 2.33]
	>40 years	30	45			
Life in a couple	Yes	93	118	0.323	0.7	[0.26 - 1.88]
	No	9	8			
Instruction of mothers/guardians	Yes	65	30	<0.001	5.62	[3.16 - 9.99]
	No	37	96			
Practicing an IGA	Yes	25	27	0.292	1.19	[0.64 - 2.21]
	No	77	99			
Schooling of the young girls	Yes	83	65	<0.001	4.1	[2.23 - 7.53]
	No	19	61			
Information on cervical cancer	Yes	99	80	<0.001	18.97	[5.68 - 63.28]
	No	3	46			
Knowledge of risks factors	Yes	69	26	<0.001	8.04	[4.41 - 14.63]
	No	33	100			
Information on HPV vaccine	Yes	96	63	<0.001	16	[6.53 - 39.18]
	No	6	63			
Knowledge on vaccine target	Yes	89	36	<0.001	17.11	[8.51 - 34.41]
	No	13	90			
Knowledge of schedule vaccine	Yes	52	10	<0.001	12.06	[5.67 - 25.63]
	No	50	116			
Prevention methods	Yes	93	35	<0.001	26.86	[12.22 - 59.05]
	No	9	91			
Favorable on EPI	Yes	101	108	<0.001	16.83	[2.2 - 128.41]
	No	1	18			

and Koranic masters were not interviewed to collect their knowledge, perceptions, attitudes and practices and to question their influences on HPV vaccination.

4. Discussion

Factors statistically and significantly associated with coverage of the first dose of the HPV vaccine were instruction of mothers or guardians (OR = 5.62 (3.16 - 9.99); $p < 0.001$), schooling of the young girls (OR = 4.1 (2.23 - 7.53); $p < 0.001$),

Table 4. Identification of factors associated with taking the 1st dose of HPV vaccine in multiple logistic regression, Koumpentoum, 2021.

Variables and modalities	adjusted OR	$CI_{95\%}$	P value
Residence rural yes versus no	1.065	[0.17 - 6.93]	0.945
Age (≤40) yes versus no	1.017	[0.38 - 2.71]	0.974
Life in a couple yes versus no	2.449	[0.54 - 11.1]	0.246
Instruction of mothers or guardians yes versus no	1.08	[0.29 - 2.2]	0.667
Practicing an IGA yes versus no	1.07	[0.35 - 3.27]	0.906
Information on cervical cancer yes versus no	4.36	[0.21 - 88.8]	0.338
Risk factors for cervical cancer yes versus no	2.06	[0.86 - 4.94]	0.102
HPV vaccine information yes versus no	10.26	[1.69 - 62.23]	0.011
HPV vaccine target yes versus no	1.81	[0.52 - 6.31]	0.35
HPV vaccination schedule yes versus no	3.67	[1.2 - 11.51]	0.022
Schooling of young girls yes versus no	1.76	[0.61 - 5.03]	0.292
Cervical cancer prevention methods yes versus no	1.04	[0.23 - 4.58]	0.954
Support for EPI in general yes versus no	18.71	[1.51 - 22.23]	0.02

information on cervical cancer (OR = 18.97 (5.68 - 63.24); p < 0.001), knowledge of risks factors (OR = 8.04 (4.41 - 14.63); p < 0.001), information on HPV vaccine (ORa = 10.26 (1.69 - 62.23); p = 0.011), knowledge on vaccine target (OR = 17.11 (8.51 - 34.41); p < 0.001), knowledge of schedule vaccine (ORa = 3.67 (1.2 - 22.51); p = 0.022), knowledge of prevention methods (OR = 26.86 (12.22 - 59.05); p < 0.001), and to be favorable in EPI in general (ORa = 18.71 (1.51 - 28.23]; p = 0.02).

In our sample, there was no association between the place of residence of mothers or guardians and HPV vaccination of young girls, contrary to the results of North American [15] and Chinese [16] [17] [18] authors. Indeed, the latter found that overall HPV vaccination coverage was higher in developed countries and urban areas than in developing countries and suburban and rural areas. However, Faye *et al.* in Kaffrine found the opposite with higher HPV vaccination coverage in rural areas [19]. This lack of difference in our sample can be explained by the fact that the department of Koumpentoum is essentially rural and does not have any large cities [10].

The age of the mothers or guardians was not associated with the vaccination of the young girl in accordance with the results found in national series such as Faye *et al.* [19] and Ndiaye *et al.* [20]. However, one might expect greater receptivity on the part of young mothers or guardians and greater mobility and at-

tendance at health facilities due to cultural realities.

We did not find an association between mothers or guardian's marital status and girl's vaccination, as in the series by Ndiaye *et al.* [20]. However, the education of mothers or guardians was associated with vaccination of young girls, as in the series of Ndiaye *et al.* (OR = 1.97; (1.81 - 2.25); p = 0.01) [20] but in contrast to that of Faye *et al.* [19]. The dissemination of key messages in local languages (Fulani, Mandingo, Serer and Wolof) by community prevention and promotion actors (community relays and aunts), health providers and Niani FM radio improved access to health information.

There was no relations between the practice of an IGA and the vaccination of young girls, contrary to the series of Ndiaye *et al.* [20] (ORa = 1.21 (1.13 - 1.85); p < 0.001), and Alene T. *et al.* [21] (ORa = 3.44 (1.97 - 6.01); p < 0.05), where the income of the head of the household was predictive of the vaccination of young girls. Indeed, even if HPV vaccination is free, there may be direct and indirect costs associated with mothers or guardians and young girls travelling to service points. These costs can be a barrier to vaccination, hence the need to strengthen advanced and mobile strategies.

Young girls whose mothers or guardians were informed about cervical cancer (OR = 18.97 (5.68 - 63.24); p < 0.001), knew its risk factors (OR = 8.04 (4.41 - 14.63); p < 0.001) and knew how to prevent it (OR = 26.86 (12.22 - 59.05); p < 0.001) were more likely to be vaccinated. Similar associations between vaccination of young girls and knowledge of cervical cancer and the possibility of cure were found by Alene T. *et al.* in Gondar, Ethiopia (ORa = 5.42 (2.69 - 11.52); p < 0.05) [21], Ndiaye *et al.* in Dakar [18] (ORa = 3.05 (2.75 - 4.53); p < 0.001) [20] and by Thiam in Kédougou (ORa = 2.98 (1.19, 7.47); p = 0.025) [22].

Knowledge of HPV vaccination (ORa = 10.26 (1.69 - 69.23); p = 0.011), knowledge of the target to be vaccinated (OR = 17.11 (8.51 - 34.51); p < 0.001) and knowledge of the HPV vaccination schedule (ORa = 3.67 (1.2 - 11.51); p = 0.022) were predictive of better vaccination of young girls. This association between good knowledge of HPV vaccination and vaccine uptake was also found in the series by Rabiu A. *et al.* in Nigeria (OR = 6.11 (1.37 - 27.34); p = 0.018) [23], Faye *et al.* in Kaffrine (OR = 10.92 (2.93 - 40.64); p < 0.001) [19] and Thiam in Kédougou (ORa = 2.98 [1.19 - 7.47]; p = 0.025) [22].

The main reasons for non-vaccination were lack of information in (71.43%) of cases and fear of side effects in (10.32%). This indicates the need to increase awareness among mothers or guardians, by diversifying communication channels, about cervical cancer, its causes, means of prevention of the disease, HPV vaccination and its safety.

Young girls whose mothers or guardians were supportive of the EPI were more likely to be vaccinated against HPV (ORa = 18.71 (1.51 - 22.23); p = 0.02). This indicates the importance of comprehensive interpersonal communication about cervical cancer and its prevention and the fact that the HPV vaccine has become a component of the EPI.

Mothers or guardians who have school education was more likely to vaccine their daughters (OR = 5.62 (3.16 - 9.99); p < 0.001) according to Ndiaye *et al*. [20] (ORa = 1.97; (1.81 - 2.25); p < 0.001). This link may be related to better understanding and adherence to health policies and a higher standard of living for educated mothers or guardians.

Also, young schooled girls were more likely to be vaccinated (OR = 4.1 (2.23 - 7.53); p < 0.001). This finding was also found during the pilot phase in 2016 by Sy K. *et al.* in West Dakar [7]. Indeed, the target young girls aged between (9) and (14) are mainly in primary and secondary school. Consequently, awareness, involvement and collaboration with the national education sector are imperative in order to reach this school target and the vaccination coverage objective of (90%).

5. Conclusion

The information provided to mothers or guardians is crucial to achieving the vaccination coverage target. Factors associated with low HPV vaccination coverage in the Koumpentoum health district are related to mothers' or guardians' lack of knowledge, which is a consequence of insufficient and inadequate communication. HPV vaccination coverage could be significantly improved through an acceleration plan focusing on interpersonal communication and involving national education sector.

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Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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