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Associated Factors with the Child's Fully Immunized in the Tambacounda Health District (Senegal)

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Abstract

To improve vaccination coverage among children under one year of age in the Tambacounda health district, a household survey was carried out among mothers or babysitters. The objective was to study the factors related to child's fully immunized in children aged 12 to 23 months. The cross-sectional, descriptive and analytical survey was carried out during the month of April 2019. A multistage cluster survey selected a sample of 657 mothers and babysitters. The data was collected using a questionnaire made from the World Health Organization reference guide. Data entry and analysis were done with Epi Info software and R. Among the women surveyed, biological mothers were the most representative (96.9%). In the series, 74.1% had a good knowledge of the age for initiating vaccination, 78.2% knew the number of contacts. The vaccination record of the children was available in 92.2%, and 71.0% of them had presented an adverse event. The proportion of children fully immunized was 41.0%. Complete childhood vaccination was positively associated with income-generating activity in women (0R = 2.4) and the short distance (<100 m) between home and place of vaccination (OR = 1.5). It was also improved by having a qualified health worker as a vaccinator (OR = 1.4) satisfaction in relation to visit (OR = 2.0), the advice given by the vaccinator (OR = 1.7) and the fixing of the date of the next vaccination appointment (OR = 2.5). The implementation of a good strategy for improving the quality of immunization services is an important element for strengthening immunization coverage in the Tambacounda health district.

Keywords

Vaccination, Child Health, Immunization Coverage, Senegal

1. Introduction

Vaccination consists of immunizing a person against an infectious disease, generally by administering a vaccine [1]. It constitutes an essential component of the human right to health and an individual, collective and governmental responsibility.

Vaccines prevent the death of more than 2.5 million children each year [2]. Sheltered from vaccine-preventable diseases, vaccinated children can grow up in good condition and reach their full potential [2]. There is overwhelming evidence to demonstrate the benefits of immunization as one of the most effective and cost-effective health interventions known. Vaccination has allowed the eradication of smallpox, an achievement considered one of the greatest triumphs of humanity [3]. However, according to the WHO there are still 24 million children under the age of one year, almost 20% of children who are born each year, who cannot receive vaccines [2].

Senegal, to lead an effective and lasting fight against these vaccine-preventable diseases, has developed, like other countries, an immunization system integrated into primary health care called the Expanded Program on immunization (EPI) since 1979. Since then, several efforts have been made across the country with effective national vaccine coverage ranging from 59% in 2005 to 63% in 2011, then to 70% in 2013, to reach 74% in 2014 [4] [5] [6] [7].

In 2018, the proportion of children fully vaccinated was 82% at the national level. Even if the national target of 90% has not been reached for the country, it can be seen from 2005 to 2017 that vaccination coverage has improved for all antigens. Despite the multiple vaccination strategies implemented in the Tambacounda health district, the proportion of children fully vaccinated remains low. Administrative data from the Tambacounda health district established this coverage at 57% in 2018 while the national coverage was 76.6% [8]. In order to strengthen demand, this study seeks to identify the factors associated with the complete vaccination of children 12 to 23 months of age in the Tambacounda health district.

2. Methodology

2.1. Study Framework

The Tambacounda health district is located in the department and region of the same name. The Tambacounda region, located in the south-east of the country, is the largest region and only concentrates 5.5% of the population, making it the region with the lowest occupation of space.

The Tambacounda health district has an area of 11,416 km^2 with an estimated population in 2018 of 274,697 inhabitants, and a natural growth rate of 2.7%.

Fixed and advanced vaccination strategies are used to make it easier for the whole population to access vaccination in the interests of equity. All health facilities offer the routine vaccination service. During these different strategies, all the antigens in the program are delivered:

- one dose of Bacillus Calmette-Guerin (BCG) vaccine,
- three doses of Oral poliovirus (OPV) vaccine,
- three doses of Pentavalent vaccine (Penta) include DTP (Diphteria, Tetanus and Pertussis) + Hepatitis B + Heamophilus influenzae b,
- three doses of Antipneumococcic (Pneumo) vaccine,
- two doses of Measle-Rubeola (MR) vaccine,
- one dose of Yellow fever (YF) vaccine.

There are six contacts vaccination, only MR2 is administered after the first birthday.

2.2. Study Type

The study was transversal, descriptive and analytical and took place from April 15 to 30, 2019.

2.3. Study Population and Sampling Protocol

The study population consisted of mothers and/or babysitters of children aged 12 to 23 months residing in the area of the Tambacounda health district.

Not included in the study were mothers or babysitters who expressed their refusal to participate, and those who were not available for the administration of the questionnaire.

The sample size was calculated using Schwartz's formula [9]. To maximize the sample size, the expected prevalence was set at 0.5, with a z of 1.96 for an alpha risk of 5%. The precision was set at 5%. A cluster effect of 1.5 was considered giving a size of 577, rounded to 600. The sample was divided into 40 clusters of 15 mothers and babysitters each.

A multistage cluster sampling methodology was carried out for sampling. It was about selecting:

- First stage: A stratified survey was carried out at this level. It consisted first of all in distributing the 40 clusters at the level of the 23 health posts in the district and then identifying the districts and villages to be surveyed. An allocation proportional to the size of the population was made at this level. Thus, depending on the population served by the health post, one or more clusters were allocated to each area. Each cluster corresponded to a district or village, selected by systematic random survey.
- Second stage: The second degree of sampling allowed the selection of concessions to be investigated at the neighborhood and village level. At this level, a systematic random survey was used while respecting the proportions between the different villages. At the village level, all of the concessions were numbered. The sampling pool (interval between two household numbers) was calculated by dividing the total number of concessions in the village by the number of concessions to be surveyed. The first concession to be investigated was identified by drawing a number between the first concession and the number of the survey step, the supervisor drew up the list of concessions to

be investigated for each village to be investigated.

- Third stage: This level of survey concerned the selection of mothers and babysitters within the concessions. All mothers/caregivers of the selected concession and fulfilling the selection criteria were surveyed. However, a mother and a babysitter could not be selected for the same child at the same time. Thus, for each household the mother had priority. In her absence the babysitter was selected. Only one person had to be selected in each concession included. When more than one person met the criteria for inclusion in the same household, a simple random survey was conducted by the interviewer. When the number of mothers/babysitters found in the household was equal to 1, it was selected without drawing.

2.4. Collection of Data

The data was collected from a questionnaire developed for this purpose and inspired by the WHO reference manual [10].

The questionnaire was administered during an individual interview with mothers and/or caregivers of children aged 12 to 23 months. Data relating to the child's immunization status was collected from the vaccination card or from the history of vaccination reported by the mother or babysitters.

Apart from the child's immunization status, the interviewers also collected in households, information relating to socio-demographic characteristics, factors linked to the vaccination system, knowledge, attitudes and practices of mothers and babysitters on vaccination.

Thirty-eight interviewers, who had at least a medium secondary education and spoke the local language, were selected and trained to administer the questionnaire

2.5. Data Entry and Analysis

The data was entered in Epi info. A double entry was made to guarantee the quality of this entry.

The data was analyzed with the R 3.3.1 software [11]. Qualitative variables were described with absolute and relative frequencies and quantitative variables by mean and standard deviation.

Bivariate analysis was made to identify the factors associated with fully immunization. The odds ratio, surrounded by their 95% confidence interval (calculated by the Woolf method), made it possible to assess the existence of a statistical link and its strength.

2.6. Ethical Considerations

Taking part in this study was voluntary. It was done after free and informed consent. Investigators administered a comprehensive information form to the mother or caregiver. Confidentiality and anonymity were respected throughout the process.

3. Results

At the end of the study, 657 people were surveyed, including 637 biological mothers, or 96.7%.

The average age of the women surveyed was 31 years with a standard deviation of 7.6 years. The minimum age of these women was 15 and the maximum age of 60. Women aged 25 - 34 were the most represented. The majority of women surveyed was not in school (62.7%) and had no income-generating activity (92.5%). Wives represented 98.3% of the sample (Table 1).

Table 1. Characteristics of the women surveyed and the child targeted (n = 657).

Parameters	Absolute frequencies (n)	Relatives frequencies (%)
Women's age groups		
[15 - 25 years[	235	35.8
[25 - 35 years[	315	48.0
[35 - 45 years[	89	13.4
45 years and over	18	2.8
Place of residence		
Rural	354	53.9
Urban	303	46.1
Marital status of the child's mother		
Married	646	98.3
Widow	8	1.2
Divorced	3	0.5
Single	0	0.0
Incomegenerating activity		
Yes	49	7.5
No	608	92.5
Education of the child's mother		
Yes	245	37.3
No	412	62.7
Gender of child		
Boy	350	53.3
Girl	307	46.7
Rank of child in siblings		
1	145	22.1
2	132	20.1
3	148	22.5
4	67	10.2
5	108	16.4
6 and over	57	8.6

Continued

Knowledge of the number of contacts		
Yes	515	78.4
No	142	21.6
Knowledge of the age of first contact		
Yes	490	74.6
No	167	25.4

The children were 12 to 23 months old with an average age of 18 months and a standard deviation of 3.20. The median age was also 18 months and the sex ratio (boys/girls) was 1.14. They were male in 53.3% of cases.

The women surveyed were among 74.6% of the women surveyed who were among the same as the age of first vaccine contact (from birth). The correct number of recommended vaccine contacts was cited by 78.4% of the women surveyed (Table 1).

No unvaccinated child was found during this investigation. The vaccination of the child was mainly done at the health posts (56.0%), by a community worker in 54.3% of the cases.

Vaccine coverage by antigen was all greater than 55%. However, adequate coverage (proportion of children fully immunised) was only 41.0%. The Penta1/MR1 drop-out rate was 32.7% against 3.0% for the Penta1/Penta3 drop-out rate (Table 2).

59.0% of the children were not fully vaccinated. The main reasons cited by mothers and caregivers for this incomplete vaccination was as follows:

- fear of adverse effects cited in 36.3% of cases;
- a trip outside the region in 24.7% of the cases;
- loss of the vaccination card in 12.4% of cases;
- the long distance between home and vaccination site in 8.5% of cases.

According to mothers and caregivers, an adverse post-immunisation manifestation was found in 71% of children. These were mainly fever (58.6%), incessant crying (27.8%), persistent local pain (9.0%) and swelling at the injection site (6.8%).

Child's fully immunization was positively associated with the presence of income-generating activity in the mother (OR = 2.43), the high rank of the child in the siblings (OR = 1.5), the short distance between the home and the place of vaccination (OR = 1.5), the qualified profile of the vaccinator (OR = 1.4).

Women's satisfaction with the quality of the vaccination service was also positively associated with child's fully immunization; with satisfaction with reception (OR = 2.0), advice from the vaccinator (OR = 1.7) and that of sharing the date of the next contact (OR = 2.5) (Table 3).

4. Discussion

In this study, the women surveyed were mainly the children's mothers (96.9%).

Table 2. Characteristics on childhood vaccination (n = 657).

Parameters	Absolute frequencies (n)	Relatives frequencies (%)
Child's vaccination location		
Health post	368	56.0
Village (advanced strategy)	199	30.3
Health center	84	12.8
Hospital	5	0.8
Private clinic	1	0.1
Distance between home and place of vaccination		
Less than 100m	288	43.9
At least100m	369	56.1
Profile of the vaccinator		
Doctor, nurse or midwife	300	45.7
Community worker	357	54.3
Systematic delivery of information by the vaccinator		
Date of next contact	571	86.9
Adverse effects of the vaccine administered	539	82.0
Vaccine-protected diseases	440	67.0
Availability of vaccination record		
Yes	606	92.2
No	51	7.8
Vaccines received		
BCG	606	92.2
OPV 1	622	94.7
OPV 2	577	87.8
OPV 3	552	85.4
Penta 1	577	87.8
Penta 2	552	85.4
Penta 3	560	85.2
Antipneumococcic 1 (Pneumo 1)	610	92.8
Antipneumococcic 2 (Pneumo 2)	585	89.0
Antipneumococcic 3 (Pneumo 3)	552	85.4
Yellow fever (YF)	390	59.4
Measle-rubeola 1 (MR1)	388	59.1
Differences between antigens of same contact		
Penta1/OPV1	45	7.23
Penta2/OPV2	25	4.33
Penta3/OPV3	8	1.42
Penta1/Pneumo1	33	5.40

Continued

Penta2/Pneumo2	33	5.64
Penta3/Pneumo3	8	1.42
MR1/YF	2	0.51
Fully immunization of child		
Yes	269	41.0
No	388	59.0
History of adverse reactions after childhood vaccination		
Yes	466	71.0
No	191	29.0
Women's satisfaction with immunization services		
Reception	612	93.2
Waiting time	561	85.4
Vaccinator behavior	618	94.1
Advice on child health	578	88.0
Sharing the date of the next contact	609	92.7

Legends: BCG: Bacillus Calmette–Guerin vaccine; OPV: Oral poliovirus vaccine; Penta: DTP (include Diphteria, Tetanus, Pertussis) + Hepatitis B + Heamophilus influenzae b; Pneumo: Antipneumococcic vaccine; MR: Measle-Rubeola vaccine; YF: Yellow fever vaccine.

Table 3. Factors associated with complete childhood vaccination (n = 657).

Parameters	Fully immunized n (%)	OR [IC à 95%]
Place of residence		
Rural	124 (41.0)	1
Urban	145 (41.0)	0.99 [0.7 - 1.4]
Marital status of the child's mother		
Maried	265 (41.0)	1.22 [0.4 - 4.2]
Widow or divorced	4 (36.4)	1
Income generating activity		
No	239 (39.3)	1
Yes	30 (61.2)	**2.43 [1.3 - 4.4]**
Education of the child's mother		
Yes	100 (41.0)	1
No	169 (41.0)	0.99 [0.7 - 1.4]
Gender of child		
Boy	137 (39.1)	0.85 [0.6 - 1.2]
Girl	132 (43.0)	1
Rank of child in siblings		
First	49 (33.8)	1
Others ranks	220 (43.0)	**1.5 [1.1 - 2.2]**

Continued

Knowledge of the number of contacts		
Yes	215 (41.7)	1
No	54 (38.0)	0.85 [0.6 - 1.2]
Knowledge of the age of first contact		
Yes	198 (40.4)	1
No	71 (42.5)	1.1 [0.8 - 1.5]
Distance between home and place of vaccination		
At least 100 m	135 (36.6)	1
Less than 100 m	134 (46.5)	**1.5 [1.1 - 2.0]**
Availability of vaccination record		
Yes	249 (39.2)	1
No	20 (41.1)	1.08 [0.6 - 1.9]
Profile of the vaccinator		
Community worker	134 (37.5)	1
Doctor, nurse or midwife	135 (45.0)	**1.4 [1.1 - 1.9]**
History of adverse reactions after childhood vaccination		
Yes	193 (41.4)	1
No	76 (39.8)	0.93 [0.6 - 1.3]
Women's satisfaction with reception		
Yes	257 (42.0)	**2.0 [1.1 - 3.9]**
No	12 (26.7)	1
Women's satisfaction with waiting time		
Yes	237 (42.2)	1.5 [0.9 - 2.3]
No	32 (33.3)	1
Women's satisfaction with vaccinator behavior		
Yes	257 (41.6)	1.6 [0.8 - 3.2]
No	12 (30.8)	1
Women's satisfaction with vaccinator advice on child health		
Yes	245 (42.4)	**1.7 [1.1 - 2.8]**
No	24 (30.4)	1
Women's satisfaction with sharing the date of the next contact		
Yes	258 (42.4)	**2.5 [1.2 - 4.9]**
No	11 (23.0)	1

In similar studies in Senegal, biological mothers were also more representative [12] [13] [14] with 91.4%, 93.1% and 93.3% respectively.

In our series, 53.8% of women resided in rural areas, which is in line with the estimates of the target for the health district establishing the rural population at

55.0% [15].

Among the women in this series, 92.5% were not engaged in any income-generating activity. Diop [14] had worked on a similar population in the Thilogne district where 92.4% were not engaged in income-generating activities. In the works of Tine to Popenguine [13] and Seck to Matam [16], these proportions were 79.0% and 89.4%. It emerged from our study that there was a statistically significant link between vaccination and the presence of income-generating activities of the mother. Children of mothers with income-generating activities were 2.43 times more likely to be fully vaccinated. Seck [16] had also found the same association and linked it to the improvement in the availability of financial resources that women could use to get to health facilities.

42.2% of the children were either 1st or 2nd of their siblings. This may be linked to the young age of the mothers surveyed. The child's rank in the siblings was statistically associated with the completeness of the vaccination.

The availability of the vaccination card could be a guarantee of complete vaccination. Indeed, Tine [13] had found that the availability of the vaccination card was a factor which increased the child's complete vaccination. In our study, the log was available in 89.5% of cases. However, it was not statistically linked to the complete vaccination of the child with an odds ratio of 0.93 [0.6 - 1.3].

Vaccination was carried out in 45.7% of the cases by qualified personnel in our study, and 79% in that of Tine [13]. This difference can be explained by the inequality in the distribution of qualified human resources between the two districts. In fact, the Popenguine health district is one of the smallest districts in Senegal with better accessibility of populations to health centers and posts in which qualified providers operate. Good accessibility to qualified providers is a favorable factor for complete vaccination, since children vaccinated with health workers with this profile are 1.5 times more likely to have full coverage.

In our series, 43.9% of the women surveyed walked less than 100 m to reach the immunization services. This indicates the proximity of the vaccination units. This good geographic accessibility was a factor favoring complete vaccination in our study with an odds ratio of 1.5 [1.1 - 2.0]. A similar result was found by Mezoe [17] in Cameroon by demonstrating that the greater the distance between the village and the health post, the less the child was likely to be fully vaccinated.

Vaccination coverage was above the national target (90%) for only three antigens, namely BCG (92.2%), OPV1 (94.7%) and Pneumo1 (92.8%). These performances were similar to those of Diop [14] and Tine [13]. Low coverage was noted for the YF and MR1 antigens with 59.4% and 59.1% respectively. The Penta1/Penta 3 dropout rates (2.94%) were close to those found in the work of Seck [16] who found 8.6%, and Diop [14] who estimated it at 9%. These acceptable drop-out rates (less than 10%) were the result of the search for irregular children by the system for stimulating irregulars and lost to follow-up in certain vaccination units. However, the search for the target of children 9 months and older was insufficient in this series because the dropout rate Penta1/MR1 was very high, at 32.7%.

The reasons most often cited by mothers and/or caregivers for non-vaccination were fear of adverse effects [36.3%] and travelling outside the region [24.7%]. Faye A [17], for his part, had found that the main reasons for leaving were lack of time (40.3%), forgetting the appointment (33.2%), loss of record card (10.3 %) and travel (7.7%).

The women interviewed had good knowledge of the age of first contact (74.6%) and the number of contacts for a complete vaccination (78.4%). These proportions of good acquaintances are high compared to other studies in Senegal. Indeed, the proportion of mothers and babysitters knowing the number of contacts was only 24.2% with Diop [14] and 37.9% with Tine [13]. This difference can be linked to important communication initiatives at the community level implemented in the Tambacounda health district since 2015 to strengthen knowledge and improve the use of immunization services [15].

The quality of the vaccination service offer is an important element in improving adequate coverage at the level of the Tambacounda health district. In fact, our study has shown that the satisfaction of the mother or caregiver improves the completeness of the child's vaccination. The factors positively influencing the completeness of this vaccination were satisfaction with reception (OR = 2.0), advice given by the vaccinator on the health of the child (OR = 1.7) and sharing the date of the next appointment (OR = 2.5).

5. Conclusion

Low adequate vaccination coverage is a reality in the Tambacounda health district. Improving the quality of the routine immunization service offer (geographic accessibility, reception, client-provider interaction, profile of qualified provider) is the main lever on which the district could rely to strengthen vaccine coverage.

Conflicts of Interest

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

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