

## Association of Vaccination Coverage Factors with Children's Immunization Status in the Local Government of Djougou in Benin in 2013

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### Abstract

**Introduction:** In recent years, several epidemics, especially measles, had been notified in some local governments of Benin such as the one of Djougou.

**Objectives:** This study aims to assess vaccination coverage and identify immunization system factors associated with children immunization status.

**Methods:** It was a cross-sectional, descriptive and analytical study. It had been conducted from 29th to 31st August, 2013 and involved 410 children aged of 12 to 23 months and their mothers/minders. The study also focused on the officers of 13 immunization services. Those respondents were randomly selected through cluster sampling in 30 villages of the local government of Djougou.

**Findings:** Coverages with tuberculosis vaccine (BCG), with vaccines against diphtheria, tetanus, pertussis, haemophilus influenzae b, and viral hepatitis B 1st, 2nd and 3rd doses (DTP1 - Hep1 - Hib1, DTC2 - Hep2 - Hib2, DPT3 - Hep3 - Hib3) and measles vaccine were respectively 96.30%, 92.90%, 89.00%, 84.60% and 72.00%. Concerning the immunization status, 29.02% of the children were not fully vaccinated. After analysis, six immunization system-related factors associated with immunization status were identified.

**Conclusion:** About one out of three children was not completely vaccinated. These results may explain the occurrence of measles epidemics recorded in the local government.

**Keywords:** Immunization status; Associated factors; Benin

### Introduction

In Benin, infant and child mortality decreased from 167 to 125 for 1000 live births from 1996 to 2006 [1]. To reduce that mortality, the WHO considers that immunization helps avoid each year 2.5 million deaths of children associated with diphtheria, tetanus, whooping cough or pertussis and measles [2,3]. In the first semester of 2013, two measles' epidemics were registered in the municipality of Djougou, respectively in the 8th and 17th epidemiological weeks [4,5]. The investigations which had been performed suspected, among other factors, non-vaccinated targets among many of the cases recorded, vaccine quality and compliance with immunization procedures. This study aims to determine immunization coverage with antigen in children and identify immunization status-related factors associated with the immunization system in the local government of Djougou in 2013.

### Setting and Methods

#### Study setting

The study took place in the local government of Djougou located in the Djougou-Copargo-Ouaké health zone. It should be mentioned that Benin health system consists of thirty-four (34) health zones. Djougou is about 450 kilometers far from Cotonou and it has a surface area of 3966 km<sup>2</sup> with a total population estimated at 259, 858 inhabitants in 2013. The local government has 13 health centers; each one had an immunization service. About 80% of the active population exerts agricultural and animal husbandry activities. At social and cultural level, many ethnic groups live together there. The main sociocultural group is the Yom-Lokpa group who represents 51.5% and Islam is the major religion practiced (72.3%) [5].

#### Type, population and period of study

It is a cross-sectional, descriptive and analytical study which was conducted from August 29 to 31, 2013. Population study consisted of children aged 12 to 23 months in the study period. It also included their mothers/minders and immunization services officers of the local government. Sample size had been determined by means of Schwartz

formula with  $k = 2$  as clustering effect. Number of children per cluster was  $392/30 = 13.06$  rounded to 14. i.e.  $14 \times 30 = 420$ .

### Sampling technique

As regards immunization services officers, it was a census; and for children and their mothers/minders; it was a cluster sampling.

### Study variables

The study dependent variable was immunization status, a binary variable which is "Good" for fully vaccinated child, and « Poor » for incompletely vaccinated child. The independent variables were grouped into factors related to parents' knowledge on immunization and factors related to immunization services.

### Data collection technique and tools

The data collection techniques used were structured individual interview with mothers/minders of eligible children and with immunization services officers and some of the data collected in the health centers had been processed and analyzed based on the documents available. Three data collection tools used were: questionnaire submitted to mothers/minders, data processing form for collecting data related to health centers and interview guide for immunization services officers.

### Operational definitions

Geographical accessibility to immunization: defined by the location of children residence at less than 5 kilometers from the immunization station.

### Data processing and analysis

The interview guides and data processing forms were processed manually. Data were entered into the questionnaires with Epi data 3.5.1 software and were analyzed with Epi info software version 3.5.1. Frequency and association measures served to describe and analyze the collected data. Karl Pearson's unadjusted chi-square ( $X^2$ ) test and Fisher's exact test were used to identify an association between two variables. Threshold for statistical significance was set at  $p = 0.05$ . We admitted that there was statistically significant association between two variables for any probability lower than 0.05 ( $p < 0.05$ ).

### Ethical and professional considerations

The informed consent and favorable opinion of target children's parents and immunization services' staff were obtained after explaining the purpose of the survey, its implementation and its interest. The respondents were reassured regarding anonymity and confidentiality of collected information. For this purpose, we used digital characters as identification marks of our survey forms. We requested the authorization of political and administrative authorities and got it.

### Results

In total, 420 children aged 12 to 23 months, 420 mothers/minders and 13 officers of immunization services participated to the study. No target of the sample refused to answer interviewer's questions. We excluded from the analysis the data of 10 children and of their mothers/minders (2.38%) for non-compliance with inclusion age criterion and data inconsistency. The analysis thus focused on 13

officers of immunization services, 410 children and 410 mothers/minders. Children's sex-ratio was 0.99 and mean age of children's mothers/minders was 27.79 years  $\pm$  5.75 years. Concerning educational status or background, 60.00% of mothers had received no education against 40.00% who were educated, including 25.12% for primary school level, 14.63% for secondary school level and 0.25% for university level.

### Mother's knowledge about immunization

The study demonstrated that 29.03% of mothers/minders did not know any Extended Program of Immunization (EPI) target disease against 70.97% who knew at least one (poor or satisfactory knowledge). Mothers had a good knowledge of EPI schedule in 50.98% of the cases, against 49.02% who had a bad knowledge of it. At least one advantage of immunization had been mentioned by 89.27% of mothers against 10.73% who did not know any. Concerning immunization side-effects, 85.61% did not know any, against 14.39% who were able to mention at least one.

### Mother's opinion about immunization services

Mothers or minders claimed that they spent on average the sum of 475.63 FCFA  $\pm$  192.02 FCFA (0.78  $\pm$  0.31 USD) per child immunization session. Concerning reception, 9.27% of them claimed to have been poorly received at immunization sessions against 91.73% considering the reception as acceptable. Waiting time for immunization had been considered as very long by 11.95% of mothers against 88.05% who found it acceptable. About one out of 5 mothers (19.02%) were once victims of missed opportunity of immunization. Two thirds (66.66%) claimed to have received advices on immunization during immunization sessions. Health workers were identified as the main channel of information on immunization in 59.27% of the cases. The study pointed out that 62.40% of mothers were informed that child should benefit from free of charge mosquito net during the last immunization campaign (measles and yellow fever vaccines) against 37.60% who had not that information. Out of the 295 children who received measles vaccine, 181 i.e. 61.35% actually received free of charge mosquito net and 38.65% had received no information.

### Organization and functioning of immunization services

Interview with the immunization staff of the 13 health facilities indicated that 15.38% of health workers had never received training on EPI management. Among those who were trained on EPI management, the last training session dated back on average to 3.18 years  $\pm$  2.48 years. Health workers' experience in EPI was 7.23 years  $\pm$  5.35 years on average. As far as accessibility is concerned, 86 villages out of 115 in the Local government, i.e. 74.78%, are located at more than 5 km far from a health center. Out of 376 advanced strategies scheduled for the first semester, 313 were implemented, i.e. 83.24%. Concerning continuity of immunization services, no health facility had performed immunization every day of the week; the number of immunization sessions varied between 1 and 3 per week with an average of 1.76  $\pm$  0.83. Only one supervision of immunization activities during the first semester of 2013 was implemented over two planned before. No health facility had EPI micro-plan or budget for immunization activities. Among the children interviewed, 281 out of 410 had an immunization card (68.50%). As far as immunization strategies are concerned, 80.70% of the children were vaccinated through fixed strategy against 19.30% through advanced strategy.

### Immunization coverage

According to vaccination cards and mother's statements, coverages with vaccines against tuberculosis (BCG), diphtheria, tetanus, pertussis, haemophilus influenzae b, and viral hepatitis B 1st, 2nd and 3rd doses (DTP1-Hep1-Hib1, DTP2-Hep2-Hib2, DTP3-Hep3-Hib3) and eventually against measles/yellow fever (MV/YFV) were respectively 96.30%; 92.90%; 89%; 84.60% and 72.00%. According to vaccination card only, those coverages were respectively 97.90%; 96.40%; 92.50%; 87.90% and 77.20% for BCG, DTP1-Hep1-Hib1, DTP2-Hep2-Hib2, DTP3-Hep3-Hib3 and MV/YFV respectively. According to statements and vaccination cards, 3.41% did not receive

any antigen against 2.10% according to vaccination card only. Out of the 410 children, 291 were completely vaccinated (70.98%) against 119 incompletely vaccinated children (29.02%).

### Factors associated with immunization status

The analysis suggested that knowledge of EPI target diseases, knowledge of immunization schedule, reception quality, missed opportunities, counseling during vaccination campaigns and free mosquito net policy were factors significantly associated with immunization status as indicated in Table 1.

Incompletely vaccinated children					
Variables	Total (N)	Number	Percentage (%)	P-value	Khi <sup>2</sup>
<b>Knowledge of EPI target diseases</b>					
None	119	44	36.97	0.01	8.81
Low	252	70	27.78		
Satisfactory	39	5	12.82		
<b>Knowledge of the EPI schedule</b>					
Good	209	35	16.75	< 0.0000001	31.2
Poor	201	84	41.79		
<b>Reception quality at the immunization service</b>					
Good	372	102	27.42	0.02	5.01
Poor	38	17	44.74		
<b>Missed opportunities for immunization</b>					
Yes	78	32	41.03	0.009	6.73
No	332	87	26.21		
<b>Advice received on immunization</b>					
Yes	271	68	25.09	0.01	5.99
No	139	51	36.69		
<b>Information on free access policy post-vaccination LLINs</b>					
Yes	256	55	21.48	0.0000014	18.81
No	154	64	41.56		
LLINs: Long-Lasting Insecticidal Nets					

**Table 1:** Distribution of child immunization status according to some characteristics related to EPI management.

Besides, many other factors investigated were not significantly associated with immunization status. These are immunization side-effects ( $p = 0.05$ ), waiting time for vaccination ( $p = 0.15$ ) and immunization fixed or advanced strategy ( $p = 0.56$ ).

### Discussion

The cluster sampling method validated in several studies on immunization coverage was used for the selection of villages/areas visited. As well, the questionnaire used derived from standardized

models [1,6,7]. Nevertheless, this study has some limits related to information gathering in children with no documents. However, all the preventive measures certainly enabled to reduce possible information biases and contribute to validity of results.

The immunization coverages encountered in this research work, compared to 2013 national standards which were 98% for BCG, 96% for DTP3-Hep3-Hib3 and 92% for VAR/VAA, indicate a gradual decline in coverage from BCG to measles/yellow fever vaccines (MV/YFV). These shortfalls may be due to lack and obsolescence of the

rolling stock, inadequacy and lack of motivation of staff, poor reception and decline in sensitization on immunization. These results are similar to those found out by EPI review in 2008 in Benin [6], and those published by Faye et al. in Senegal in 2010 [8]. But they are different from those of Bouvier et al. in Switzerland in 1994 [9], and of the 3rd Population and Health Survey (EDS III) carried out in Benin in 2006 [1]. The differences observed with Bouvier et al. may be due to the fact that the study population which is European and its health culture would seem to be more favorable for immunization adherence.

The proportion of children non-completely vaccinated was 29.02%. The result is close to 30.40% and 32.00% found respectively by Makoutodé et al. in 2006 in Benin [7] and by Benin EPI review in 2008 [6]. In 2010, Faye et al. [8] had found in Senegal 32.6%. But it is different from the one of Benin EDS III in 2006 [1] who identified that 53% of the children had not been completely vaccinated. This difference may be due to the improvements brought to the immunization program since 2006 in Benin.

The high rate of implementation of advanced immunization strategies may explain the absence of association between immunization status and the distance separating the place of residence from the health center. But, a study conducted by Shafiqullah et al. in Kabul in Afghanistan pointed out that immunization status was associated with proximity of health centers [10].

The study showed that knowledge of EPI target diseases and immunization schedule was significantly associated with immunization status. This situation suggests that improvement made to children's immunization coverage and immunization status necessarily involve actions towards mothers, especially in the area of sensitization on immunization.

In his research work, information on the free mosquito net policy at sessions for immunization against measles was significantly associated with immunization status. This reflects that the policy of distribution of free mosquito nets during vaccination periods impacted positively on children's immunization status through parent's additional motivation. As regards vaccination services, the study proved that poor reception, missed opportunities and advices on vaccination were significantly associated with immunization status. These factors adversely influenced the children's immunization status. These results confirm the conclusions made by Makoutodé et al. in Benin [7] and by Schwartz et al. in Gabon [11]. By contrast, the study pointed out that waiting time, convenience of vaccination days and immunization strategy, were not significantly associated with immunization status. However, proportions in the group of children non-completely vaccinated were higher. This may be explained by the fact that, when waiting time is long or too much long, mothers/minders tend not to come back to vaccination, particularly if the latter exert an income generating activity. They will also tend to abandon vaccination sessions which coincide with the days of market or of their economic activities.

## Conclusion

The study conducted in the Local government of Djougou has pointed out that one out of three children was not completely vaccinated. Many factors related to the immunization system were identified as associated with immunization status. These are, among others, bad reception, missed opportunities for immunization, absence of advices on vaccination, mothers' poor knowledge on EPI and vaccination schedule. The proportion of children not completely vaccinated identified in the study would well account for the occurrence of measles epidemics in the local government and throughout the country. Therefore, it is necessary to develop sustainable strategies focused on factors identified in this research work in order to improve the immunization coverages and keep them above national standards.

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