

Factors Associated to the Non-adherence to Vaccination Appointments in the Ngambe Health District, Littoral Region, Cameroon: A Case Control Study

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Authors' contributions

This work was carried out in collaboration among all authors. Author RN conceive the study, authors RN and DT designed the study and wrote the protocol, with supervision from authors DN and LN. Author RN performed the statistical analysis and wrote the first draft of the manuscript. Authors DN and LN managed the analyses of the study. Author RN managed the literature searches. All authors read and approved the final manuscript.

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ABSTRACT

Background: Vaccination is what is strongly recommended in protecting against childhood diseases. The Expanded Program of Immunization (EPI) in Cameroon started in 1976 as a pilot project and became operational all over the country in 1982 where vaccination is seen a fundamental right of every child in the country. However, rural areas have lots of constrains to the effective implementation of vaccination programs some of which are population-related.

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Purpose: This study aimed to assess the association between some factors and adherence to vaccination appointments in Ngambe Health District; a typical rural health district in Cameroon.

Methods: This was a case control study where the vaccination records of health facilities in the district were reviewed and parents who respected their vaccination appointments formed the controls while those who missed a vaccination appointment were the cases. They were then traced for interviewed and data analyzed using Epi infos version 3.5.4.

Results: Out of 94 parents, 37.2% had missed a vaccination appointment. In parents older than 36, the odds of missing an appointment was 11 (95%CI 3.69-34.43) while those with <4 children were 0.10 less likely to miss an appointment (95%CI 0.04-0.28). Parent's education, household size and ANC attendance also influenced adherence to vaccination appointments. After adjustment, only age and whether or not child was born in the hospital remained statistically significant associated with adherence.

Conclusion: User related factors influence uptake of vaccination services in the Ngambe Health District of Cameroon; a rural area, some of which are age of the parents, number of children the parent has and the total household size. Therefore, adding to the availability of vaccines, a high-level political commitment aimed at increasing utilization of health services and effectively taking vaccination to the population are indispensable.

Keywords: Factors; associated; adherence; vaccination appointments; Ngambe Health District; Cameroon.

1. INTRODUCTION

When it concerns protection against certain childhood diseases, vaccination is what is strongly recommended by the medical community [1,2]. Vaccines are available to prevent many diseases in people of all ages. The primary vaccine-preventable diseases of childhood are diphtheria, invasive diseases caused by the *Haemophilus influenzae* type b (Hib) bacterium, measles, poliomyelitis (polio), rubella ("German" measles), Tuberculosis (TB), tetanus, mumps, varicella (chickenpox), pertussis (whooping cough) pneumococcal infections, and diarrhea with rotavirus [3,4].

Parental decisions regarding immunization are very important for increasing the immunization rate and compliance, decreasing any possible immunization errors. Deficiencies in parents' knowledge about the importance of vaccination, lack of knowledge on the various diseases for which their children are being protected, the adverse effects and contraindications of vaccines often lead to many immunization errors including children up-to-date vaccinations [5,6]. Parental decision to take their children for vaccination is also affected by socio-demographic variables. Some of these factors include whether or not a child is in a rural area, the distance to the hospital where vaccination takes place and many other socio-demographic parameters like single parenthood, family size, and age of the mother [7-9].

In Cameroon, Expanded Program of Immunization (EPI) started in 1976 as a pilot project that was coordinated by the Organization for the Coordination of the Control of Endemic Diseases in Central Africa (OCEAC). This pilot project became operational in all the regions of the country in 1982 where vaccination is seen a fundamental right of every child in the country [4]. However, immunization coverage is still below target. Recent WHO and UNICEF reports showed a decline in the immunization coverage between 2009 and 2011 from about 91% to 75% and a slight increase to 85% in 2013 [10].

The Cameroon government is already doing a lot to take vaccines to the target population and reduce any inequality to accessibility to immunization activities. This is done using various strategies like the outreach and the mobile strategies where health teams leave the health facilities with vaccines to meet the population in their localities. Also, punctual Supplementary Immunization Activities (SIAs) are carried out after every 6 months and/or when need arises. Still, children are not being vaccinated and on time as scheduled. In the rural settings where outreach strategies are primordial in achieving vaccination target, after vaccination sessions, some vaccines can't go back to the cold chain if some condition are not met. This leads to unopened vial vaccine wastage, translating to less vaccines available, further leading to low immunization coverage. This study therefore was to investigate how some factors

relate to the non-adherence to vaccination appointments in a typical rural health district in Cameroon.

2. MATERIALS AND METHODS

2.1 Study Design

This was a community based case control study where health facility records were reviewed to identify the cases and the controls. They all were traced and questionnaire administered after obtaining written consent to participate in the study. Targeted were parents who started to vaccinate their children (with BCG) in January 2015. Cases were parents who had missed at least one vaccination appointment between January and April 2015 (between BCG up to and including the 3rd DPT dose). While the control group were parents who had not missed any appointment within the same time frame.

2.2 Study Setting and Procedure

The study was carried out in the Ngambe Health District (NHD), Littoral region, Cameroon. Ngambe is a typical rural area in the Sanagal Maritime Division of the Littoral region, Republic of Cameroon. This Health District embodies two Sub-Divisions which are the Massouk-Songloulou Sub Division and the Ngambe sub-Division. Ngambe Health District has 7 health areas; each of these health areas has at least an Integrated Health Center (IHC) to cater for the health needs of the population with a District Hospital serving as the first referral health facility.

Firstly, vaccination registers in all the health functional health facilities in the health district were reviewed to identify the cases and the controls. Then they were all traced back to their respective communities and contacted for questionnaire administration as shown in Fig. 1.

2.3 Sample Size Determination

To determine the sample size for this study, the formula for sample size comparing two proportions was used as used by Shuaib et al. [11]. The formula is:

$$n = \frac{2 [Z_{crit}\sqrt{2P(1-P)} + Z_{pwr}\sqrt{P_1(1-P_1) + P_2(1-P_2)}]^2}{d^2}$$

Where: n is the total sample size (the sum of the sizes of the two groups; the control and the cases). Z_{crit} is the standard variate of the Z distribution assuming at a significance level of 5% (1.960). Z_{pwr} is the value the Z distribution assumes at the statistical power of 80% which is 0.842. P_1 and P_2 are the proportion of the event in the control and the cases respectively and P is the average of P_1 and P_2 . D is the absolute value of the minimum expected difference between the two proportions. $d = |P_1 - P_2|$.

From a study carried out by Faisal Shuaib et al. [11], the proportion of children who did not adhere to their vaccination appointments whose parent or guardian attended higher than primary school was 28.2%. The proportion of children

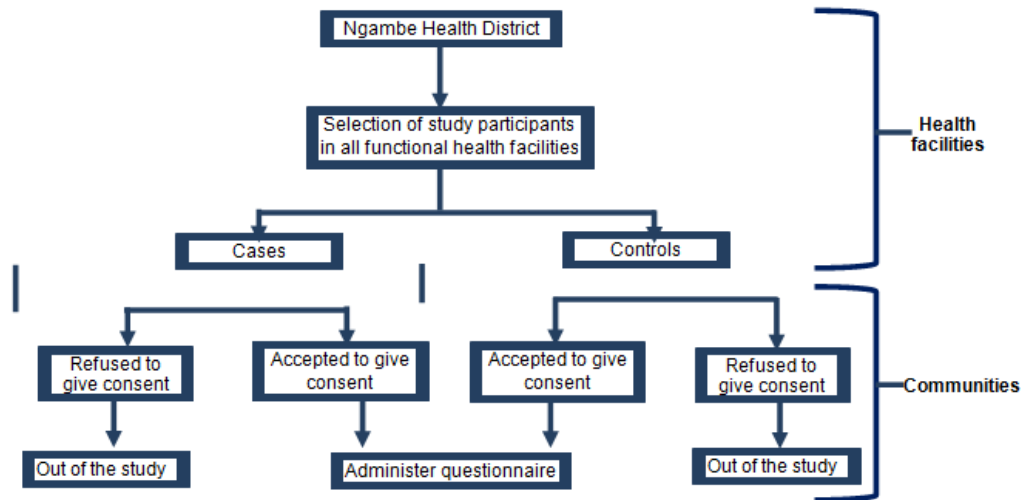


Fig. 1. Procedure of data collection (Study flow chart)

who adhered to their vaccination appointments whose parent had the primary school level as their highest educational qualification was 4.50% giving a minimum expected difference.

$$d = 0.282 - 0.045 = 0.237, \text{ and } P = \frac{0.282 + 0.045}{2} \therefore P = 0.1635$$

Substituting the terms in the equation for calculating sample size and including a 10% nonresponse rate gives n= 102. Giving 51 cases and 51 controls.

2.4 Sampling Technique

With the Chief of health facilities in all the seven health areas of the health district, we started by going through the various vaccination registers to sort out those children who had missed at least one vaccination appointment since they started in January 2015 with BCG till April when they were supposed to have been vaccinated with the 3rd DPT dose. The parents of these children were the 'cases'. Also, those children who did not miss any appointment were sorted out and their parents formed the 'control' group. After that, they were traced for administration of the questionnaire.

The questionnaire was basically of closed ended type with three sections, first was whether the participant was a "case" or a "control". And the sociodemographic characteristics and finally evaluation of some basic knowledge about the

diseases and vaccines against which their children were being vaccinated.

2.5 Data Analysis

Information from the questionnaire were entered into Epi infos version 3.5.4. where data analysis was done without matching. The chi square (χ^2) test was used and level of significance was set at the 5%. A multivariate logistic regression analysis was performed, where variables that were statistically significant at the bivariate level were included in a multivariate logistic regression analysis to adjust for possible confounders.

3. RESULTS AND DISCUSSION

3.1 Results

Of the 94 parents sampled, 4(4.3%) were male. Mean age of parents was 28.4 years (SD= 6.7) years. Close to half, 43(45.7%) of the participants were single and 42 (44.7%) of them were married. The mean age of the index children was 5.32 months and more than half (57.3%) of them were male.

Majority of the respondents 29(30.9%) were from the Ngambe Centre Health Area while Saha and Ngogbog Health Areas contributed just 5 (5.3%) each. Bikat is the only health area where those who missed their vaccination appointment (cases) were more than those who adhered to their vaccination appointment (controls) (Fig. 1).

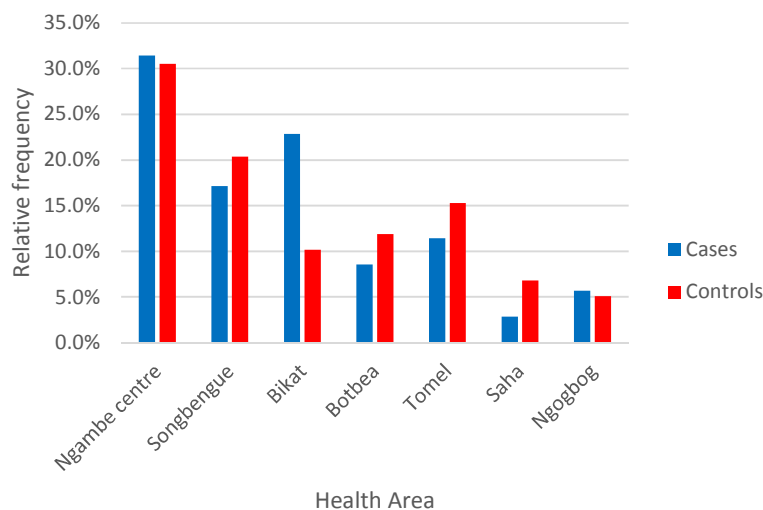


Fig. 2. Distribution of study parents according to the health area

On analysis, marital status educational level, age, parity, household size, distance from the health facility and attendance of ANC were highly associated with adherence to vaccination appointments (Table 1).

After controlling for confounders, only age and whether children were born in the hospital or not were found to be statistically significantly

associated to adherence to vaccination appointment (Table 2).

3.2 Discussion

This study examined associations between adherence to vaccination appointments and user-related (socio-demographic) factors. Only 62.8% of children who started vaccination in

Table 1. Effect on factors on adherence to vaccination appointment (n=94)

Characteristic	Cases n=35	Control n=59	Odds Ratio (95%CI)	χ^2	P-value
Single parenthood					
No	26(41.3%)	37(58.7%)	1.72 (0.86-4.33)	0.86	0.35
Yes	9(26.0%)	22(71.0%)			
Marital status					
Others	22(42.3%)	30(57.7%)	1.62(0.69-3.85)	0.84	0.36
Married	13(31.0%)	29(69.0%)			
Educational level					
Primary and below	12 (63.2%)	7(36.8%)	3.88(1.35-11.11)	6.85	0.01
Secondary and above	23(30.7%)	52(69.3%)			
Age					
36 and above	18(78.3%)	5(21.7%)	11.44(3.69-34.43)	21.93	0.001
16-35	17(23.9%)	54(76.1%)			
Parity					
0-4	15(22.4%)	52(77.6%)	0.10(0.04-0.28)	21.99	0.001
5 and above	20(74.1%)	7(25.9%)			
Child's sex					
Male	17(32.1)	36(67.9)	0.64(0.27-1.49)	0.67	0.41
Female	17(42.5)	23(57.5)			
Means of transport					
Foot	8(61.5)	5(38.5)	3.2(0.96-10.72)	2.70	0.10
Others means of transport	27(33.3)	54(66.7)			
Family size					
2-5	9(16.7%)	45(83.3%)	0.12(0.04-0.28)	22.97	0.001
6 and above	26(65.0%)	14(35.0%)			
Distance from the health facility(km)					
0-5	5(14.7%)	29(85.3%)	0.17(0.06-0.51)	10.11	0.001
6 and above	30(50.0%)	30(50.0%)			
Time to reach the health centre					
0-60 minutes	8(14.5)	47(85.5)	0.08(0.08-0.21)	26.91	<0.001
61 and above	27(69.2)	12(30.8)			
Employment status					
No	30(42.9%)	40(57.1%)	2.85(0.96-8.50)	2.83	0.09
Yes	5(20.8%)	19(79.2%)			
Possession of a functional radio or TV* set					
No	19(45.2%)	23(54.8%)	1.86(0.79-4.33)	1.51	0.22
Yes	16(30.8%)	36(69.2%)			
Child born in the hospital					
No	17(68.0)	8(32.0)	6.02(2.22-16.3)	12.06	0.001
Yes	18(26.1)	51(73.9)			
Attendance of ANC					
No	16(69.6)	7(30.4)	6.26(2.23-17.56)	13.62	0.001
Yes	19(26.8)	52(73.2)			

January 2015 were vaccinated as per the EPI vaccination calendar of Cameroon for infants.

Like the study by Smith, Chu and Barker [12], single parent were more likely not to adhere to the vaccination appointment of their children compared to those who live with their partners. This is not unexpected because partners may give moral and financial support for children to be vaccinated on time. Husband may remind their wives and provide them with the necessary moral and financial means for the vaccination of the child [13]. This is not likely going to the case if the partners are not there; a particularly serious condition with unmarried mothers as it is the case in this district where about 45.7% of all the children are born to single mothers.

Long distances from the health facilities is a well-known influence on the utility of health services, usually negatively [14,15]. In this study, parents living closer (less than 5km) to the health facility were less likely not to adhere to their children's vaccination appointment. Therefore, children of

the villages hosting a health facility have better chances of being adequately immunized since access to the health facilities is better for them. Monsiur and Saker [16] also demonstrated similar associations between distance and complete childhood vaccination. However, in rural areas like the Ngambe Health District, routine and regular outreach vaccination activities can neutralize the effect of long distances from the health facilities. This is also possible with good means of transport at the disposal of the health facilities.

Age sometimes may serve as a proxy for the parents' accumulated knowledge, which may have a positive influence on adequate utilization of health services and immunization of children [16]. However, this study's results showed that the chances of adhering to a child's vaccination appointment reduces as age increases. This result is in line with Lucius [17]. The inverse relationship between age and respect of vaccination appointment may be due to the increase in responsibility and number of children

Table 2. Multivariate analysis of the predictors of adherence to vaccination appointments

Covariates	AOR*	95% CI°	P-value
Knowledge of when a child is normally supposed to have completed routine vaccination			
Other responses	Reference		
9 months	2.90	0.14-58.73	0.49
Age	0.76	0.62-0.95	0.01
Attendance of ANC			
No	Reference		
Yes	5.83	0.59-93	0.13
Child born in the hospital			
No	Reference		
Yes	15.82	2.18-213.04	0.04
Family size			
6 and more	Reference		
5 and less	5.92	0.66-52.80	0.11
Level of education			
Primary and below	Reference		
Secondary and above	0.82	0.09-6.77	0.85
Knowledge of some EPI targeted diseases			
Less than 3	Reference		
3 and above	1.15	0.13-10.08	0.89
Parity	2.09	0.77-5.70	0.15
Time taken to reach the health facility			
0-60 minutes	Reference		
More than 60 minutes	0.27	0.04-1.99	0.20
Knowledge of a child is normally supposed to take the first vaccine			
Others responses	Reference		
At birth	0.37	0.02-8.09	0.53

*Adjusted Odds Ratio

to cater for that is associated to increase in age. All these may distract parents from their responsibility of watching over the timely vaccination of their children [17]. Since age correlates positively with parity, they have similar association to adherence to vaccination appointments. Parents with less than four children were less likely to miss a vaccination appointment. This may be because parents with many children face a higher burden of care and resource constrains associated with increased number of children, which has a negative effect on healthcare utilization and children immunization [18–20]. Other studies from low and middle countries have also found similar association between parity and vaccination status [21–23].

Delivery in the hospital goes with health information on various health issues including vaccination, hence account for the positive association between delivery in a health facility and adherence to vaccination appointment. As demonstrated by the results. Also, our results show that parents' level of education was not significantly associated with adherence to vaccination appointment after adjustment. Possibly, health personnel are doing their best to educate the parents on the importance of vaccination so much so that the effect of formal education on adherence to vaccination appointment has been neutralized. This is unlike in the study by Bhuwan and collaborators [24], where children with parents who have only primary level of education were more likely to fail to adhere to the vaccination appointments compared to parents with at least secondary level of education.

Parents who did not know up to three EPI targeted diseases were 2.65 (95% CI: 1.03, 6.81) times as likely not to respect vaccination appointments as those who knew at least three of the EPI targeted diseases. This relationship was reproduced at the multivariate analysis after adjustment, though not statistically significant. This is supposed to be the case since knowledge of the diseases may also mean knowledge of the consequences of the diseases and measure of prevention [25–27]. With this knowledge, appropriated measures will usually be put in place at the individual level to protect their children from any eventual attack from these diseases. This includes seizing an opportunity when it presents to protect the child from these diseases and usually the most convenient and cost-effective way is by vaccination.

In line with result of a study by Mosiur Rahman and Sarker Obaida-Nasrin [16], exposure to mass media (ownership a functional TV and radio set) showed a positive relationship with adherence to vaccination appointment AOR: 1.44; 95%CI: 0.25, 8.08. Exposure to the mass media is a source of education to parents not only on the importance of vaccination but also on the risk of not vaccination their children on time [17]. This is particularly important since in recent years, a number of governmental and non-governmental organizations have expanded their maternal and child health-related programs on television, radio, and newspapers, likely haven increased parents' knowledge about immunization especially in urban areas.

4. CONCLUSION

Adherence to vaccination appointments is an important aspect in immunization of infants. It is more critical in rural areas because of the field difference between rural and the urban population and depends of some factors most of which are user-related (sociodemographic). Level of education, age, parity, distances from the health facility and whether or not the parents are living with their partner have been shown to have an influence of adherence to vaccination appointment especially in the rural health district. Though the Ministry of Public Health is not (expected to be) perfect in the organization and implementation of immunization activities, user related factors also contribute to the non-adherence to vaccination appointments in the Ngambe Health District with just 62.8% of children being vaccinated on as per the EPI schedule. For a country that is engaged in fighting against vaccine preventable diseases more effort is needed. Policy makers at the district, regional and national level needs to direct resources so as to meet the need of persons far from the health facilities and those parents having many children. Therefore, adding to the availability of vaccines, a high-level political commitment aimed at increasing utilization of health services and effectively taking vaccination to the population are indispensable.

CONSENT

Written consent was obtained from every participant who accepted to take part in the study.

ETHICAL APPROVAL

All authors hereby declare that the study have been examined and approved by the appropriate ethics committee and have therefore been performed in accordance with the ethical standards laid down in the 1964 Declaration of Helsinki. Ethical approval was granted by the University of Buea Faculty of Health Science Ethical Review Board (FSH IRB), and the reference number is 2015/315/UB/FHS/IRB. Administrative authorization was gotten from the Regional Delegate of Public Health for the Littoral Region and the District Medical Officer of the Ngambe Health District.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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