

1 **FACTORS ASSOCIATED TO THE NON-ADHERENCE**
2 **TO VACCINATION APPOINTMENTS IN THE NGAMBE**
3 **HEALTH DISTRICT, LITTORAL REGION, CAMEROON:**
4 **A CASE CONTROL STUDY**
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10 **ABSTRACT**
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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.

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 outcome.

Conclusion: User related factors influence uptake of vaccination services in the Ngambe Health District od 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.

12
13 *Keywords: Factors, Associated, Adherence, Vaccination Appointments, Ngambe Health*
14 *District, Cameroon*
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16
17 **1. INTRODUCTION**
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19 When it concerns protection against certain childhood diseases, vaccination is what is
20 strongly recommended by the medical community[1, 2]. Vaccines are available to prevent
21 many diseases in people of all ages. The primary vaccine-preventable diseases of childhood
22 are diphtheria, invasive diseases caused by the *Haemophilus influenza* type b (Hib)

23 bacterium, measles, poliomyelitis (polio), rubella (“German” measles), Tuberculosis (TB),
24 tetanus, mumps, varicella (chickenpox), pertussis (whooping cough) pneumococcal
25 infections, and diarrhea with rotavirus[3, 4]

26 Parental decisions regarding immunization are very important for increasing the
27 immunization rate and compliance, decreasing any possible immunization errors.
28 Deficiencies in parents’ knowledge about the importance of vaccination, lack of knowledge
29 on the various diseases for which their children are being protected, the adverse effects and
30 contraindications of vaccines often lead to many immunization errors children up-to-date
31 vaccinations[5, 6]. Parental decision to take their children for vaccination is also affected by
32 socio-demographic variables. Some of these factors include whether or not a child is in a
33 rural area, the distance to the hospital where vaccination is to take place and many other
34 socio-demographic parameters like single parenthood, family size, and age of the mother [7–
35 9].

36 In Cameroon, Expanded Program of Immunization (EPI) started in 1976 as a pilot project
37 that was coordinated by the Organization for the Coordination of the Control of Endemic
38 Diseases in Central Africa (OCEAC). This pilot became operational in all the regions of the
39 country in 1982 where vaccination is seen a fundament right of every child in the country [4].
40 However, immunization coverage is still below target. Recent WHO and UNICEF reports
41 showed a decline in the immunization coverage between 2009 and 2011 from about 91% to
42 75% and a slight increase to 85% in 2013[10].

43 The Cameroon government is already doing a lot to take vaccines to the target population
44 and reduce any inequality to accessibility to immunization activities. This is done using
45 various strategies like the outreach and the mobile strategies where health teams leave the
46 health facilities with vaccines to meet the population in their localities. Also, punctual
47 supplementary immunization activities (SIAs) are carried out after every 6 months and when
48 need arises. Still, children are not being vaccinated and on time as scheduled. In the rural
49 settings where outreach strategies are primordial in achieving vaccination target, after
50 vaccination sessions, some vaccines can’t go back to the cold chain if the condition are not
51 met. This leads to unopened vial vaccine wastage, translating to less vaccines available,
52 further leading to low immunization coverage. This study therefore was to investigate how
53 some factors relate to the non-adherence to vaccination appointments in a typical rural
54 health district in Cameroon.

55 **2. MATERIAL AND METHODS**

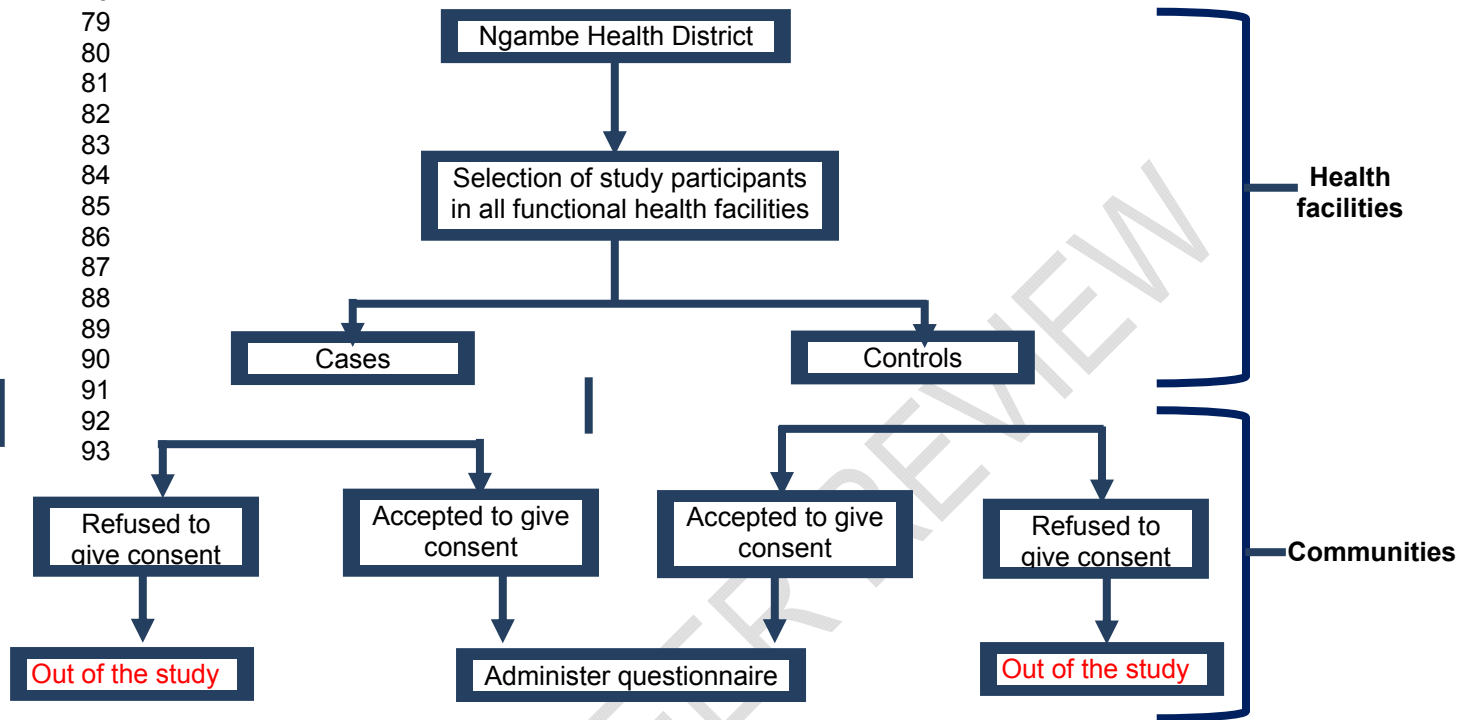
56 **2.1. Study design**

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59 This was a community based case control study where health facility records were reviewed
60 to identify the cases and the controls. They all were traced and questionnaire administered
61 after obtaining written consent to participate in the study. Targeted were parents who started
62 to vaccinate their children (with BCG) in January 2015. Cases were parents who had missed
63 at least one vaccination appointment between January and April 2015 (between BCG up to
64 and including the 3rd DPT dose). While the control group were parents who had not missed
65 any appointment within the same time frame.
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67 **2.2. Study setting and procedure**

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

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



95
 96 Figure 1: Procedure of data collection (study flow chart)

97 **2.3. Sample size determination**

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

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

100 Where: n is the total sample size (the sum of the sizes of the two groups; the control and the
 101 cases). Z_{crit} is the standard variate the Z distribution assumes at a significance level of 5%
 102 (1.960). Z_{pwr} is the value the Z distribution assumes at the statistical power of 80% which
 103 (0.842). P_1 and P_2 are the proportion of the event in the control and the cases respectively
 104 and P is the average of P_1 and P_2 . D is the absolute value of the minimum expected
 105 difference between the two proportions. $d = |P_1 - P_2|$

106 From a study carried out by Faisal Shuaib et al.[11], the proportion of children who did not
 107 adhere to their vaccination appointments whose parent or guardian attended just primary
 108 school was 28.2%. The proportion of children who adhered to their vaccination appointments
 109 whose parent had the primary school level as their highest educational qualification was
 110 4.50%. giving a minimum expected difference $d = 0.282 - 0.045 = 0.237$, and $P =$
 111 $\frac{0.282 + 0.045}{2} \therefore P = 0.1635$

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

114 **2.4. Sampling technique**

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

122 The questionnaire was basically of closed ended type with three sections, first was whether
123 the participant was a "case" or a "control". And the sociodemographic characteristics and
124 finally evaluation of some basic knowledge about the diseases and vaccines against which
125 their children were being vaccinated.

126 **2.5. Data analysis**

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

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133 **2.6. Ethical approval**

134 Ethical review was done and approved by the Faculty of Health Sciences Institutional
135 Review Board (FHS-IRB). Administrative authorization was gotten from the Regional
136 Delegation of Public Health of the Litoral region and from the DMO for the Ngambe Health
137 District.

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139 **3. RESULT AND DISCUSSION**

140 **3.1. Results**

141 Of the 94 parents sampled, 4(4.3%) were male. Mean age of parents was 28.4 years (SD=
142 6.7) years. Close to half, 43(45.7%) of the participants were single and 42 (44.7%) of them
143 were married. The mean age of the index children was 5.32 months and more than half
144 (57.3%) of them were male.

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

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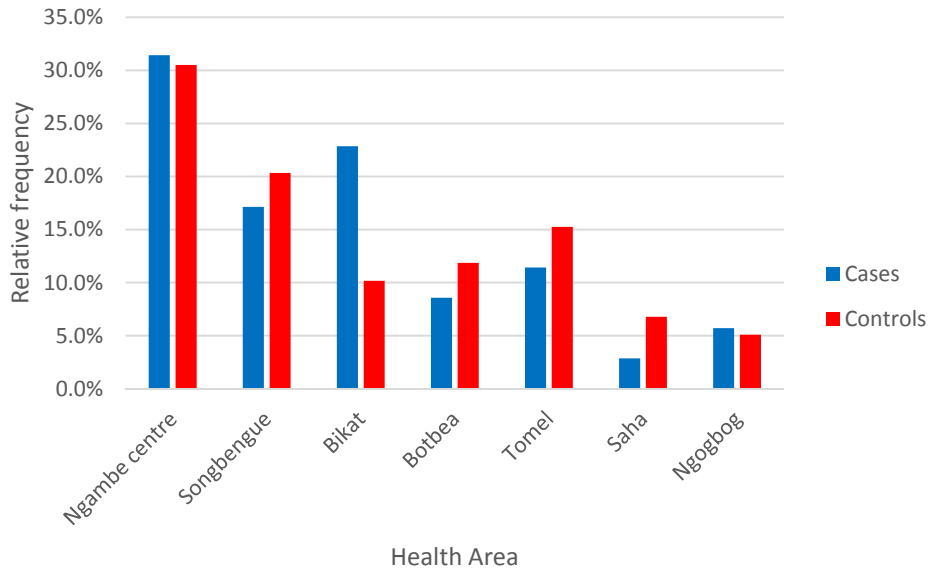


Figure 2: Distribution of study parents according to the health area

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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).

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

Characteristic	Cases n=35	Control n=59	Odds (95%CI)	Ratio	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%)				

Characteristic	Cases n=35	Control n=59	Odds (95%CI)	Ratio χ^2	P-value
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)			

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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: 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			

Covariates	AOR*	95% CI°	P-value
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

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3.2. Discussions

167 This study examined associations between adherence to vaccination appointments
168 and user-related (socio-demographic) factors. Only 62.8% of children who started
169 vaccination in January 2015 were vaccinated as per the EPI vaccination calendar of
170 Cameroon for infants.

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

179 Long distances from the health facilities is a well-known influence on the utility of
180 health services, usually negatively[14, 15]. In this study, parents living closer (less than 5km)
181 to the health facility were less likely not to adhere to their children's vaccination appointment.
182 Therefore, children of the villages hosting a health facility have better chances of being
183 adequately immunized since access to the health facilities is better for them. Monsiur and
184 Saker[16] also demonstrated similar associations between distance and complete childhood
185 vaccination. However, in rural areas like the Ngambe Health District, routine and regular
186 outreach vaccination activities can neutralize the effect of long distances from the health
187 facilities. This is also possible with good means of transport at the disposal of the health
188 facilities.

189 Age sometimes may serve as a proxy for the parents' accumulated knowledge,
190 which may have a positive influence on adequate utilization of health services and
191 immunization of children[16]. However, this study's results showed that the chances of
192 adhering to a child's vaccination appointment reduces as age increases. This result is in line
193 with Lucius [17]. The inverse relationship between age and respect of vaccination
194 appointment may be due to the increase in responsibility and number of children to cater for
195 that is associated to increase in age. All these may distract parents from their responsibility
196 of watching over the timely vaccination of their children[17]. Since age correlates positively
197 with parity, they have similar association to adherence to vaccination appoints. Parents with
198 less than four children were less likely to miss a vaccination appointment. This may be
199 because parents with many children face a higher burden of care and resource constrains
200 associated with increased number of children, which has a negative effect on healthcare
201 utilization and children immunization[18–20]. Other studies from low and middle countries
202 have also found similar association between parity and vaccination status[21–23]

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

213 Parents who did not know up to three EPI targeted diseases were 2.65 (95% CI: 1.03,
214 6.81) times as likely not to respect vaccination appointments as those who knew at least
215 three of the EPI targeted diseases. This relationship was reproduced at the multivariate
216 analysis after adjustment, though not statistically significant. This is supposed to be the case
217 since knowledge of the diseases may also mean knowledge of the consequences of the
218 diseases and measure of prevention[25–27]. With this knowledge, appropriated measures
219 will usually be put in place at the individual level to protect their children from any eventual
220 attack from these diseases. This includes seizing an opportunity when it presents to protect
221 the child from these diseases and usually the most convenient and cost-effective way is by
222 vaccination.

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

232 **4. CONCLUSION**

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

251

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

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254 **ETHICAL APPROVAL**

255

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

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UNDER PEER REVIEW