FACTORS ASSOCIATED TO THE NON-ADHERENCE TO VACCINATION APPOINTMENTS IN THE NGAMBE HEALTH DISTRICT, LITTORAL REGION, CAMEROON: A CASE CONTROL STUDY

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.

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.

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 influenza* 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 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 is to take 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 became operational in all the regions of the country in 1982 where vaccination is seen a fundament 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 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 the 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. MATERIAL 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.

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 figure 1.

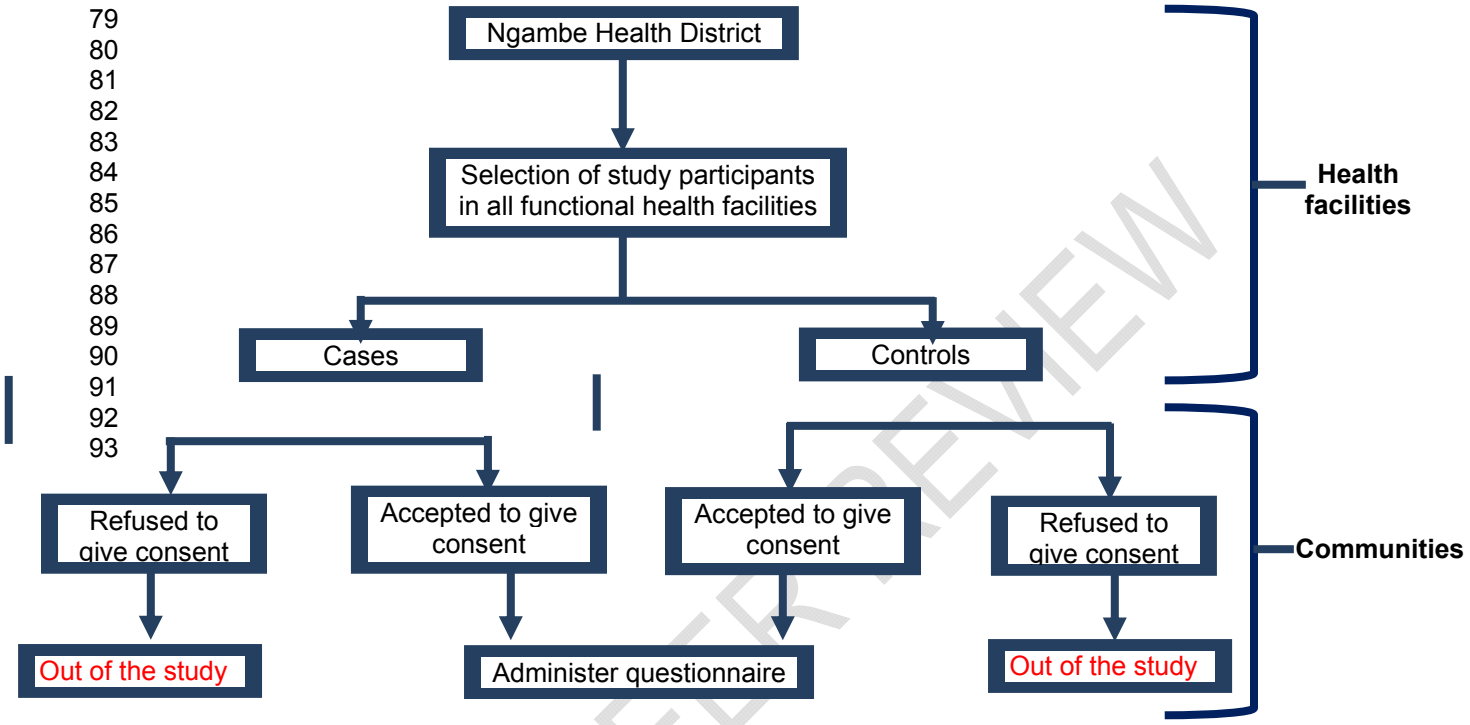

Figure 1: Procedure of data collection (study flow chart)

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:

$$n = \frac{2\left[Zcrit\sqrt{2P(1-P)} + Zpwr\sqrt{P1(1-P1) + P2(1-P2)}\right]^2}{d^2}$$

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 the Z distribution assumes at a significance level of 5% (1.960). Z_{pwr} is the value the Z distribution assumes at the statistical power of 80% which (0.842). P_1 and P_2 are the proportion of the event in the control and the cases respectively and Pis the average of P_1 and P_2. **D** is the absolute value of the minimum expected difference between the two proportions. $d = |P1 - P2|$

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 just primary school was 28.2%. The proportion of children 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, and $P = \frac{0.282+0.045}{2}$ ∴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, their parents 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. RESULT 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) (figure 1).

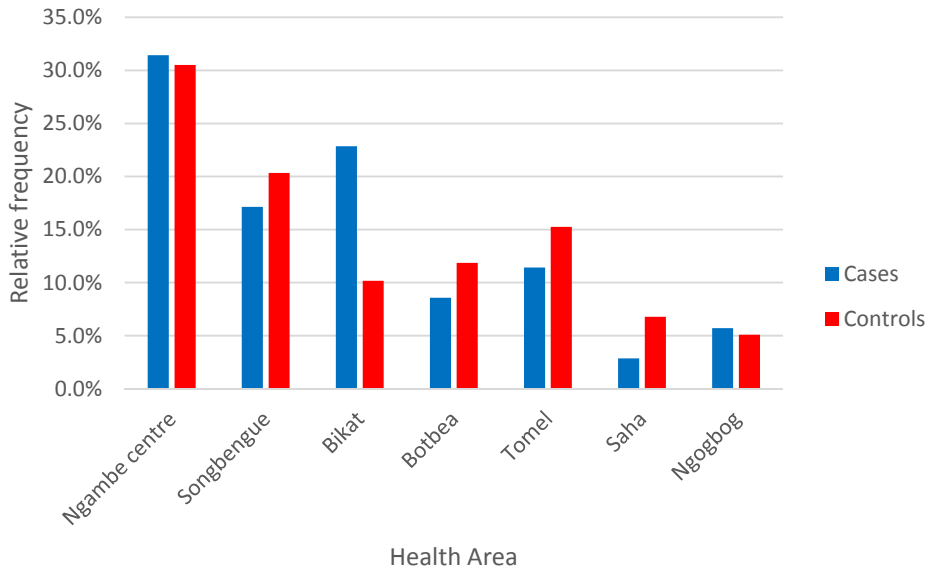

Figure 2: Distribution of study parents according to the health area

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).

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%)			

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

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

159
160
161 ### 3.2. Discussions

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

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

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

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

REFERENCES

1. WHO, UNICEF, World Bank. State of the world's vaccines and immunization. 3rd edition. Geneva: World Health Organisation; 2009.

2. David E. Bloom, David Canning, Erica Seiguer. The Effect of Vaccination on Children's Physical and Cognitive Development in the Philippines. Harvard University: PROGRAM ON THE GLOBAL DEMOGRAPHY OF AGING; 2011.

3. Sanofi Pasteur. A parents guide to vaccine-preventable diseases in children. USA: Sanofi Pasteur INC; 2010.

4. Ministry of Public Health, UNICEF. Norms and Standards of The Expanded Programme on Immunization of Cameroon. Yaounde, Cameroon: Ministry of Public Health; 2009.

5. Gellin B, Maibach E, Marcuse E. Do parents understand immunizations? A national telephone survey. Pediatrics. 2000;106:1097–1102.

6. Richards A, Sheridan J. Reasons for delayed compliance with the childhood vaccination schedule and some failings of computerised vaccination registers. Aust NZ j public health. 1999;23:315–317.

7. Schoeps A., Quedraogo N., Kagone M., Sie A., Muller O., Becher H. Socio-demographic determinants of timely adherence to BCG, Penta3, measles, and complete vaccination schedule in Burkina Faso. 2013. doi:10.1016/j.vaccine.2013.10.063.

8. Jean Joel R Bigna, Jean Jacques N Noubiap, Claudia S. Plottel, Charles Kouanfack. Factors associated with non-adherence to scheduled medical follow-up appointments among Cameroonian children requiring HIV care: a case-control analysis of the usual-care group in the MORE CARE trial. International Journal of health geographics. 2014;3. doi:10.1186/2049-9957-3-44.

9. Etana B., Deressa W. Factors associated with complete immunization coverage in children aged 12-23 months in Ambo Woreda, Central Ethiopia. 2012. doi:10.1186/1471-2458-12-566.

10. WHO, UNICEF. Cameroon: WHO and UNICEF estimates of immunization coverage: 2013 revision. 2013.

11. Faisal Shuaib, Denise Kimbrough, Michele Roofe, McGwin G Jr, Pauline Jolly. Factors associated with incomplete childhood immunization among residents of St. Mary parish of Jamaica. West Indian Med J. 2010;59:549–554.

12. Smith P., Chu S., Barker L. Children who have received no vaccines: who are they and where do they live? Pediatrics. 2004;114:187–95.

13. Ruhul Amin, Telma Joana Corte Real De Oliveirab, Mateus Da Cunhab, Tanya Wells Brownc, Michael Favina, Kelli Cappeliera. Factors limiting immunization coverage in urban Dili, Timor-Leste. Glob Health Sci Pract. 2013;1:417–27.

14. Muller J., Smith T., Mellor S., Rare L., Genton B. The effects of distance from home on attendance at a small rural health centre in Papua New Guinea. Internationa Journal of Epidemiology. 1998;27:878–84.

15. Anja Schoeps, Sabine Gabrysch, Louis Niamba, Ali Sié, Heiko Becher. The Effect of Distance to Health-Care Facilities on Childhood Mortality in Rural Burkina Faso. Am J Epidemiol. 2011;173:492–8.

16. Mosiur Rahman, Sarker Obaida-Nasrin. Factors affecting acceptance of complete immunization coverage of children under five years in rural Bangladesh. Salud Pública de México. 2010;52. doi:10.1590/S0036-36342010000200005.

17. Donsa LD. An Examination of Mothers' Socio-Demographic Factors Associated With Incomplete Vaccination Status among Under-five Populations in Malawi. 2013. http://scholarworks.gsu.edu/iph_theses/285/. Accessed 20 Dec 2014.

18. Bhatia J. C. Levels and causes of maternal mortality in Southern India. Studies in Family Planning. 1992;24:310–8.

19. Pebley A. R., Goldman N., Rodriguez G. Prenatal and Delivery care and childhood immunization in Guantemala: do family and community matter? Demography. 1996;33:231–47.

20. Emily Sonneveldt, Willyanne DeCormier Plosky, John Stover. Linking high parity and maternal and child mortality: what is the impact of lower health services coverage among higher order births? BMC Public Health. 13. doi:10.1186/1471-2458-13-S3-S7.

21. Berhane Y., Masresha F., Zerfu M., Birhanu M., Kebede S., Shashikant S. Status of Expanded Program on Immunization in a rural town-South Ethopia. Ethopian Medical Journal. 1995;33:83–93.

22. Fatiregun A. A., Okoro A. O. Maternal determinants of complete child immunization among children age 12-23 months in a southern district of Nigeria. Vaccine. 2012;30:730–6.

23. Hull B., McIntyre P., Sayer G. Factors associated with low uptake of measles and pertussis vaccines - an ecologic study based on the Australian Childhood Immunisation Register. Australia NZ Journal of Public Health. 2001;25:405–10.

24. Bhuwan Sharma, Hemant Mahajan, G. D. Velhal. Immunization Coverage: Role of Sociodemographic Variables. Advances in Preventive Medicine. 2013;2013:5.

25. Andre FE, Booy R, Bock HL, Clemens J, Datta SK, John TJ, et al. Vaccination greatly reduces disease, disability, death and inequity worldwide. Bulletin of the World Health Organization. 2008;86:140–6.

26. Naeem M, Khan MU, Adil M, Hussain S. Inequity in childhood immunization between urban and rural areas of Peshawar. Journal of Ayub Medical College Abbottabad. 2011;23:134–137.

27. Malkar VR, Khadilakar H, Lakde RN, Joge US, Chaudhari SG. Assessment of Socio demographic Factors Affecting Immunization Status of Children in Age Group of 12-23 Months in a Rural Area. Indian Medical Gazette May. 2013;:164–69.