Austin Journal of Vaccines & Immunotherapeutics

Open Access

Austin Publishing Group

Research Article

Immunization Outside the Expanded Program on Immunization in Abidjan City, Cote d'Ivoire

Douba A*, Boa A, Ekra KD, Bénié BVJ, Aka J, Menan H, Abokon A, N'guessan BT,Timite-Konan M, Ouattara SG, Sow K, Kouassi NJ, Tiembré I and Bissagnené E

1Comité National d'Experts Indépendants pour la Vaccination et les Vaccins de Côte d'Ivoire s/c Institut National d'hygiène Publique, Cote d'Ivoire

***Corresponding author:** Alfred Douba, Comité National d'Experts Indépendants pour la Vaccination et les Vaccins de Côte d'Ivoire s/c Institut National d'hygiène Publique, Cote d'Ivoire

Received: February 10, 2017; **Accepted:** April 20, 2017; **Published:** May 01, 2017

Abstract

Immunization is one of the greatest achievements of public health policies. To compensate for the lack of information on the non-EPI immunization coverage, a study was conducted in Abidjan, Côte d'Ivoire. This research study had three objectives: To estimate Yellow Fever, Meningitis, Tetanus, Typhoid Fever, Hepatitis B, Pneumococcus, and Influenza vaccine immunization coverage among people aged at least 2 years in Abidjan city, to identify variables associated with the vaccination status and to determine the reasons for non-vaccination. The method used was cluster sampling. The study included 2000 respondents from 8 health districts. Findings showed that immunization coverage was 2.4% for influenza, 2.7% for pneumococcus, 6.1% for hepatitis B, 14.8% for typhoid fever, 17.3% for tetanus, 19.9% for meningitis, and 59% for yellow fever vaccine. Gender, sanitary district, head of household's income and educational level were variables associated with at least 4 vaccines statuses. Main reasons for non-vaccination were ignorance of the need for immunization, ignorance of the target population for immunization, negligence and the high costs of vaccines. Effort is needed to increase immunization coverage in Abidjan, and generally in Cote d'Ivoire.

Keywords: Immunization; coverage; Cote d'Ivoire

Abbreviations

EPI: Expanded Program on Immunization; WHO: World Health Organization; WAHO: West African Health Organization

Introduction

Immunization is one of the greatest achievements of public health policies [1]. Second to access to drinking water, immunization is one of the most effective public health measure for controlling infectious diseases [2]. It has significantly contributed to saving millions of children's lives around the world particularly since the launch of the World Health Organization (WHO) Expanded Program on Immunization (EPI) in 1974 and its implementation [3,4]. Public health accomplishments with immunization include eradication of smallpox in 1980 [5,6] and the reduction in reported polio cases from 350,000 in 125 countries in 1988 [7,8] to 9 in 2 countries in 2015 [9]. Other success from immunization includes the neonatal tetnus elimination Initiatives and its immunization and the immunization of pregnant women and women of childbearing age. Through the neonatal tetnus elimination and combined with clean and safe childbirths and umbilical cord care during the neonatal period, have helped to reduce neonatal tetanus cases in the world from 10538 to 2161 cases, 2603 to 835 cases in Africa, and in specifically in Côte d'Ivoire from 311 to 12 cases, from 1995 to 2014 [10-12].

Vaccines and Immunization are among the most cost-effective health intervention [13]. In the USA for example, smallpox eradication cost 100 million US dollars and that also enabled the world to yield about 1.35 billion annual savings over the 10 years following the eradication of the disease. There are even greater benefits in low-income countries where gaining a year of healthy life due to immunization was estimated at 14-20 US dollars, i.e. 7000-10 000 FCFA, assuming that a US dollar is worth 500 FCFA [14].

Implementation of the WHO EPI has been widespread across the world and its coverage reflected in the number of vaccines and target population in implementing countries including Côte d'Ivoire. However, in Côte d'Ivoire as in many other countries, coverage data on the non-EPI populations are scarce. For example a study among university of Abidjan-Cocody students showed only 3.7% coverage for Hepatitis B vaccination [15]. This study however, did not give full coverage of non-EPI vaccination coverage in Abidjan. To compensate for the limited information, this study seeks to estimate non-EPI immunization coverage in Abidjan, Côte d'Ivoire. The study estimates immunization coverage for Tetanus, Hepatitis B, Meningitis, Yellow Fever and Typhoid Fever among people aged at least 2 years in Abidjan city. In addition we examine factors associated with the vaccination status and determine reasons for non-vaccination.

Materials and Methods

The study use data from a cross-sectional household survey conducted in the 8 sanitary districts of Abidjan city: Eastern Abobo, Western Abobo, Adjamé-Plateau, Cocody-Bingerville, Koumassi-Port Bouet, Marcory-Treichville, Eastern Yopougon and Western Yopougon-Songon. The survey was conducted over 31 days from April to May 2016.

The survey included one person selected from each household who had lived in one of the 8 sanitary districts in Abidjan city for at least 6 months, never been vaccinated since he/she was born, and was at least 2 years old. If the selected person in a household was less than 18 years old, one of the adults in the home answered the questions.

Citation: Douba A, Boa A, Ekra KD, Bénié BVJ, Aka J, Menan H, et al. Immunization Outside the Expanded Program on Immunization in Abidjan City, Cote d'Ivoire. Austin J Vaccines & Immunother. 2017; 4(1): 1011.

Table 1: Distribution of number of households and clusters by district.

Districts	Number of households	Number of households to be surveyed	Number of 7-person clusters
Eastern Abobo	147982	267	38
Western Abobo	100379	181	26
Adjamé Plateau	160975	291	42
Cocody Bingerville	134096	242	35
Koumassi Port-Bouet	201384	364	52
TreichvilleMarcory	105526	191	27
Eastern Yopougon	109533	198	28
Western Yopougon Songon	147206	266	38
TOTAL	1107081	2000	286

Those who refused to participate in the study and those absent from household at the time of the interviewers' visits were excluded from the study.

Sampling method and sample size

The method used was cluster sampling. A cluster was made up of 7 people. We selected the areas to be visited in each sanitary district using a cluster sampling. In each area, the households to be surveyed were selected according to the WHO method for immunization coverage surveys. In each household, one person was surveyed. The person surveyed per household was selected using a simple random sampling.

The formula used to calculate the sample size was as follows:

$$n = eg \times \frac{{\varepsilon_\alpha}^2}{i^2} \times p(1-p)$$

with

eg: Cluster effect = 2

ε_α: Reduced deviation of the normal distribution at α standard error = 1.96

i: precision of the estimate = 0.05

p: rate of immunization coverage outside EPI expected for each vaccine = 6%

Let's assume a sample of 174 people per sanitary district. The sample size of all 8 sanitary districts was at least 1,392 people.

The sample size was finally rounded up to 2,000 people, i.e. 286 clusters of 7 people. A proportional allocation of this size per sanitary district was used ($n_i = n \times (N_i/N)$).

With:

n_i = number of people to be surveyed per sanitary district

n = sample size (2 000people)

Ni = number of households in the sanitary district

N = number of households in all 8 sanitary districts of Abidjan city (1107081)

Distribution of number of households and clusters by district is presented in Table 1.

Measurement

Immunization status refers to having been vaccinated or not vaccinated against each non-EPI vaccine: yellow fever, meningitis, typhoid fever, pneumococcus, influenza, hepatitis B and tetanus.

These vaccines are on the list of vaccines provided by the National Institute for Public Hygiene which is the national organization in charge of immunization outside the EPI in Côte d'Ivoire.

Other variables in the study include gender (male and female), age, educational level (unschooled, nursery and primary, secondary, and higher), religion (Christianity, Islam), marital status (Married, single, cohabitation), head of household's monthly income, and sanitary district of residence (Eastern Abobo, Western Abobo, Adjamé-Plateau, Cocody-Bingerville, Koumassi-PortBouet, Marcory-Treichville, Eastern Yopougon and Western Yopougon-Songon).

Complete immunization refers to having taken all vaccines (yellow fever, meningitis, typhoid fever, pneumococcal infections, influenza, hepatitis B and tetanus).

The reasons for non-vaccination were grouped into four categories. Category 1 refers to "lack of information" included ignorance of the need for immunization, of the target population for immunization, of the place of immunization, of the immunization schedules, the fear of adverse reactions and the misconceptions about contraindications to vaccination.

Category 2 refers to "lack of motivation" included the distrust of immunization, rumours, vaccination postponement, negligence and lack of time due to activities. Category 3 refers to "barriers to immunization" included the remoteness of immunization place, inconvenient vaccination hours, poor welcome, absence of vaccinators, too long wait, high transportation costs, and high prices of vaccines. Category 4 refers to "other reasons" included sickness, dependency on parents, fear of injections, lack of financial resources, travel purpose, and prohibition against vaccines.

Data analysis

SPSS 20 was used for the analysis.

We calculate the proportions for each category of reasons for non-vaccination. The denominator used in the calculation of these proportions was the number of people surveyed. The Chi-square test was performed to investigate any association between each dependent variable and the independent variables.

Ethical considerations

Prior to participation in the study, we obtained informed consents

Table 2: Distribution of immunization coverage per vaccine.

	Vaccine against						
	Yellow Fever	Meningitis	Tetanus	Typhoid Fever	Hepatitis B	Pneumococcus	Influenza
Immunization coverage (%)	59.7	19.9	17.3	14.8	6.1	2.7	2.4
Complete immunization (%)	0.5						

from the respondents or their parents if they were under 18 years. The anonymity of respondents was respected.

Results

Characteristics of sample

A total of 1,952 people were interviewed. Two thirds of the respondents were females (66.4%). The median age was 29 years, ranging from 2 to 84 years. Among the respondents, 54.2% were aged between 21 and 40. In terms of educational level, a third of the respondents had secondary education (32.5%), slightly over a quarter were unschooled people (27.1%). Almost two-thirds of the respondents were Christians (59.6%) and a slightly over a third were Muslims (37.8%). The proportion of respondents who did not live as a couple was 53.9%. The vast majority of respondents did not know the head of household's income (60.4%). The proportion of respondents with vaccination records was 35.7%.

Immunization coverage

Distribution of immunization coverage is presented in Table 2. Overall, 59% of respondents had yellow fever vaccine and 2.4% had influenza vaccine. Only 0.5% of respondents had all vaccines (yellow fever, meningitis, typhoid fever, pneumococcal infections, influenza, hepatitis B and tetanus).

Reasons for non-vaccination

Distribution of reasons for non-vaccination is presented in Table 3. The lack of information, motivation and barriers to immunization were the main categories for reasons of non-vaccination. Specifically, the main reasons for non-vaccination were ignorance of the need for immunization (29.30%), ignorance of the target population for immunization (31.40%), negligence (29.95%) and the high costs of vaccines (31.10%).

Socio-demographic variables associated with immunization status

Association between immunization status and selected socio-demographic variables is presented in Table 4-5. Gender, sanitary district, head of household's income and educational level were significantly associated with at least 4 vaccines statuses with at least 4 vaccines statuses (yellow fever, meningitis, hepatitis B and tetanus).

Table 3: Distribution of reasons for non-vaccination.

Reasons for non-vaccination	Number	Percentage (%)
Lack of information	**1 654**	**82.58**
Ignorance of the need for immunization	587	29.30
Ignorance of the target population for immunization	689	31.40
Ignorance of the immunization place	277	13.83
Ignorance of the immunization schedules	44	02.20
Fear of adverse reactions	33	01.65
Misconception about contraindications to vaccination	24	01.20
Lack of motivation	**842**	**42.04**
Distrust of immunization	20	01.00
Rumours	16	00.80
Postponed vaccination	21	01.05
Negligence	600	29.95
Very busy, parents very busy	185	09.24
Barriers to immunization	**748**	**37.34**
Remote vaccination place	64	03.19
Inconvenient vaccination hours	08	00.40
Poor welcome	05	00.25
Vaccinator absent	06	00.30
Vaccines missing	13	00.65
Long wait	16	00.80
High transportation cost	13	00.65
High prices of vaccines	623	31.10
Other reasons	**98**	**01.95**
Vaccination prohibited by religious leader, traditional healer, father, others	00	00.00
Sickness	10	00.50
Dependency on parents	02	00.10
Fear of injections	04	00.20
Lack of financial resources	20	01.00
Travel	03	00.15

Discussion

Immunization coverage

The immunization coverage varied from one vaccine to another ranging from 2.4% for influenza vaccine to 59% for yellow fever vaccine. This immunization coverage (19.9% for meningitis, 17.3% for tetanus, 14.8% for typhoid fever, 6.1% for hepatitis B and 2.7% for pneumococcus) indicated that a small proportion of the population (in Abidjan) was vaccinated against these vaccine-preventable diseases. This implies that the vast majority of the population in Abidjan was at risk of contracting these diseases, including yellow fever and meningitis which are epidemic-prone and hepatitis B which has a high prevalence (13%) in the population of the country [16].

Among the vaccines included in this study, the yellow fever vaccine had the highest coverage. This could be due to the yellow fever outbreaks that occurred in Abidjan in 2001 and 2008 for which reactive vaccination campaigns were organized [17,18]. In addition, this could be due to the fact that the yellow fever vaccine is mandatory for who so ever is entering or leaving the Ivorian territory [19,20]. According to the World Health Organization, yellow fever immunization coverage less than 60% is not sufficient to prevent yellow fever outbreaks [21]. Thus, the population of Abidjan city

Table 4: Association between immunization status and selected socio-demographic variables.

	Yellow fever		Meningitis		Typhoid fever		Pneumococcus	
	X^2	P	X^2	P	X^2	P	X^2	P
Gender	6.66	0.01	10.37	0.001	1.07	0.29	0.22	0.63
Female								
Male								
Age	6.31	0.09	0.53	0.91	1.30	0.72	37.21	0.0001
2-20								
21-40								
41-60								
61-84								
Educational level	38.28	0.0001	14.17	0.003	22.36	0.0001	16.95	0.001
unschooled								
Nursery and primary								
Secondary								
Higher								
Religion	0.76	0.38	1.39	0.23	5.16	0.02	0.02	0.87
Christian								
Muslim								
Cohabitation	7.58	0.006	0.90	0.34	0.47	0.48	0.70	0.40
Yes								
No								
Head of household's income (fcfa)*	32.28	0.0001	19.54	0.001	19.76	0.001	7.21	0.02
<= 60 000								
61000–100000								
101000–200 000								
201000–300 000								
>300 000								
Sanitary districts	65.95	0.0001	23.87	0.0001	18.42	0.002	6.06	0.19
Abobo								
Adjamé-Plateau								
Cocody-Bingerville								
Koumassi-Port Bouet								
Treichville-Marcory								
Yopougon								

*1 US$=500 fcfa

appears to be at risk of yellow fever outbreak.

The vaccine with the lowest coverage was influenza vaccine. This could be due to several reasons. Firstly, the price of influenza vaccine at the time of the study was 7,000 FCFA (USD14). In a country where the poverty index was 46% in 2015 [22], this price seems to be unaffordable for a large part of the population. Besides, since the circulating seasonal influenza virus varies from year to year, the vaccine must be taken every year. Moreover, since the population at high risk of developing influenza consists of pregnant women, children under 5 years, the elderly over 65 years, immune-compromised patients and people with chronic disease [23,24], anyone not in these categories may not be interested in influenza vaccine and will not get vaccinated.

With regard to complete immunization, 0.5% of respondents were up to date on all vaccines (yellow fever, meningitis, tetanus, typhoid fever, hepatitis B, pneumococcus and influenza). This very small proportion of completely vaccinated people results from the low coverage of vaccines received separately.

Variable associated with immunization status

There was an association between the educational level and each vaccine included in the study. A study on socio-demographic factors associated with incomplete immunization revealed that education was an important determinant for immunization status [25]. The association between education and immunization status could be explained by the fact that education increases people's understanding

Table 5: Association between immunization status and selected socio-demographic variables (second part).

	Influenza		Hepatitis B		Tetanus	
	X^2	P	X^2	P	X^2	P
Gender						
Female	0.14	0.70	6.27	0.01	22.88	0.0001
Male						
Age						
2-20						
21-40	10.29	0.006	29.53	0.0001	2.94	0.40
41-60						
61-84						
Educational level						
Out of school						
Nursery and primary	17.00	0.001	24.01	0.0001	21.55	0.0001
Secondary						
Higher						
Religion						
Christian	3.22	0.07	4.64	0.03	1.44	0.23
Muslim						
Cohabitation						
Yes	1.96	0.16	0.05	0.82	50.23	0.0001
No						
Head of household's income (fcfa)						
<= 60 000						
61000–100000						
101000–200000	3.24	0.1	36.28	0.0001	17.41	0.002
201000–300000						
>300000						
Sanitary districts						
Abobo						
Adjamé-Plateau						
Cocody-Bingerville	5.41	0.14	14.92	0.01	31.62	0.0001
Koumassi-Port Bouet						
Treichville-Marcory						
Yopougon						

of health, hence their regular attendance at healthcare services including immunization clinics [26]. Education helps to better understand the benefits of vaccination in maintaining good health through the prevention of vaccine-preventable diseases. It also helps to better perceive the cost-benefits of vaccination as compared to a vaccine-preventable disease treatment.

The head of household's income was associated with six out of seven vaccines included in the study. The association between income and immunization status could be explained by the costs induced by vaccination. Indeed, vaccination could generate transportation costs from the place of residence to the vaccination place, in addition to the non-EPI vaccine costs. At the National Institute of Public Hygiene which is in charge of non-EPI immunization, the price of a dose of vaccine is 5000 FCFA (USD 10) for Yellow Fever, 2500 FCFA (USD 5) for meningitis AC, 6500 FCFA (USD 13) for meningitis ACYW135, 1000 FCFA(USD 2) for tetanus, 3500 FCFA (USD 7) for typhoid fever, 3500 FCFA (USD 7) for hepatitis B, 9500 FCFA (USD 19) for pneumococcus and 7 000 FCFA (USD 14) for influenza [27]. Vaccination could be out of reach for a large proportion of the population in a country where 46% of the population lived below the poverty line in 2015 [22].

There was an association between the sanitary district of residence and five vaccines included in the study. This association could be due to several factors. The first factor is the presence or absence of a vaccination clinic in the district. Presence of a vaccination clinic in the district of residence could be a contributing factor to high vaccination. This is because presence of a clinic helps to raise awareness of the need to prevent vaccine-preventable diseases and by reducing the distance to the vaccination clinic, hence a reduction in the transportation costs related to vaccination. The second factor is the health habits of populations. Some populations give priority to prevention. Thus, the latter will be more likely to get vaccinated compared to those who give top priority to curative care. Studies conducted in several African countries also revealed that the place of residence was an important determinant of the immunization status [25,28-33].

Reasons for non-vaccination

The main reasons for non-vaccination were ignorance of the need for immunization, ignorance of the target population for immunization, negligence and the high costs of vaccines. The first two reasons reflect the respondents' lack of information about immunization while the third one reflects their lack of motivation. These three reasons for non-vaccination could be reduced or avoided through regular campaigns to raise the population's awareness of the extent (morbidity and mortality) of vaccine-preventable diseases. In addition, raising awareness about the benefits of vaccine-preventable diseases vaccination and that the associated cost-effectiveness of vaccination is better than the cost-effectiveness of a vaccine-preventable disease treatment. In the Philippines, in the region of Metro Manila, a public awareness campaign on the Expanded Program on Immunization, with particular emphasis on measles resulted in a rise in the measles vaccination coverage from 21% to 45% in five months and then that of other vaccines from 20% to 24% over the same period [34]. The vaccination campaign would raise awareness in a population about the benefits of vaccinations. This awareness could lead to a change in the population's attitude which would eventually attend immunization clinics [35].

Study limitations

Our study has limitations. Firstly, regarding tetanus vaccine, no distinction was made between the doses received by women as part of the EPI and those received outside the EPI. Secondly, for over half of respondents who did not have immunization records, their immunization statuses were reported orally. This situation could cause an overestimation or underestimation of immunization coverage.

Conclusion

The study on immunization coverage outside the Expanded

Program on Immunization in Abidjan city has demonstrated that except for the yellow fever vaccine, the others preventive vaccines for diseases such as meningitis, tetanus, typhoid fever, hepatitis B, pneumococcal and influenza had less than 20% coverage. With regard to socio-demographic characteristics, there was an association between the level of education, the head of household's income, the sanitary district of residence, gender and at least four vaccines (yellow fever, meningitis, hepatitis B and tetanus). The reasons for non-vaccination were mostly ignorance of the need for immunization, ignorance of the target population for immunization, negligence and the high costs of vaccines. Raising people's awareness of the extent of vaccine-preventable diseases and the benefits of vaccination in the prevention of vaccine-preventable diseases could encourage them to attend immunization clinics more frequently. Finally, a study could be conducted to identify the communication channels that can easily reach the population, through which the health authorities could broadcast messages with the aim of changing people's attitudes towards immunization.

Acknowledgements

We acknowledge the West African Health Organization (WAHO) whose financial support enabled the implementation of this study sponsored by the National Immunization Technical Advisory Group of Côte d'Ivoire.

The draft study was approved by the National Committee of Ethics and Research.

References

1. WHO. Programme elargi de vaccination. Rapport d'activites pour l'annee. 1993.
2. Leif Gothefors. Impact des vaccins dans les pays à bas et hauts revenus. Ann Nestle. 2008; 66: 55-70.
3. WHO. Global vaccine action plan 2011-2020. Geneva. WHO press. 2013; 147.
4. Bugvi AS, Rahat R, Zakar R, Zakar MZ, Fischer F, Nasrullah M, et al. Factors associated with non-utilization of child immunization in Pakistan: Evidence from the demographic and health survey 2006-07. BMC Public Health. 2014; 14: 1-7.
5. Henderson DA. Eradication: Lessons from the Past. MMWR Supplements. 1999; 48: 16-22.
6. Etana B, Deressa W. Factors associated with complete immunization coverage in children aged 12-23 months in Ambo Woreda, Central Ethiopia. BMC Public Health. 2012. 12: 1-9.
7. WHO. Polio vaccines: WHO position paper, January 2014. Weekly epidemiological record 2014; 9: 73-92.
8. CDC. Update on vaccine-derived polioviruses. Morbidity and Mortality Weekly Record 2006; 55: 1093-1097.
9. WHO. Polio vaccines: WHO position paper – March, 2016. Weekly epidemiological record 2016; 91: 145-168.
10. OMS, UNICEF, FNUAP. Eliminer durablement le tétanos maternel et néonatal. Plan strategique. 2012-2015; 28.
11. WHO. Global Health observatory data repository: Neonatal tetanus, reports cases by WHO region.
12. WHO. Global Health observatory data repository: Neonatal tetanus, reports cases by country.
13. The Global Alliance for Vaccines and Immunization (GAVI). Advocacy for Immunization. 2001.
14. Bloom DE, Canning D, Weston M. The value of vaccination. World economics. 2005; 6.
15. Lohoues-Kouacou MJ, Assi C, Nigue L, Biekre AR, Ouattara A, Kone S, et al. Hepatitis B: cross-sectional study of knowledge and immunization among students at University of Cocody, Ivory Coast. Rev Epidemiol Sante Publique, 2013; 61: 494-498.
16. Assi C, Ouattara A, Allah-Kouadio E, Diakite M, Kone S, Lohoues-Kouacou MJ, et al. Vaccination coverage against hepatitis B and prevalence of HBsAg: a cross-sectional study involving 592 persons attending public screening in Abidjan. Clin Res Hepatol Gastroenterol. 2011; 35: 506-507.
17. Zengbe-Acray P, Douba A, Traore Y, Dagnan S, Attoh-Toure H, Ekra KD. Couts de la riposte vaccinale contre la fievre jaune a Abidjan, 2001. Sante publique. 2009; 21: 383- 391.
18. Kouassi DP, Zengbe-Acray P, Akani BC, Douba A, Aka LPN, Kouassi KPR. Cout moyen d'une campagne de vaccination: fievre jaune. Abidjan. 2008.
19. OMS. Liste des pays, territoires et zones: Vaccination contre la fievre jaune-prescriptions et recommandations ; situation du paludisme ; et autres prescriptions en matiere de vaccination.
20. OMS. Amendement à l'annexe 7 (fievre jaune) du Reglement sanitaire international (2005).
21. WHO. Yellow fever technical consensus meeting. Geneva. 1998; 31.
22. Banque Mondiale. Côte d'Ivoire: Presentation.
23. WHO. Influenza virus infections in humans. 2014; 2.
24. WHO. Vaccines against influenza WHO position paper - November 2012. Weekly epidemiological record, 2012; 87: 461-476.
25. Douba A, Aka LBN, Yao GHA, Zengbe-Acray P, Akani BC, Konan N. Facteurs sociodémographiques associés à la vaccination incomplète des enfants de 12 a 59 mois dans six pays d'Afrique de l'ouest. Santé publique, 2015; 27.
26. Greenaway ES, Leon J, Baker DP. Understanding the association between maternal education and use of health services in Ghana: Exploring the role of health knowledge. J Bio soc Sci. 2012; 44: 733-747.
27. Institut National d'Hygiene Publique de Cote d'Ivoire. Fiche de pre-enregistrement pour activités vaccinales. 2016.
28. Komlan Q, Roméo G, Gaudence DJ, Léonard F, Flore O, Hugue T. Equité d'accès et immunisation au Benin : Rapport sur le profil des inégalités d'accès des enfants a la vaccination. 2005; 56.
29. Maina LC, Karanja S, Kombich J. Immunization coverage and its determinants among children aged 12-23 months in a peri-urban of Kenya. Pan African Medical Journal. 2013; 14: 1-7.
30. Roy SG. Risk factors for childhood immunization incompletion in Ethiopia (master'sthesis). 2010.
31. Payne S, Townend J, Jasseh M, Jallow YL, Kampmann B. Achieving comprehensive childhood immunization : an analysis of obstacles and opportunities in The Gambia. Health Policy and Planning, 2013; 29:193-203.
32. Donsa LD. An examination of mothers' socio-demographic factors associated within complete vaccination status among under-five populations in Malawi (master'sthesis). 2013.
33. Wiysonge CS, Uthman OA, Ndumbe PM, Hussey GD. Individual and contextual factors associated with low childhood immunization coverage in Sub-Saharan Africa: A multilevel analysis. PLoS ONE. 2012; 7: 37905.
34. Rasmuson M. Sustaining EPI: What Can Communication Do? A publication of the HEALTHCOM Project. 1990; 17.
35. Douba A, Nicaise Aka LB, Attoh-Toure H, BangamanAkani C, Auguste Yao GH. Konan N, Accray-Zengbe P. An Analysis of Risk Factors for Incomplete Immunization for Children in Cote d'Ivoire: Examination of 1998-1999 and 2011-2012 Demographic and Health Survey. Health Sci. 2016; 17.