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ORIGINAL ARTICLE

Completeness and Timeliness of Immunization among Children aged 12 to 23 months in South-South Nigeria

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Keywords:

Childhood Immunization, Timeliness, Completeness, South-South, Nigeria

ABSTRACT

Background: Completeness and timeliness of immunization ensures optimal immune response and protection from vaccine-preventable diseases. This study aimed at assessing completeness and timeliness of immunization among children aged 12 to 23 months in Alakahia, Rivers State.

Methods: This was a descriptive cross-sectional study amongst 440 children selected using cluster sampling technique. A validated structured interviewer-administered questionnaire was administered. Two focus group discussions (FGDs) held with 14 purposively selected mothers of study participants using a topic guide. Descriptive statistics involved frequency and percentages for categorical, and mean and standard deviation for continuous variables. Inferential statistics was done using chi-square with p-value of < 0.05 accepted as significant. Thematic content analysis was done for the FGDs

Results: Mean age of participants was 20 months (± 6 months). A total of 232 (52.7%) and 128 (29.1%) mothers had secondary and tertiary education, respectively. Coverage was highest for BCG 405 (92.1%) and lowest for measles and yellow fever vaccines 322 (73.2%). Out of 215 children whose cards were seen, 164 (76.3%) were completely immunized. Pentavalent-1 was the most timely immunization 267 (67.3%) while measles and yellow fever were the least-timely 130 (40.4%). Mother's education was a significant factor associated with timeliness (p<0.001). Lack of adequate knowledge about immunization and absence of social and economic resources emerged as major barriers.

Conclusion: High immunization rates do not necessarily imply timeliness of vaccination. The researchers advocate for interventions improving access to information, maternal education and other identified barriers to immunization timeliness and completeness.

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INTRODUCTION

Vaccine-preventable diseases remain a common cause of childhood mortality with an estimated three million deaths each year.[1] Immunization is acclaimed as one of the most beneficial and cost-effective disease prevention measures available today.[2] Immunization against childhood diseases is one of the most important means of preventing morbidity and mortality in children. [1, 3] Immunization can be active, in which case the immune system is stimulated to produce antibody or cell-mediated immunity against an infectious agent by administering a vaccine or a toxoid.[2] Immunization can also be passive where preformed antibodies are introduced exogenously and also via the placenta in an unborn child. Active immunization produces long-lasting immunity while passive

immunization produces temporal immunity.[2] In Nigeria, immunization began in 1956 during the smallpox epidemic.[1] The Expanded Programme on Immunization (EPI) started in 1979 to combat deadly childhood diseases which were considered to be the cause of high infant morbidity and mortality.[1] The list of killer diseases such as small pox, polio, measles, yellow fever, tuberculosis, tetanus, and pneumonia, which have been eradicated, controlled or whose burden has dramatically reduced by immunizations continues to grow.[1, 4]

Routine immunization of children in Nigeria is carried out using a combination of vaccines.[5] According to the Nigerian Federal Ministry of Health, a child is considered to be completely immunized if he or she has received Bacille Calmette Guerin (BCG) vaccination against tuberculosis, three doses of pentavalent vaccine against diptheria, pertussis, tetanus, hepatitis B and haemophilus influenza, at least three doses of polio vaccine, one dose of yellow fever and one dose of measles vaccine.[1] According to this schedule, children 12 to 23 months should have completed their immunizations and be fully immunized.

Timely receipt of vaccines ensures optimal immune response to the vaccines.[6] When vaccines are taken too early in life or at prolonged intervals, the immune response can be jeopardized either by already existing maternal antibodies or inadequate immune response by the body.[6, 7] Immunization is timely when received at the earliest appropriate time, defined as within 30 days of the recommended age.[7] Recommendations for vaccine administration at certain ages is important because such recommendations are based on the estimation of the age at which the child's risk for that particular disease is highest.[8] Timely receipt of vaccines is important as it ensures that the recipient is protected from the disease as early as possible.[6, 8]

A study done in Switzerland showed that despite coverage rates of as high as 95% for Diphtheria and Tetanus vaccines, all immunizations were administered with significant delays.[9] In a cluster survey in El Salvador, only 26.7% were vaccinated within the age interval recommended by the EPI.[10] In a study in Nigeria, about 30% of the children presented after four weeks of age for their first immunization; 18.9%-65% of the children were delayed in receiving various vaccines compared to the recommended ages for receiving the vaccines.[11]

Nigeria has witnessed a gradual and consistent reduction in immunization coverage as the rate dropped from about 80% in the 90's to about 12.9% in 2003.[1] This is said to be the worst in the African sub-region. As a consequence, completeness and timeliness of immunization have been compromised. Factors associated with complete immunization and timeliness as reported from studies are cultural factors, poor supervision of health workers, poor programme planning and monitoring and increasing age of infants.[3, 8, 11-13]

This study aimed at assessing the completeness and timeliness of immunization as well as identify barriers and facilitators for completeness and timeliness of immunization in children aged 12 to 23 months in Alakahia, Rivers State.

METHODOLOGY

This was a descriptive cross-sectional study which employed both qualitative and quantitative approaches to data collection. It was conducted between August and October 2017 amongst children aged 12-23 months residing in Alakahia, Rivers State, Nigeria. Alakahia is a community in Obio-Akpor Local

Government Area (LGA), one of the urban LGAs in Rivers State. The community is host to the permanent site of the University of Port Harcourt Teaching Hospital (UPTH) and is close to the location of the University of Port Harcourt. It has several schools and a market with a large population of students and staff of the University and its teaching hospital as residents. The community indigenes are of Ikwerre ethnic group and are predominantly farmers. The Alakahia community is laid out in orderly streets and clearly delineated compounds. Members of the community access health services from the Aluu Health Centre and the UPTH. Immunization days are Mondays, Wednesdays and Fridays in UPTH and on Tuesdays and Fridays.in the Aluu Health Centre.

Only children aged between 12 and 23 months as at their last birthday whose parents had resided in Alakahia community for at least one year were considered eligible for inclusion in the study. For the quantitative aspect of the study, a sample size of 440 children aged 12-23 months was obtained using the formula for single proportion: $n= z^2 (pq)/e^2$,[14] where n is the calculated sample size, z is the 95% confidence of 1.96, e = the level of accuracy set at 0.05 and p=17.4% representing the proportion of children who were completely immunized obtained from another study.[4] Cluster sampling method was employed. Alakahia is divided by a road into two hamlets. These were taken as two clusters. One of the clusters was chosen by simple random sampling (balloting). All households with a child aged 12 to 23 years were included in the study until sample size was reached.

A validated structured interviewer-administered National Immunization Survey History Questionnaire developed by the Centre for Disease Control (CDC)[15] was used to obtain information from the mothers. Two research assistants who were medical doctors on National Youth Service deployment were trained to administer the study tool. Questions were asked about the child's immunization status, when each vaccine was received and factors associated with immunization. Information about the child's vaccination was also obtained from the vaccination card (where available) or by maternal history and transferred to the study instrument. The qualitative aspect of the study was done to ascertain reasons, beliefs and perceptions around the factors associated with delayed or missed vaccination dose and timeliness of immunization. This consisted of two focus group discussions (FGD) and purposive sampling was employed to select a total of 14 mothers of children aged 12 to 23 years (eight in the first group and six in the second). Discussions lasted a maximum of 45 minutes. The researcher was the moderator while an assistant took notes and operated the digital voice recorder.

Data was imputed into an excel spreadsheet and analyzed using the Statistical Package for the Social Sciences (SPSS) version 21.0. Data underwent consistency checks to ensure accuracy and completeness. Simple frequency tables of maternal and child health characteristics were made. Frequencies and percentages for immunization completeness and timeliness were presented in tables. Inferential statistics were done using chi-square and a p-value of < 0.05 was accepted as statistically significant at a 95% confidence interval. The transcripts from the two FGDs were first read for a general overview, clarity, and comprehension. The author's notes from the field supplemented the text. A thematic framework was developed from the narratives of discussants. Descriptive statements were formed, and quotes were lifted from their original statements to explain the identified themes.

Ethical approval was obtained from the Ethics Committee of the University of Port Harcourt. Permission for the study was obtained from the community leaders. A written informed consent was obtained from the mothers with eligible children before administration of questionnaires and their confidentiality was given utmost regard. Children who were unimmunized or incompletely immunized were referred to the Aluu Primary Health Centre or University of Port Teaching Hospital to access immunization services.

RESULTS

A total of 440 questionnaires were administered with 100.0% response rate. The mean age of the children was 20 ± 6 months. Majority of study participants 284 (64.5%) were aged 21-23 months. The highest proportion of the mothers 232 (52.7%) had secondary education followed by those with tertiary education 128 (29.1%). The majority were unemployed 299 (68.0%). (Table 1) Four hundred and fourteen (94.1%) of the mothers claimed their children had immunization cards. Of these, 215 (51.9%) were able to show their immunization cards. Immunization coverage was highest for BCG, 405 (92.1%) and lowest for measles and yellow fever, 322 (73.2%). (Table 2)

The highest proportion of children who received their immunizations promptly was 267 (67.3%) for Pentavalent-1 while the lowest proportion applied to those who took measles and yellow fever immunization 130 (40.4%). (Table 3) According to respondents' self-report, a total of 311 (70.7%) of children completed their immunization. However, vaccination cards reviewed for 215 study participants showed that 164 (76.3%) children were completely immunized. (Table 4) Among the 129 children who reported that they were either partially immunized or not immunized, the most prevalent barrier identified was lack of information 74 (57.4%).

Table 1: Socio-demographic characteristics of study participants

Variable	Frequency (n =440)	Percent
Child's age (months)		
12-14	76	17.3
15-17	44	10.0
18-20	35	8.0
21-23	285	64.7
Sex of child		
Male	211	48.0
Female	229	52.0
Mother's marital status		
Married	431	98.0
Unmarried	9	2.0
Mother's education		
No formal education	26	5.9
Primary	54	12.3
Secondary	232	52.7
Tertiary	128	29.1
Mother's occupational status		
Employed	141	32.0
Unemployed	299	68.0
Duration of residence in the community		
<2years	90	20.5
≥2years	350	79.5

Other reasons are as listed in Table 5. No socio-demographic characteristic was seen to be significantly associated with immunization status. (Table 6) Two major themes emerged in the course of the FGDs on barriers to immunization completeness and timeliness. The themes include:

Poor Knowledge about Timing and benefits of Immunization

Participants felt that some mothers miss their children's vaccination appointments and do not complete immunization because they are ignorant of the importance of the individual vaccines.

Table 2: Immunization history of study participants with or without immunization card

Variable	Frequency	Percent
Do you have an immunization card for your child? (n=440)		
Yes	414	94.1
No	26	5.9
Was the card seen? (n=414)		
Yes	215	51.9
No	199	48.1
Has your child received BCG vaccine? (n=440)		
Yes	405	92.1
No	26	5.9
Can't remember	9	2.0
Was BCG scar seen? (n=440)		
Yes	290	65.9
No	150	34.1
Has your child received Pentavalent one vaccine? (n=440)		
Yes	397	90.2
No	39	8.9
Can't remember	4	0.9
Has your child received pentavalent two vaccine? (n=440)		
Yes	385	87.5
No	51	11.6
Can't remember	4	0.9
Has your child received pentavalent three? (n=440)		
Yes	363	82.5
No	73	16.6
Can't remember	4	0.9
Has your child received OPV0? (n=440)		
Yes	393	89.3
No	43	9.8
Can't remember	4	0.9
Has your child received OPV1? (n= 440)		
Yes	396	90.0
No	40	9.1
Can't remember	4	0.9
Has your child received OPV2? (n=440)		
Yes	382	86.8
No	53	12.1
Can't remember	5	1.1
Has your child received OPV3? (n=440)		
Yes	363	82.5
No	71	16.1
Can't remember	6	1.4
Has your child received HBV vaccine? (n=440)		
Yes	389	88.4
No	46	10.5
Can't remember	5	1.1
Has your child received Measles and Yellow fever vaccines? (n=440)		
Yes	322	73.2
No	114	25.9
Can't remember	4	0.9

Table 3: Timeliness of immunization among study participants

Variable	Frequency	Percent
BCG (n=405)		
Timely (birth to 7 days)	245	60.5
Not timely (>7 days)	160	39.5
Pentavalent 1 (n=397)		
Timely (6 - 10 weeks)	267	67.3
Not timely (<6 weeks, >10 weeks)	130	32.7
Pentavalent 2 (n=385)		
Timely (10-14 weeks)	240	62.3
Not timely (<10 weeks, >14 weeks)	145	37.7
Pentavalent 3 (n=363)		
Timely (14 to 18 weeks)	211	58.1
Not timely (<14 weeks, >18 weeks)	152	41.9
OPV0 (n=393)		
Timely (birth to 7 days)	246	62.6
Not timely (>7 days)	147	37.4
OPV1 (n=396)		
Timely (6 - 10 weeks)	266	67.2
Not timely (<6 weeks, >10 weeks)	130	32.8
OPV2 (n=382)		
Timely (10-14 weeks)	236	61.8
Not timely (<10 weeks, >14 weeks)	146	38.2
OPV3 (n=363)		
Timely (14 to 18 weeks)	211	58.1
Not timely (<14 weeks, >18 weeks)	152	41.9
HBV0 (n=389)		
Timely (birth to 7 days)	237	60.9
Not timely (>7 days)	152	39.1
Measles and Yellow fever (n=322)		
Timely (9 -12 months)	130	40.4
Not timely (<9 months, >12 months)	192	59.6

Table 4: Completeness of immunization for study participants

Variable	Frequency	Percent
Immunization status based on verbal report (n=440)		
Completely immunized	311	70.7
Partially immunized	99	22.5
Not immunized	30	6.8
Immunization status based on vaccination cards seen (n=215)		
Completely immunized	164	76.3
Partially immunized	51	23.7
Not immunized	0	0.0

"Parents lack knowledge of it [immunization], and if educated, they become aware." (Participant 6, FGD 2)

Other participants shared their knowledge about the importance of timing for vaccines would aid compliance with vaccine timeliness.

''It is important to follow it [immunization schedule] as they say you should so that it [the vaccines] will work well'' (Participant 3, FGD 1). *''The vaccines have been tested and hypothesis [research] done and so the scientists know why it is set at that time''* (Participant 4, FGD 2).

Lack of Social and Economic Resources

Some participants identified the challenges of lack of domestic support as a hindrance to completing immunization. The participants claimed mothers would not miss a child's vaccine if she had adequate help at home.

"If the mother is sick and does not have help in the house she can't go." (Participant 7, FGD 1)

The issue of direct and indirect costs of immunization was also raised. Mothers complained that apart from transport costs, they are sometimes made to pay for vaccines that are supposed to be free, and this caused delays when funds were not available on the scheduled date for immunization.

"Vaccines are supposed to be free, and so when mothers have to pay, and charges are high, they won't want to come back." (Participant 2, FGD 2)

Table 5: Barriers to the completeness of immunization among study participants

Variable	Frequency	Percent
Barriers (n=129)		
Lack of information	74	57.4
Lack of motivation	21	16.3
Others	34	26.3
Lack of information (n=74)		
Unaware of the need for immunization	27	36.5
Unaware of the need to return for 2nd and 3rd dose	26	35.1
Place/time of immunization unknown	14	18.9
Fear of side reactions	4	5.4
Wrong ideas about contraindications	3	4.1
Lack of Motivation (n=21)		
Postponed till another time	19	90.5
No faith in immunization	2	9.5
Others (n=34)		
Place of immunization too far	7	20.6
Mother too busy	7	20.6
Time of immunization inconvenient	3	8.8
Mother's illness	3	8.8
Vaccines expensive	3	8.8
Vaccinator absent	3	8.8
Child ill-not brought	3	8.8
Community crises	3	8.8
Child ill-brought not given	1	2.9
Health worker's strike	1	2.9

Table 6: Distribution of some selected socio-demographic variables across children's immunization status

Variable	Immunization status		Total	$\chi 2$	p-value
	Fully immunized (n=311)	Not fully immunized (n=129)			
Sex of child					
Male	146 (69.2)	65 (30.8)	211	0.433	0.511
Female	165 (72.1)	64 (27.9)	229		
Mother's marital status					
Married	307 (71.2)	124 (28.8)	431	3.052	0.081
Unmarried	4 (44.4)	5 (55.6)	9		
Mother's occupation					
Employed	108 (76.6)	33 (23.4)	141	3.502	0.062
Unemployed	203 (67.9)	96 (32.1)	299		
Mother's educational status					
Educated	300 (72.5)	114 (27.5)	414	12.27	**< 0.001***
Uneducated	11 (42.3)	16 (57.7)	26		
Residency status					
<2years	62 (68.9)	28 (31.1)	90	0.176	0.675
≥2years	249 (71.1)	101(28.9)	350		

*Statistically significant

DISCUSSION

The Federal Government of Nigeria has set a target of 90% immunization coverage rates by 2020.[16] For this to be realized, there needs to be a lot of emphasis on completeness and timeliness of vaccinations. Our study findings show that vaccination completeness stood at

76.3% among those with vaccination cards. This finding is similar to that from a similar study in Enugu, Nigeria.[17] However, a study carried out to compare two cities in Nigeria (Calabar and Bauchi) demonstrated immunization completion rates in Calabar to be slightly higher than that seen in this study, while immunization completion rates were far lower in Bauchi than observed in this study.[16] The implications of our findings is that a little more than one-fourth of the study population had not completed their vaccinations and are therefore prone to vaccine preventable diseases. Public health efforts need to focus on closing this gap in immunization completeness.

However, complete immunization does not necessarily mean timely immunization coverage. Despite the vaccination completion observed in this study, only a third of the vaccines were received within the specified time with as much as two-thirds received at inappropriate times. This was particularly true for measles, yellow fever, OPV2 and BCG vaccines. The observed delays in taking measles and yellow fever vaccines is probably due to the long interval between OPV3/ Penta3 received at 14 weeks and measles/yellow fever vaccines received at 9 months. Another researcher also noted that vaccines were administered with significant delays despite high coverage rates.[10] The effectiveness of a vaccine is influenced by the time of administration such that administration before or after the optimal period can lead to immunogenic compromise.

Other studies identified many of the same barriers to completeness and timeliness of immunization as those in this study.[16, 19] Two reviews of publications and grey literature described reasons for non-vaccination in low and middle-income countries. The reviews assert that while there were geographic barriers to access and missed opportunities for vaccination, reasons for non-vaccination relating to parental knowledge or attitudes reflected region-specific health-seeking behaviors and perceptions.[20, 21] In the present study, immunization completion was significantly higher among children whose mothers were educated compared to women who were not. This implies that maternal education plays a key role in improving immunization completeness and timeliness. It is therefore imperative for interventions to focus on giving women and girls access to quality education.

Immunization coverage is one of the indicators used to measure a country's progress towards achieving the health-related sustainable development goals through the reduction of childhood morbidity and mortality.[22, 23] Delay in the uptake of a particular vaccine or missed vaccinations has serious public health implications for disease outbreaks, morbidity, and mortality.[23] It is therefore imperative that the Nigerian health authorities initiate and implement interventions to address the identified barriers to completeness and timeliness of vaccinations. The barriers of poor knowledge of vaccination timeliness and economic and social constraints identified during the FGDs need to be addressed. Health workers need to go beyond information about the importance and benefit of vaccines to provide more details about the necessity and benefit of timely administration of vaccines. In addition, under the table fees for services that are meant to be completely free can be a source of missed opportunities or delayed vaccination. Those who manage public health care facilities need to enforce existing policies against hidden charges and under-the-table fees.

This study relied on a relatively large sample size, community-based data collection,

vaccination cards and a mixed method approach to overcome some of the limitations of other studies. However, the descriptive cross-sectional nature of data collection is a limitation as the health outcomes from poor timing of vaccine administration cannot be demonstrated. The researchers, therefore, advocate cohort and case-control study designs to evaluate outcomes and impact of poor timing of vaccinations.

Conclusion

This study showed that high immunization rates do not necessarily imply timeliness of vaccination. Best outcomes for vaccination programmes can only be achieved through achieving 90% coverage and optimum timeliness for every vaccine. The researchers advocate for interventions that address access to information, maternal education and other barriers to timeliness and completeness of immunization.

REFERENCES

1. Ophori EA, Tula MY, Azih A V., Okojie R, Ikpo PE. Current trends of immunization in Nigeria: Prospect and challenges. Trop Med Health. 2014 Apr; 42(2): 67-75.
2. Orenstein WA, Pickering LK. Immunization practices. In: Nelson textbook of pediatrics. 18th ed. Philadelphia: Saunders; 2007. p. 1058-1071.
3. Miyahara R, Jasseh M, Gomez P, Shimakawa Y, Greenwood B, Keita K, et al. Barriers to timely administration of birth dose vaccines in The Gambia, West Africa. Vaccine. 2016 Jun; 34(29): 3335-3341.
4. Adeboye M, Adesiyun O, Adegboye A, Eze E, Abubakar U, Ahmed G et al. Measles in a tertiary institution in Bida, Niger state, Nigeria: Prevalence, immunization status and mortality pattern. Oman Med J. 2011 Mar; 26(2): 114-117.
5. Okafor I, Dolapo D, Onigbogi M, Iloabuchi I. Rural-urban disparities in maternal immunization knowledge and childhood health-seeking behaviour in Nigeria: A mixed method study. Afr Health Sci. 2014 Jun; 14(2): 339.
6. Babirye JN, Engebretsen IMS, Makumbi F, Fadnes LT, Wamani H, Tylleskar T et al. Timeliness of childhood vaccinations in Kampala Uganda: A community-based cross-sectional study. Ellis RD, editor. PLoS One. 2012 Apr 23; 7(4): e35432.
7. Abbott P, Menzies R, Davison J, Moore L, Wang H. Improving immunisation timeliness in Aboriginal children through personalised calendars. BMC Public Health. 2013 Dec; 13(1): 598.
8. Vasudevan L, Labrique AB, Mehra S, Wu L, Levine O, Feikin D et al. Maternal determinants of timely vaccination coverage among infants in rural Bangladesh. Vaccine. 2014 Sep; 32(42): 5514-5519.
9. Heininger U, Zuberbühler M. Immunization rates and timely administration in pre-school and school-aged children. Eur J Pediatr. 2006 Feb; 165(2): 124-129.
10. Suarez-Castaneda E, Pezzoli L, Elas, M, Baltrons R, Crespin-Elias E., Pleitez OA et al. Routine childhood vaccination programme coverage, El Salvador, 2011: In search of timeliness. Vaccine 2014 Jan; 32(4): 437-444.
11. Sadoh AE, Eregie CO. Timeliness and completion rate of immunization among Nigerian children attending a clinic-based immunization service. J Health Popul Nutr. 2009 Jun; 27(3): 391-395.

12. Schoeps A, Ouédraogo N, Kagoné M, Sié A, Müller O, Becher H. Socio-demographic determinants of timely adherence to BCG, Penta-3, Measles and complete vaccination schedule in Burkina Faso. Vaccine. 2013 Dec; 32(1): 96-102.
13. Laryea DO, Abbeyquaye Parbie E, Frimpong E. Timeliness of childhood vaccine uptake among children attending a tertiary health service facility-based immunisation clinic in Ghana. BMC Public Health, 2014 Dec; 14(1): 90.
14. Kirkwood BR. Essential medical statistics. 2nd ed. Malden, Mass: Blackwell Science; 2003. 420.
15. CDC. National Immunization survey history questionnaire. Atlanta: CDC; 2010. 1-4.
16. Cockcroft A, Usman MU, Nyamucherera OF, Emori H, Duke B, Umar NA et al. Why children are not vaccinated against measles: a cross-sectional study in two Nigerian States. Arch Public Heal. 2014 Dec; 72(1): 48.
17. Tagbo BN, Eke CB, Omotowo BI, Onwuasigwe CN, Onyeka EB, Mildred UO. Vaccination coverage and its determinants in children aged 11-23 months in an urban district of Nigeria. World J Vaccines, 2014 Oct; 04(04): 175-183.
18. Barman D, Dutta A. Access and barriers to immunization in West Bengal, India: quality matters. J Health Popul Nutr. 2013 Dec; 31(4): 510-522.
19. Rainey JJ, Watkins M, Ryman TK, Sandhu P, Bo A, Banerjee K. Reasons related to non-vaccination and under-vaccination of children in low and middle income countries: Findings from a systematic review of the published literature, 1999–2009. Vaccine. 2011 Oct; 29(46): 8215-8221.
20. Favin M, Steinglass R, Fields R, Banerjee K, Sawhney M. Why children are not vaccinated: A review of the grey literature. Int Health 2012 Dec; 4(4): 229-238.
21. Maternal Health Task Force. The Sustainable Development Goals and Maternal Mortality [Internet]. Harvard T.H. Chan School of Public Health. 2017 [cited January 23, 2018]. p. 1. Available from: https://www.mhtf.org/topics/the-sustainable-development-goals-and-maternal-mortality/
22. UNICEF. The State of the World's Children 2016: A fair chance for every child. New York; 2016.
23. Hu Y, Li Q, Luo S, Lou L, Qi X, Xie S. Timeliness Vaccination of Measles Containing Vaccine and Barriers to Vaccination among Migrant Children in East China. Xu J, editor. PLoS One. 2013 Aug; 8(8): e73264.