Immunization coverage and its determinants among children 12-23 months of age in Aden, Yemen

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ABSTRACT

الأهداف: تقييم وضع التطعيم والعوامل المتغيرة التي تؤثر عليه لدى الأطفال الذين تتراوح أعمارهم مابين 12-23 شهراً في محافظة عدن باليمن.

الطريقة: أُجريت هذه الدراسة المقطعية في مدينة عدن، اليمن وذلك خلال الفترة من مارس إلى يوليو 2007م حيث تم اختيار 680 أماً من 37 مجمعاً سكنياً. وبعد ذلك تم إجراء المقابلات الشخصية مع الأمهات وتم الحصول على بعض المعلومات الديموغرافية والاجتماعية وكذلك السؤال عن وضع التطعيم عند الأطفال، وتم تقييم مدى التغطية وعدم الالتزام بكافة اللقاحات. بالإضافة إلى ذلك تمت دراسة الترابط بين مدى التغطية لكافة اللقاحات والصفات الديموغرافية والاجتماعية باستخدام تحليل الانحدار اللوجستي باعتبار وضع التطعيم متغيراً غير مستقل.

النتائج: أظهرت النتائج أن 83.1% من الأطفال الذين تضمنتهم الدراسة قد أكملوا كافة اللقاحات، في حين أخذ 10.4% جزءاً منها، و 6.5% لم يأخذوا أياً من اللقاحات اللازمة. لقد وصل معدل الأطفال الحاصلين على بطاقة التطعيم إلى 84.9%، فيما كانت نسب تغطية اللقاحات كالتالي: 92.9% للتطعيم ضد السل، 89.6% للجرعة الثالثة من تطعيم شلل الأطفال، 86.6% للتطعيم ضد الدفثيريا (الخناق)، والسعال الديكي، والجرعة الثالثة من الكزاز، والتطعيم ضد التهاب الكبد البائي، و89.1% للتطعيم ضد الحصبة. أظهر تحليل الانحراف متعدد المتغيرات بأن إكمال جدول اللقاحات مرتبط بامتلاك بطاقة التطعيم (OR=14.71; 95% CI: 8.50-25.44) وتقدم الأم في العمر (OR=0.41; 95% CI: 0.22-0.77)

خاتمة: أشارت الدراسة إلى أن 16.9% من الأطفال لم يقوموا بإكمال كافة اللقاحات وذلك بالرغم من ارتفاع نسبة تغطية اللقاحات، وقد كانت هذه النسبة أقل بين أطفال الأمهات المتقدمات في السن وأمهات الأطفال الذين يمتلكون بطاقة التطعيم، ولذلك فنحن بحاجة إلى زيادة الوعي حول أهمية التطعيم وتسهيل الحصول على الخدمات الصحية ومن بينها بطاقة التطعيم.

Objectives: To assess the immunization status of children aged 12-23 months and its determinants in Aden, Yemen.

Methods: This cross-sectional survey was conducted between March and July 2007 during which time mothers of 680 children from 37 randomly selected clusters in Aden, were interviewed. Information on socio-demographic profiles and children's immunization status was obtained. Immunization coverage of all officially provided vaccines was assessed. Analysis of association between immunization coverage and the socio-demographic characteristics were tested using logistic regression analysis with the immunization status as the dependent variable.

Results: We found that 83.1% had complete, 10.4% had partial, and 6.5% were never immunized. The immunization card retention rate was 84.9%. The immunization coverage was 92.9% for Bacillus-Calmette-Guérin, 89.6% for Oral Polio Vaccine-3, 86.6% for Diphtheria, Pertusis and Tetanus-3 and Hepatitis-B vaccination, and 89.1% for measles. Multivariate analysis showed that children with an immunization card (odds ratio [OR]=14.71; 95% confidence interval [CI]: 8.50-25.44) were more likely to have complete immunization, while children with older aged mothers (OR=0.41; 95% CI: 0.22-0.77) were more likely to have complete immunization.

Conclusion: Despite the high immunization coverage, 16.9% of children did not have complete immunization, and this rate was lower among children of older mothers, and those who retained their immunization cards. Raising awareness of immunization and increasing access to health services must be strengthened.

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Immunization against childhood diseases is one of the most cost-effective public health interventions available, and has saved the lives of millions of children in the last 3 decades. Immunization also prevents many more millions from suffering debilitating illness, and lifelong disability.[1,2] Achieving and maintaining high levels of immunization coverage among children is necessary for the control and elimination of the major preventable diseases of childhood.[2] In Yemen, although vaccines for the major vaccine preventable diseases (VPDs) are available free for the public under the Expanded Programme on Immunization (EPI) since its establishment in 1979,[3] the overall complete immunization coverage for Yemeni children within the age 12-23 months was only 37.2%.[4] The VPDs still cause nearly one third of the total deaths, and large number of disabilities among the under 5 years Yemeni children.[5] In Aden, routine administrative data showed that 92% of targeted children were completely immunized, but there was lack of recent household community-based data on childhood immunization coverage.[6] Therefore, the objective of this study was to assess the immunization status of children aged 12-23 months and its determinants in Aden, Yemen.

Methods. A cross-sectional survey of selected households in Aden governorate was conducted between March and July 2007. Aden is the economic and commercial capital of the Republic of Yemen. Geographically, it is located at the southwest tip of Yemen and the Arab peninsula at a distance of 424 km from the political capital, Sana'a. Aden has a population of around 590,471 residing in 8 administrative districts.[7] Historically, Aden is the pioneer in providing health care services at the national level. Health care services were provided mainly by public health facilities through 17 health centers and 8 maternity centers and 6 major hospitals. More recently, since the 1990s, there are a growing number of private hospitals, health centers, and clinics involved in health services provision.[6] The sample size was calculated applying the formula for estimating a population proportion with specified absolute precision using the following formula:[8]

$$n = \frac{DE \; Z^2_{1-\alpha/2} \times P \; (1 - P)}{d^2}$$

Where, n is the sample size, $Z^2_{1-\alpha/2}$ is the certainty wanted, expressed in the percentage point of the normal distribution corresponding to the 2-sided level of significance; P is the percentage of immunization coverage in children aged 12-23 months in Yemen; d is the precision or error allowable; and DE is the design effect: the ratio between the variance from the cluster design to the variance that would be obtained from a simple random sample.[8] Applying the above formula with the following considerations: i) The estimated coverage of immunization in children aged 12-23 months in the urban area of Yemen in the Yemeni Survey for Family Health (YSFH) of 67.2%.4 ii) The desired confidence level (α) for $\alpha = 0.05$, $Z^2_{1-\alpha/2} = 1.96$. iii) Precision or error allowable of 5%. iv) The design effect of 2:[2]

$$n = \frac{2 \times (1.96)^2 \; (0.67 \times 0.33) = 680}{(0.05)^2}$$

So, a sample size of 680 households with mothers and their children aged 12-23 months were taken from selected districts of Aden. A cluster sampling method other than the 30 clusters of 7 children method suggested by the WHO,[9] was used in this study to meet the required sample size and to be able to look for the role of different factors on the immunization status. According to the census data of the total number of households in different districts,[7] and by using the probability proportionate to size simple random sampling, the number of needed clusters and households in each district was calculated.

Proceeding from house to house looking for our inclusion criteria of having at least one child aged 12-23 months with his/her mother, respondents (mothers and their children) were proportionally enrolled from 37 randomly selected clusters in the 8 districts of Aden. Respondents were interviewed using a structured pre-designed questionnaire after being informed of the purpose of the study and after giving their verbal agreement to take part in the study. Information on socio-demographic profiles was obtained through face-to-face interviews. Information on their children's immunization status was collected from the child's immunization card when available or from the history of immunization uptake as provided by the mother. With regards to maternal recall of the child immunization status, 8 questions were selected from the United Nations Children's Fund (UNICEF) Household Baseline Survey.[10]

Independent variables in this study were child (gender; age; child birth order; birth interval from previous birth and the place of birth as well as the type of delivery), mother (age; age at first birth; marital status; educational level; type of occupation and mother khat chewing habit), father (educational level; type of occupation and father khat chewing habit) and family (size; type and residency of the family; monthly income and monthly expenditure on khat) characteristics. Each of these variables was dichotomized into 2 categories and

redefined taking into consideration that the reference (least risky) category in all variables equals 0. Initially, the unadjusted relationship between each independent variable and the child immunization status, using the simple logistic regression method and calculating the crude odds ratio (OR) as a measure of association with its 95% confidence interval (CI) was carried out.

Multivariate analysis to explore the effect of the different studied variables on the likelihood of children to have complete immunization was performed by binary logistic regression using odds ratio (OR) and its 95% confidence interval (95% CI). Enter method was used in all multivariate analysis models. In the first multivariate model, all independent variables were entered together as potential predictors. The adjusted OR as a measure of association with 95% CI was calculated. Then, all variables with a p-value <0.05 in the bivariate analysis, simple logistic regression, and the first model of multivariate analysis as well as the variables with theoretical relevance were selected to enter together in the second model of the multivariate analysis. Thus, this logistic model was rerun several times omitting all variables with a p-value of ≥0.05. In each step, model fitness was checked by Hosmer-Lemeshow goodness-of-fit test, and variables that did not add any significant value to the model were omitted one by one starting with the variable of the largest p-value until reaching the best fitting model. Only variables that showed significant association with the immunization status were presented in the result section.

Immunization coverage of all vaccines covered by the Yemeni EPI and their dropout rates were assessed. A child was defined as completely immunized if he had received one dose of Bacillus-Calmette-Guérin (BCG), 3 doses of Oral Polio Vaccine (OPV), 3 doses of Diphtheria, Pertusis and Tetanus (DPT), and hepatitis B and one dose of measles vaccines at time of data collection. Analysis of association between immunization status and child's, mother's and family's socio-demographic characteristics was carried out and tested using Chi-square tests and logistic regression, with 0.05 level as the cut-off value for statistical significance using the Statistical Package for Social Sciences (SPSS Inc, Chicago, IL, USA) version 15. The study was approved by the Institutional Research and Ethics Committee Meeting of the Universiti Kebangsaan Malaysia, Project code: FF-265-2006.

Results. Of the total 680 enrolled households, the researchers found 565 (83.1%) children had received all recommended doses of the routine EPI vaccines, 10.4% of them had missed at least one dose of the routine EPI vaccines, and 6.5% of the children were never immunized at the time of data collection. It was also observed that 84.9% of the total number of children had EPI immunization cards. This study shows that 92.9% had received BCG, 89.6% had completed the 3 OPV doses, and 89.1% had received the measles vaccine. With regards to DPT and Hepatitis B vaccines' coverage, 86.6% of all children had completed 3 doses of each vaccine. The overall dropout rate between BCG to Measles vaccines was very low (4.1%) and the drop out rate between DPT1/DPT3 was 5.5%. While the dropout rate between OPV1/OPV3 was 4.1%. The univariate analysis for the association between various socio-demographic characteristics and the immunization status of children (**Tables 1 & 2**) showed that maternal age of 35 years and more (x^2 (1)= 5.27, p=0.022), maternal age at the delivery of the first baby of 20 years and more (x^2 (1)= 4.39, p=0.048) as well as having children whose fathers worked as professionals or clerks (x^2 (1)= 5.49, p=0.019) were associated with complete immunization of their children. On the other hand, the multivariate analysis (**Table 3**) showed that children whose mothers have the child's immunization card (OR=14.71; 95% CI:8.50–25.44) were more likely to have complete immunization, while children having older age mothers, 35 years or older (OR=0.41; 95% CI:0.22–0.77) were more likely to have complete immunization.

Table 1 - Association between children's characteristics and their immunization status.

Child characteristics	Immunization status				*P*-value[a]
	Complete (n=565)		Incomplete (n=115)		
	f	(%)	f	(%)	
Gender					0.861
Male	290	(51.3)	58	(50.4)	
Female	275	(48.7)	57	(49.6)	0.551
Birth order					
1-3	397	(70.3)	84	(73.0)	
>3	168	(29.7)	31	(27.0)	
Birth interval (months)					0.372
1st child	174	(30.8)	46	(40.0)	
<36	170	(30.1)	34	(29.6)	
≥36	221	(39.1)	35	(30.4)	
Place of birth					0.532
Health facility	361	(63.9)	77	(67.0)	
Home	204	(36.1)	38	(33.0)	
Type of delivery					0.671
Vaginal delivery	493	(87.3)	102	(88.7)	
Caesarean delivery	72	(12.7)	13	(11.3)	

[a]Differences tested by x^2

Table 2 - Association between family characteristics and their childrens' immunization status.

Family characteristics	Immunization status				*P*-value[a]
	Complete (n=565)		Incomplete (n=115)		
	f	(%)	f	(%)	
Mother's age (years)					0.022*
<35	403	(71.3)	94	(81.7)	
≥35	162	(28.7)	21	(18.3)	
Mother's age at first birth (years)					0.048*
<20	138	(24.4)	38	(33.0)	
≥20	427	(75.6)	77	(67.0)	
Marital status					0.534
Married	546	(96.6)	113	(98.3)	
Currently unmarried	19	(3.4)	2	(1.7)	
Mother's education					0.061
Low education	325	(57.5)	77	(67.0)	
Higher education	240	(42.5)	38	(33.0)	
Mother's occupation					0.073
Employed	85	(15.0)	10	(8.7)	
Housewife	480	(85.0)	105	(91.3)	
Father's education					0.062
Low education	180	(31.9)	47	(40.9)	
Higher education	385	(68.1)	68	(59.1)	
Father's occupation					0.019*
Clerk & professional work	318	(56.3)	51	(44.3)	
Other type of works	247	(43.7)	64	(55.7)	
Family size (person)					0.435
<5	119	(21.1)	28	(24.3)	
≥5	446	(78.9)	87	(75.7)	
Family type					0.547
Nuclear	263	(46.5)	50	(43.5)	
Extended	302	(53.5)	65	(56.5)	
Family residency					0.091
Urban	408	(72.2)	74	(64.3)	
Semi urban and slum	175	(27.8)	41	(35.7)	
Per capita income (years)					0.218
<7756	367	(65.0)	27	(63.5)	
≥7756	128	(22.6)	18	(15.6)	
No response	70	(12.4)	24	(20.9)	
Father khat chewing					0.162
Yes	380	(67.3)	85	(73.9)	
No	185	(32.7)	30	(26.1)	
Mother khat chewing					0.590
Yes	50	(8.8)	12	(10.4)	
No	515	(91.2)	103	(89.6)	
Expenditure on khat monthly (years)					0.565
≤5000	170	(30.1)	41	(35.7)	
>5000	168	(29.7)	35	(30.4)	
Not chewing khat	180	(31.9)	28	(24.3)	
No response	47	(8.3)	11	(9.6)	

[a]Differences tested by x^2, *p<0.05

Table 3 - Factors of complete immunization status of children aged 12-23 months.

Variables	OR	95% CI
Child's immunization card		
Mothers have child's immunization card	1	-
Mothers did not have child's immunization card	14.71	8.50-25.44
Mother's age		
Younger mother's age	1	-
Older mother's age	0.41	0.22-0.77

OR - odds ratio, CI - confidence interval

Discussion. This household survey's immunization coverage of 83.1% is still below the 90% target for under ones with complete immunization by 2010,[3] but it is higher than the 66.7% of complete immunization reported by Abdel Rahim,[11] amongst the same age group of children in Aden in 1995. However, this survey's figure was lower than 92% reported by routinely administrative data in 2007 in Aden as an important intervention to achieve Millennium Development Goals targets.[6] Compared to the child's immunization card retention rate of 84.9% reported in this study, a lower card retention rate of 41.6% was reported in the urban areas of Yemen by the YSFH.[4] In a related context, Ba'Amer reported a retention rate of 66.7% in Al-Mukalla, Yemen.[12] The higher card retention rate in Aden could be partially attributed to the higher educational level of women in Aden compared to other Yemeni governorates.[7] The contribution of under immunizations to the resurgence of VPDs has been well documented and children with incomplete immunization have greater risks of contracting these diseases.[2,13] Although 10.4% of children in the present study had partial immunization and 6.5% were never immunized, these rates are lower than what were found in Abdel Rahim's study,[11] where 19.3% of children had partial immunization, and 14% were never immunized. This difference might be attributed to the progress in the coverage improvement of EPI services as indicated by the EPI report 2004.[3] In the Al-Mukalla district, the second main city, and seaport after Aden in southern Yemen, Ba'Amer's[12] findings were almost similar to those reported in this study, where 82.4% of children of the same age had complete, 12.4% had partial, and 5.2% were never immunized. For both, Al-Mukalla and Aden, the prevalence of complete immunization was higher than the national coverage of 37.2%, and the immunization coverage of 67.2% in the urban areas of Yemen as reported by the YSFH.[4] Compared to other Arab countries, 90% and more of the surveyed children aged 12-23 months had full immunization in Algeria, Egypt, and Lebanon,[14] while

87% of Syrian[15] children had full immunization. The achievement of 90% immunization coverage among infants for all recommended vaccines was established by the international public health community as a principal goal to interrupt the transmission of VPDs. Furthermore, this high level of coverage could provide a degree of protection even for unimmunized children due to the herd effect.[13] It should be pointed out from our findings that this coverage goal has already been achieved for BCG only (92.9%), but approaching the goal with 89.6% for OPV3, 89.1% for measles vaccines, and 86.6% for DPT3 and Hepatitis B3. Almost similar figures for all vaccines were reported by Ba'Amer, except for 88.1% reported for the BCG vaccine.[12] This might be due to the difference in mothers' accessibility to health facilities and delivery care in these 2 cities. If the mother delivers in a hospital or health and maternity center, her infant should receive the BCG vaccine before discharge. Therefore, counselling on immunization should be part of birth preparation during antenatal visits, and the immunization can actually serve as the motivation for a postpartum visit.[16] In agreement with our findings that shows higher coverage in specific vaccines than the overall immunization coverage, a large body of literature concluded that, coverage level for different types of vaccines are mostly higher than the prevalence of complete immunization.[16-19] The percentage of children receiving DPT1 is widely used as an indicator to show the level of access or utilization of immunization services by the population.[16-19] Good access to services is a prime determinant of immunization and a rate of DPT1 less than 90% implies that access to immunization services is not good.[16,20,21] Good access to immunization service as evidenced by a high DPT1 coverage of 91.6% was found in the present study. Good access to immunization services was also reported in Al-Mukalla with DPT1 coverage of 90.5%.[12] Lower DPT1 coverage of 55.6% was reported in the YSFH,[4] and 85% by the routine administrative report in Yemen.[6] The present study access rate was also similar to those obtained in most Arab countries.[22] In other developing countries like India,[16,17] and Nigeria,[23] many studies showed a lower rate of access to immunization services. However, higher rates of 97% and more were reported in Egypt[24] and Dhaka, Bangladesh.[25] Despite the reported higher rates of access, the proportion of children with complete immunization was very low in Dhaka, Bangladesh.[25] Globally, a larger number of children dropped out of the immunization series after receiving one or more vaccinations than are left out entirely.[13] The dropout rate of 5.5% from first to third dose of DPT in our study was lower than the dropout rate of 6.1% as reported by Abdel Rahim.[11] A DPT1 to DPT3 dropout rate of 5% was reported in Dhaka, Bangladesh.[25] A dropout rate of 23.2%,[17] 21.2%,[21] and 18%,[18] from DPT1 to DPT3 were reported in India. A lower dropout rate of 4.1% was also reported from BCG to measles in this study compared to the rate of 20.4% reported by Abdel Rahim.[11] Compared to our results, a dropout rate of 13% from BCG to measles was found in Dhaka, Bangladesh.[25] Several limitations should be acknowledged in assessing the results of this study. The first limitation is that, Aden governorate was selected purposively from a total of 21 Yemeni governorates. Since Aden was purposively selected, this might limit the generalizability of the results to only the urban areas of Yemen and similar areas in the region. Second, we tried our best to minimize recall bias by confirming and reconfirming the children's immunization status by enquiring about the various aspects of the vaccine, such as site, number, and age of administration; but as it is the case with any other study, it could not be totally eliminated.

In conclusion, although immunization coverage is high, access to health care services is high and the drop out rate is very low in Aden, Yemen, still 16.9% of children did not have complete immunization, and 15.1% did not have their immunization cards. Health education and communication programme interventions must be designed to cover the specific details of the national EPI vaccines according to the recent schedule, and the threats of VPDs covered under the national EPI. Also, to raise parents and the general publics awareness of the importance of the immunization card as a vital record to facilitate the follow up of different vaccines doses, to remind parents to avoid dropout doses, and hence encourage them to complete the immunization of their children. Special focus should be devoted to younger mothers, mothers who married early and gave birth to their first babies at younger age, non-working mothers, and families with non-working or manually working fathers. Furthermore, there is a need for an intervention directed to improve the access and delivery of the immunization services through strengthening, reinforcing, and expanding the available immunization services.

References

1. World Health Organization. State of The World's Vaccines and Immunization. (WHO/V&B/02.21). Geneva: World Health Organization; 2002.
2. Adams AM, Jacoby SF. NGO Participation in GAVI and Immunizations Social Mobilization and Reaching the Marginalised. Washington (DC): Mailman School of Public Health, Columbia University; 2004.
3. Ministry of Public Health. The Annual Report of Child Health Directorate, 2004. Sana'a (Yemen): Ministry of Public Health; 2004.

4. Ministry of Public Health. Yemeni survey for family health. (0556) D-06/(2004) 06M:2004. Sana'a (Yemen): Ministry of Public Health and Population, the Central Statistical Organization, and the Arab Project of Family Health; 2004.
5. United Nations Development Programme. Country evaluation: Assessment of development results - Yemen. New York (NY): United States of America; 2005.
6. Ministry of Public Health. The Annual Report of Expanded Programme on Immunization 2007. Aden (Yemen): Aden Office; 2008.
7. Ministry of Planning. Central Statistical Organization. Sana'a (Yemen): Yemeni Population and Housing Census; 2005.
8. Lwanga SK, Lemshow S. Sample Size Determination in Health Studies; A Practical Manual. Geneva (SW): World Health Organization; 1991.
9. World Health Organization. Immunization Coverage Cluster Survey-Reference Manual. Immunization, Vaccines and Biologicals. (WHO/IVB/04.23) Geneva (SW): World Health Organization; 2005.
10. UNICEF. IMCI household baseline survey. Household level survey questionnaire. Generic tool prepared by EPP/Evaluation and Health Section of UNICEF in collaboration with IMCI Inter-Agency Working Groups. New York (NY): United Nations Children's Fund, 1999.
11. Abdel Rahim JA. Immunization coverage among children up to the age of two years-Aden Governorate [dissertation]. Aden (Yemen): University of Aden: 1995.
12. Ba'Amer AA. Coverage and barriers of routine child vaccinationin Mukalla district, Hadramout governorate, Yemen. ***East Mediterr Health J*** 2010; 16: 223-227.
13. World Health Organization. UNICEF. Increasing immunization coverage. Vacc Immuniz Update 2002; 2(3):3-11.
14. United Nations. Economic and Social Council. Summary of midterm reviews and major evaluations of country programmes. (Updated 2005 July 1. Accessed: 2008 April 10). Available from URL: http://www.unicef.org/about/execboard/files/05-10_agenda.pdf
15. League of Arab States. Selected indicators of the Arab family health survey. Cairo (Egypt): Pan Arab Project for Family Health; 2006. p. 5-37.
16. Patra N. Universal immunization programme in India: the determinants of childhood immunization. ***Journal of Economic Literature*** 2005; 25: 13-20.
17. Manjunath U, Pareek RP. Maternal knowledge and perceptions aboutthe routine immunization programme--a study in a semiurban area in Rajasthan. ***Indian J Med Sci*** 2003; 57: 158-163.
18. Chhbara P, Nair P, Gupta A, Sandhir M, Kannan AT. Immunization in urbanised villages of Delhi. ***Indian J Pediatr*** 2007; 74: 131-134.
19. Ibnouf AH, Van den Borne HW, Maarse JAM. Factors influencing immunization coverage among children under five years of age in Khartoum State, Sudan. ***South Africa Fam Practice*** 2007; 49: 14-19.
20. Seidel R. Behaviour change perspectives and communication guidelines on six child survival interventions. Academy for Educational Development. (Updated: 2005 Accessed: 2008 April 12). Available from URL: http://www.jhuccp.org/pubs/cp/child_survival/BehaviorChangePerspectives.pdf
21. Nath B, Singh JV, Awasthi S, Bhushan V, Kumar V, Singh SK. A study on determinants of immunization coverage among 12-23 months old children in urban slums of Lucknow district, India. ***Indian J Med Science*** 2007; 61: 598-606.
22. UNICEF. The State of the world children 2008: Child survival. New York: Oxford University Press; 2008.
23. Babalola S, Adewuyi A. Factors Influencing Immunization Uptake in Nigeria: Theory-based Research in Six States. Report. Abuja (Nigeria): Partnership for Transforming Health Systems; 2005.
24. El-Zanaty FH. Support to National Communication Polio Plan Baseline Survey. (Updated: 2002 Accessed: 2008 April 20). Available from: http://www.unicef.org/evaldatabase/index_14262.html
25. Khan MN, Rahman ML, Miah AA, Islam MS, Musa SA, Tofail F. Vaccination coverage survey in Dhaka District. ***Bangladesh Medical Research Council J*** 2005; 31: 46-53.

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Al-Saigul AM, Al-Alfi MA. Audit of well-baby care in primary health care centers in Buraidah, Saudi Arabia. ***Saudi Med J*** 2009; 30: 956-960.

Khalil MK, Nadrah HM, Al-Yahia OA, Al-Saigul AM. Sero-response to measles vaccination at 12 months of age in Saudi infants in Qassim Province. ***Saudi Med J*** 2008; 29: 1009-1013.

Al-Zubairi LM, Raja'a YA, Al-Saidi IA. Effect of breastfeeding on growth in Yemeni infants. ***Saudi Med J*** 2007; 28: 1715-1717.

Al-Mazrou YY, Khalil MK, Elgizouli SA, Al-Jeffri MH, Bakhsh MM, Mishkais AA. Diphtheria, pertussis, and tetanus serosurvey in Saudi children. ***Saudi Med J*** 2007; 28: 1230-1233.