ORIGINAL PAPER

Nagoya J. Med. Sci. **79**. 179 ~ 188, 2017
doi:10.18999/nagjms.79.2.179

Socio-economic and demographic determinants of full immunization among children of 12–23 months in Afghanistan

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ABSTRACT

Immunization is one of the most cost-effective interventions to reduce vaccine-preventable diseases morbidity and mortality. Vaccination coverage is very low in Afghanistan; National Risk and Vulnerability Assessment (NRVA) Survey 2008 estimated the coverage of fully immunized children to be 37%. The current study was designed to examine the factors influencing full immunization among children aged 12–23 months. Demographic and vaccination data of 2,561 children of 12–23 months was extracted from the Afghanistan Health Survey (AHS) 2012. The data was analyzed by logistic regression to estimate adjusted odds ratios (AOR) and 95% confidence intervals (CI). The study found that 38.8% of the children were fully immunized. The coverage for specific vaccines was 80.9% for BCG, 72.0% for OPV3, 64.8% for measles, and 50.1% for Penta3. Urban residence (AOR = 0.60, 95% CI 0.40–0.90 relative to rural), children of poorer families (AOR = 1.36, 95% CI 1.10–1.67 relative to poorest), some education (AOR = 1.59, 95% CI 1.20–2.11 relative to no education) and antenatal care (AOR = 1.70, 95% CI 1.44–2.01 relative to not received) were found to be significant predicators of full immunization. This study indicated that the full-immunization rate in Afghanistan was quite low compared to the national target of 90% coverage. Therefore, strategies taking into account the identified factors seem to be vital to improve vaccination coverage.

Key Words: Afghanistan, determinant, vaccination, children, coverage

INTRODUCTION

Vaccination of children through the administration of the Expanded Program on Immunization (EPI) has been very successful and cost-effective among all available public health measures,[1] contributing to the reduction of infant and child morbidity and mortality.[2] It is estimated that immunization annually averts 2.5 million child deaths from vaccine-preventable diseases worldwide.[2] In addition, immunization is highly efficient. For example, the cost of treatment of hypertensive patients for a year of health life saved varies from $4,340 to $87,940 in the United States, while

Received: September 8, 2016; accepted: March 17, 2017

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most of the immunizations cost $50 or less per health life year saved.[3)]

The EPI was established by the World Health Organization (WHO) in 1974 with the aim of extending immunization worldwide, in order to control vaccine-preventable diseases.[4)] This program initially targeted six diseases: diphtheria, whooping cough (pertussis), tetanus, measles, poliomyelitis, and tuberculosis.[5,6)] Afterwards, hepatitis B, haemophilus influenzae B (HiB), pneumococcus, rotavirus, human papilloma virus (HPV), yellow fever, meningococcal meningitis, Japanese encephalitis, and rubella were considered as important vaccines for the global immunizations and gradually countries began to introduce some of them into their routine immunization systems.[6)]

Presently, the EPI has emerged as a highly effective and efficient method to improve child survival.[7)] The program's interventions led to the notable decline in vaccine-preventable diseases worldwide.[8)] Eradication of smallpox, reduction of polio incidence by 99% and neonatal tetanus by 94% have led to dramatic decrease in the morbidity, disability, and mortality of childhood diseases.[9)]

Despite these global efforts, it is estimated that about 2 million children under the age of five-years-old die of vaccine-preventable diseases annually, mostly in the developing countries of Africa and Asia.[10)] The underlying cause of this mortality is poor immunization coverage (<80%) against diphtheria, tetanus, pertussis, polio, and measles in low and middle income countries.[11)] If countries could raise and sustain their routine immunization coverages to a global average of 90%, the aforementioned additional two million deaths of children under five-years-old could be prevented.[10)]

Afghanistan is a poor and landlocked country in south Asia.[12)] Afghanistan has been implementing EPI since 1978.[13)] The National Immunization Program (NIP) in Afghanistan provides vaccination services through fixed (facility based), outreach, and mobile strategies.[14)] The routine immunization schedule of the country for children less than one year of age is as follows: one dose of Bacillus Calmette Guerin (BCG) vaccine at birth, five doses of oral polio vaccine (OPV) at birth, 6, 10, 14 weeks and 9 months, three doses of Penta (diphtheria, pertussis, tetanus, hepatitis B [Hep B] and haemophilus influenzae B [Hib]) at 6, 10, and 14 weeks, and one dose of measles vaccine at 9 months.[14)] The children are considered to be fully immunized by completion of BCG, three doses or more of OPV, three doses of Penta, and measles vaccinations before their first birthday.[15)]

A health challenge common in the majority of low-income countries, Afghanistan suffers from a high rate of mortality for children under five years old (97 per 1,000 live births) and infants (77 per 1,000 live births).[16)] High prevalence of vaccine-preventable diseases is one of the underlying causes of this high mortality.[3,17-19)]

Improving immunization coverage requires a deep understanding of the factors influencing full immunization of children.[20-22)] There have been only a few studies in Afghanistan superficially reflecting that issue. As such, the purpose of this study was to identify and introduce the determinants of full immunization among children aged 12 to 23 months through a secondary analysis of Afghanistan Health Survey (AHS) 2012.

MATERIALS AND METHODS

Study design

AHS 2012 was designed and conducted through a collaborative effort of Ministry of Public Health of Afghanistan, Johns Hopkins University (JHU), and Indian Institute of Health Management Research (IIHMR). The survey started in July 2012 and ended in December 2012. The

survey mainly focused on 1) household and population characteristics (characteristic of population, household composition, household possessions, educational attainment, characteristics of households and survey respondents), 2) maternal and child health (contraception knowledge and use, antenatal care, tetanus toxoid vaccinations, delivery care, childhood immunization, breastfeeding and common childhood illnesses), 3) illness and injuries, 4) care-seeking behaviour, 5) health expenditures, and 6) perceptions of health services.

Details of study design and data collection were described in the AHS 2012 report.[15] In brief, AHS 2012 was the survey combining the data of two projects throughout 34 provinces of Afghanistan. They were 1) the results-based financing (RBF) project in 9 provinces, and 2) the monitoring and evaluation technical assistance to strengthening health activities for the rural poor (METASHARP) in the others (25 provinces).

In RBF provinces, a multi-stage probability sampling scheme was applied. In the first stage, health facilities were sampled by using stratified random technique. In the second stage, two villages or clusters were randomly selected from the list of all villages in the catchment areas of the sampled health facilities. In the third stage, 24 households were sampled at each of the selected villages using simple random sampling. Through this sampling, a total of 563 clusters were sampled, and survey was completed at 552 clusters with 12,209 actual households. Among them, 72 households were not responded. There were 14,780 eligible women among the responded households, of which 14,551 women were successfully interviewed, finding 14,874 eligible children. The information was obtained from 14,589 out of 14,874 eligible children.[15]

In METASHARP provinces, the stratified multi-stage cluster sampling was applied. In the first stage, a list of clusters within each province was developed. In the second stage, clusters were sampled using systematic random sampling in each province. In the third stage, each cluster was sub-divided into segments of 20 households. Finally, one segment was randomly selected and all households within the segment were sampled.

Among those children, the subjects of this study were 2,561 children aged 12–23 months. The vaccination history of the children in the AHS 2012 dataset were collected through vaccine cards and/or mothers/caregivers' recall. Among the 2,561 children, the vaccination status was found for 1,028 (40.1%) children from vaccine cards and the remaining 1,533 (59.9%) from mothers/caregivers' recall.

Ethical approval for the survey was secured from the Institutional Review Board (IRB), Ministry of Public Health (MoPH) and the Committee for Human Subjects Research (CHR) at JHU.

Variables description

Full immunization was selected as the dependent variable of this study. A child aged 12–23 months was considered to be fully immunized if he or she had received 1) one dose of BCG vaccine, 2) three or more doses of OPV vaccine (OPV3), 3) three doses of Penta vaccine (Penta3), and 4) one dose of measles vaccine before his or her first birthday. This variable was created from the available data in the child health and immunization section of the individual woman's questionnaire.

The independent variables included for the study were six socioeconomic and demographic factors. Those were 1) residence, 2) sex, 3) education of mother or caregiver, 4) mother or caregiver had received antenatal care (ANC), 5) mother or caregiver parity and, 6) wealth status. The inclusion criteria of the mentioned independent variables were based on the prior literature reviews and availability within the AHS 2012 dataset. The variables were categorized or grouped in the following manner: residence was divided into rural and urban areas; sex of the child as girl or boy; education of mother or caregiver was grouped as no education and some education; ANC visits of mothers or caregivers in the last two years coded as received and/or not received;

mother or caregiver parity was grouped as 0–2 children, 3–5 children, and 6 or more children; and wealth index was divided into poorest, poorer, middle, richer, and richest categories. In AHS 2012, wealth index has been defined as a summary variable being composed of the ability to purchase goods and services, to possess electric power and electric equipment such as refrigerator, air-conditioner, sewing machine, iron, radio, television, DVD player/VCR, satellite phone, cell phone, and to have bicycle, motorcycle, car, tractor, and thresher. These components were selected from principle components analysis to measure the wealth status.[15)]

Data analysis

Distribution and proportion of socioeconomic/demographic variables, as well as coverage of the outcome variable (full immunization status of children of 12–23 months), were calculated. Binomial distribution was used for the calculation of 95% confidence interval (CI) for percentage. A logistic regression model was applied to estimate the odds ratio (OR) for factors with a 95% CI. OR was mutually adjusted for residence, sex, wealth status, education, ANC, and parity. A p-value of less than 0.05 was considered to be statistically significant. The analysis was performed using statistical package for the social sciences (SPSS) software version 20.

RESULTS

The total number of subjects for this study was 2,561 children aged 12–23 months. Table 1 shows the socio-economic and demographic characteristics of the targeted children and their mothers or caregivers. Male children had a higher proportion with 52.0%. The majority of those children (62.4%) belonged to the poorer and poorest families. Only 9.1% of children's mothers or caregivers had some education. More than half of them (52.6%) had at least one-time experience of receiving ANC. Among the mothers or caregivers, the 3–5 parity group had the largest proportion of respondents (39.0%).

Table 2 shows the vaccination status of children aged 12–23 months. The coverage of fully immunized children was 38.8%. For specific vaccinations the coverage was 80.9% for BCG, 72.0% for OPV3, 64.8% for measles, and 50.1% for Penta3.

Table 3 shows associations of selected socioeconomic and demographic determinants with the full immunization status of children aged 12–23 months. There were significant associations of full immunization with residence, education and ANC at both crude and adjusted ORs. Although the poorer group of wealth status had a significantly larger OR relative to the poorest, the other groups of the wealth status such as middle, richer and richest did not have significant associations. Children who lived in urban areas demonstrated a significantly lower adjusted OR compared to those that lived in rural areas (0.60, 95% CI 0.40–0.90, p=0.014). The children who had been grown in poorer households showed a significantly higher adjusted OR (1.36, 95% CI 1.10–1.67, p=0.004), whereas the children belonging to the richer and richest groups showed a lower adjusted OR (0.93, 95% CI 0.67–1.30, p=0.678). The adjusted OR for mothers or caregivers with some education was significantly higher (1.59, 95% CI 1.20–2.11, p<0.001) relative to no education. Similarly, children of mothers or caregivers who received ANC had a significantly higher OR (1.70, 95% CI 1.44–2.01, p<0.001) compared to those did not receive it. Although it was assumed that the male children were more likely to be fully immunized than female children, the study did not find a significant association between sex of the children and the full immunization (adjusted OR=1.17, 95% CI 0.99–1.37, p=0.065). The parity also did not have a significant association with full immunization of the targeted children.

Table 1 Characteristics of children aged 12–23 months (n=2,561) and their caregivers from Afghanistan Health Survey 2012

Characteristics	Rural		Urban		Total	
	n	%	n	%	n	%
Sex of children						
Girl	1,141	47.8	88	50.9	1,229	48.0
Boy	1,247	52.2	85	49.1	1,332	52.0
Wealth status						
Poorest	984	41.2	3	1.7	987	38.5
Poorer	608	25.5	3	1.7	611	23.9
Middle	416	17.4	17	9.8	433	16.9
Richer	227	9.5	24	13.9	251	9.8
Richest	153	6.4	126	72.8	279	10.9
Education of mother/caregivers						
No education	2,183	91.4	145	83.8	2,328	90.9
Some education	205	8.6	28	16.2	233	9.1
Antenatal care						
Not received	1,175	49.2	38	22.0	1,213	47.4
Received	1,213	50.8	135	78.0	1,348	52.6
Parity						
0–2	735	30.8	52	30.1	787	30.7
3–5	922	38.6	77	44.5	999	39.0
≥6	731	30.6	44	25.4	775	30.3

Table 2 Immunization coverage of children aged 12–23 months (n= 2,561)

Vaccination coverage	Frequency		
	n	%	95% confidence interval
BCG[a] vaccine	2,072	80.9	79.3–82.4
OPV3[b] vaccine	1,845	72.0	70.3–73.8
Penta3[c] vaccine	1,284	50.1	48.2–52.1
Measles vaccine	1,660	64.8	62.9–66.7
Full immunization[d]	994	38.8	36.9–40.7

[a] Bacille Calmette Guerin, an antituberculosis vaccine

[b] Three doses of oral polio vaccine

[c] Three doses of pentavalent vaccine, five individual vaccines combine as one: haemophilus influenzae type B, pertussis, tetanus, hepatitis B, and diphtheria

[d] Full immunization is defined as a child who has received one dose of both BCG and measles vaccines as well as three doses of the Penta and OPV vaccines.

Table 3 Odds ratio (OR) and 95% confidence interval (CI) of socioeconomic and demographic determinants for full immunization (n=2,561)

Variables	Fully immunized		Crude			Adjusted[a]		
	n	(%)	OR	95% CI	p	OR	95% CI	p
Residence								
Rural	943	(39.5)	1	Reference		1	Reference	
Urban	51	(29.5)	0.64	0.46–0.90	0.010	0.60	0.40–0.90	0.014
Sex								
Girl	455	(37.0)	1	Reference		1	Reference	
Boy	539	(40.5)	1.16	0.99–1.36	0.074	1.17	0.99–1.37	0.065
Wealth								
Poorest	363	(36.8)	1	Reference		1	Reference	
Poorer	274	(44.8)	1.40	1.14–1.72	0.001	1.36	1.10–1.67	0.004
Middle	166	(38.3)	1.07	0.85–1.35	0.576	1.00	0.79–1.27	0.981
Richer	94	(37.5)	1.03	0.77–1.37	0.844	0.98	0.73–1.31	0.880
Richest	97	(34.8)	0.92	0.69–1.21	0.538	0.93	0.67–1.30	0.678
Education								
No	876	(37.6)	1	Reference		1	Reference	
Some	118	(50.6)	1.70	1.30–2.23	<0.001	1.59	1.20–2.11	0.001
ANC[b]								
Not received	394	(32.5)	1	Reference		1	Reference	
Received	600	(44.5)	1.67	1.42–1.96	<0.001	1.70	1.44–2.01	<0.001
Parity								
0–2	320	(40.7)	1	Reference		1	Reference	
3–5	367	(36.7)	0.85	0.70–1.03	0.091	0.88	0.73–1.07	0.217
≥6	307	(39.6)	0.96	0.78–1.17	0.673	0.98	0.80–1.21	0.860

[a] Adjusted mutually for all other independent variables in the table

[b] Antenatal care

DISCUSSION

The present study examined the immunization coverage and determinates affecting the full immunization among 2,561 children aged 12–23 months. The study found an estimated coverage of 38.8% for full immunization, which was higher than the 12% and 37% reported by National Risk and Vulnerability Assessment (NRVA) reports in 2005 and 2008, respectively.[23] However, compared to other studies in developing countries like Burkina Faso, Malawi, India, Bangladesh and Pakistan, it was very low.[20,24-27] The findings of specific vaccine coverage in this study (80.9% for BCG, 72.0% for OPV3, 64.8% for measles, and 50.1% for Penta3) were approximately similar to 2012 estimation by UNICEF and WHO for BCG (75%), OPV3 (71%), and measles (68%), but not for Penta3 (71%).[28]

Among the vaccines, BCG showed the highest proportion (80.9%). This was very likely due to BCG being administrated as one dose right after birth,[15] although it was to be administered

from child birth to the first 12 months of child's life.[23] The coverages of OPV3 (72.0%) and measles (64.8%) were found to be higher than that of Penta3 (50.1%), possibly because of frequent OPV and measles vaccination campaigns.[21,23] These campaigns included supplemental immunization activities conducted at national and subnational levels, enforced by the national immunization multi-year plan of Afghanistan.[14]

The results demonstrated that full and specific immunization coverages were low, being far below the 90% coverage goal which was stipulated in both the Afghanistan National Immunization Program (NIP) 2011–2015 plan[14] and State of the World's Vaccines and Immunization report of 2009, developed by WHO and UNICEF.[10] The potential factors mainly influencing immunization coverage encompass health system functions, as well as socio-economic and demographic characteristics of the population.[10,20,21,24] The results of logistic regression (Table 3) suggested that there were significant associations among four out of six analyzed predictor variables for full immunization among children 12–23 months. Residence, wealth status (children of poorer families), education, and ANC were significantly associated with full immunization, while neither sex of the children nor parity of mother or caregiver showed significant associations.

In this study, residence was significantly associated with the full immunization; it was less frequent in urban residence than in rural areas. The result was consistent to some extent with those of studies in Burkina Faso and India,[20,25,29] while studies in Ethiopia, and Kenya demonstrated no influence of residence with the full immunization.[21,22,30] In the studies in Ethiopia, Nigeria, and Zimbabwe, urban areas were significantly associated with full immunization of children.[31-34] Outreach activities to target rural communities have been mentioned as a major factor contributing to full immunization in rural areas,[32] while mothers or caregivers have mainly been responsible for taking their children to health facilities for vaccination in urban settings.[29]

The current study showed that poorer families were 1.36 times more likely to complete vaccination for their children relative to the poorest, without influencing the middle, the richer, and the richest. This could be due to the implementation of Basic Package of Health Services (BPHS) in Afghanistan, which is financed by the foreign aids and implemented through the government's contracts with non-governmental organizations (NGOs).[35] BPHS includes seven components; 1) maternal and newborn care, 2) child health and immunization, 3) public nutrition, 4) communicable disease treatment and control, 5) mental health, 6) disability and physical rehabilitation services, and 7) regular supply of essential drugs.[36] It operates in the rural areas where over 80% of the population.[36] The package was designed to ensure the MoPH pro-poor vision of the health sector in which the poor are expected to utilize more services than the non-poor.[37] The findings from Balanced Score Card Survey (BSC) indicated that the provision of BPHS have been pro-poor and pro-female.[37] The pro-poor alignment of BPHS was associated with a higher provision of the services, particularly immunization in the poorer and poorest communities. However, some studies in Ethiopia, Pakistan, Nigeria and Zimbabwe have reported that children belonging to rich families were more likely to complete immunization.[22,27,33,34]

The education of mothers or caregivers was significantly associated with full immunization status of the children in this study. The children whose mothers or caregivers had some education were 1.59 times more likely to complete the vaccination schedule compared to those whose guardians had no education. This finding was in line with numerous studies conducted in Afghanistan and other developing countries.[18,21-23,32,33,38]

In addition to education, ANC was significantly associated with the full immunization with OR of 1.70. Other previous studies also indicated the associaton.[21,22,33] This finding indicated that maternal health seeking behavior could increase similar behavior towards their children.[33]

The present study found no significant associations of children's sex and parity with full immunization. There were some studies with the similar findings,[18,22] although other studies in

Ethiopia and Bangladesh showed that female children were more likely to be fully immunized.[39,40] Concerning parity, some studies presented no significant associations,[22,31] while some others found that the lower numbers of children in the families were associated with a higher probability of full immunization.[34,41]

The limitations of this secondary analysis based on AHS 2012 were as follows. The first was that the associations were measured in a cross-sectional design. An ideal design may be a prospective study where the information on factors are collected at birth and follow the vaccination history in an objective way. The AHS 2012 collected the information of the factors and vaccination history at one time, and the current study restricted the children aged 12 to 23 months to reduce the misclassification on the factors and vaccine history. Since the difference in the conditions and recall on the factors listed in Table 3 of mothers/caregivers between at birth and 1 year after birth factors might be not large, the influence of the association might be limited. The second was that the available information was restricted to be those from the AHS dataset. This is the common limitation of secondary analyses. The final limitation is that not all data on immunization in the dataset could be validated through vaccination cards. In 59.9% of subjects, the immunization status was obtained from the memory of the mothers/caregivers. One of the advantages in this study was that one researcher was from Afghanistan, and could intuitively judge the plausibility of the results derived from the analysis.

Based on the above findings, the following is recommended. Outreach strategies which have been functioning effectively in rural areas could be applied to urban settings to improve the existing accessibility gaps. More integration in the provision of synergetic health interventions like the integration of immunization consultation in ANC visits and/or providing ANC services in outreach sessions of immunization will probably improve vaccine coverage.

In conclusion, the current study estimated vaccine coverage and examined the factors influencing the immunization completion of children aged 12–23 months. The findings emphasized that full immunization status was significantly associated with residence, wealth status (children of poorer families), and education status of mothers/caregivers, and ANC. The study also showed that no specific vaccine coverage reached the Afghanistan NIP target (90% coverage).[14] In addition, the proportion of fully immunized children aged 12–23 months remained far below optimal coverage.

ACKNOWLEDGEMENTS

We offer sincere gratitude to the Ministry of Public Health of Afghanistan for sharing the dataset of Afghanistan Health Survey 2012. We are also grateful to thank Dr. Tawab Saljuqi, Dr. Ahmad Kamran Osmani and Dr. Muhamamd Daud Azimi for their professional comments during the design and throughout this study. Finally, we thank Dr. Rahman Arafatur for his contribution in analyzing the data using SPSS software.

CONFLICTS OF INTEREST

The authors declare that there are no conflicts of interest.

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