Research Article

Coverage of vitamin A supplementation among under-five children in an urban resettlement colony of district Gautam-Budh Nagar, Uttar Pradesh

Harsh Mahajan, Shalini Srivastav, Sidhyartha Mukherjee

Department of Community Medicine, School of Medical Sciences and Research, Sharda University, Greater Noida, Uttar Pradesh, India.
Correspondence to: Harsh Mahajan, E-mail: harsh2709@gmail.com

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Abstract

Background: The Government of India launched the National Vitamin A Prophylaxis Program in 1970. Currently, under this program, a total of nine doses of vitamin A should be given to the children orally, with the first dose at 9–12 months of age, followed by biannual doses at 6-monthly interval up to the age of 5 years.

Objective: To evaluate all dose vitamin A supplementation (VAS) coverage and its associated factors and decipher reasons for poor coverage in children aged 12–59 months.

Materials and Methods: This study was a cross-sectional survey conducted in Bhangel area of district Gautam-Budh Nagar, Uttar Pradesh, India. The WHO 30-cluster sampling technique was used to select the study subjects. Study subjects included 210 children in the age group of 12–59 months. On the basis of documentary evidence/recall of mothers, the data were recorded in the prestructured pro forma. Bivariate analysis using χ^2-test was applied to study the association between variables, and multivariate analysis was applied on variables found to be significant on bivariate analysis.

Result: Only 6.2% (13/210) children received all doses of Vitamin A due for respective age. The factors found to be significantly associated with VAS coverage were age, religion, and immunization status for VPDs on bivariate analysis and only age group on multivariate analysis. The most common reason for missing the doses of vitamin A was ignorance among parents, which was found in 84.8% (167/197) subjects.

Conclusion: Appropriate measures should be taken to improve the national coverage of all dose VAS.

KEY WORDS: Coverage, vitamin A supplementation, under-five children

Introduction

Vitamin A deficiency (VAD) is the leading cause of preventable childhood blindness and reduced immunity towards infections which results in increased mortality from childhood diseases. Globally, the highest prevalence of the biochemical VAD (serum retinol concentration <0.70 μmol/l) in under-five age group is in India which is 62%.[1] In India, the prevalence of VAD is higher than the WHO's limit indicating a public health problem (Bitot's spots: >0.5%, night blindness in children: >1%) and around 0.3 million children die of VAD every year.[2] The child mortality can be reduced by 24% by improving the vitamin A status of a population.[3]

The Government of India launched the National Vitamin A Prophylaxis Program in 1970 to prevent VAD among children. Currently, under this program, a total of nine doses of vitamin A should be given to the children orally in syrup form, with the

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first dose of 1 mL (1 lac I.U.) at 9–12 months of age, followed by two doses per year of 2 mL (2 lac I.U.) each at 6-monthly interval up to the age of 5 years. These doses of vitamin A should be given to the children during their visits to the government health centers/private clinics, and, of these, the first two doses are given along with the routine immunization against various vaccine preventable diseases (VPDs) such as measles, diphtheria, pertussis, tetanus, and poliomyelitis. At the government health centers and private clinics, monitoring of VAS is done through the child immunization card on which the record of all the vitamin A doses administered to the child is maintained by the health professionals.

Previous studies conducted in India by Sachdeva and Dutta,[4] Taneja et al.,[5] and Singh et al.[6] focusing only on the first dose vitamin A supplementation (VAS) among children of 12–23 months of age have reported the coverage to be 37.6%, 37.8% and 54.3%, respectively. With regard to later doses of vitamin A, a study by Bhutia based on literature review of various studies conducted in different states of India from 1991–2012 showed that the overall coverage of VAS for children aged 12–59 months is low at 20.2% for one dose in 6 months.[7] This figure is almost similar to that found by Agrawal using National Family Health Survey-III (NFHS-III) 2005–2006 data of India reflecting poor supplementation of vitamin A (24.8%) among children of 12–35 months age group for one dose in 6 months.[8] The various factors that play a role on the coverage of VAS in India have been identified as child's age, sex, religion, mother's education, and immunization status for VPDs.[4,8]

According to the latest UNICEF report, the coverage of complete VAS among children in India in the year 2013 has been reported to be 53%.[9] This figure is still far from the UNICEF target of 70% VAS coverage for two annual doses of vitamin A.[10] In comparison to the VAS coverage of India, other countries such as Mauritania (North Africa), Mozambique (south east Africa), Uzbekistan (Central Asia), and Nepal (south east Asia) have appreciably reached the universal VAS coverage (i.e., 99%) whereas, the lowest VAS coverage (i.e., 13%) is reported in the Central American countries of Haiti and Guatemala.[9]

Most of the previous studies in India have been done to evaluate the coverage of first dose of vitamin A only and not the subsequent doses. Moreover, very few studies have been conducted to evaluate the VAS coverage in the state of Uttar Pradesh (UP) in India. Therefore, the objectives of this study were to evaluate the coverage of all the doses of vitamin A due for age in children of 12–59 months age group, study the factors associated with VAS coverage, and decipher the reasons for missing the doses of VAS.

Materials and Methods

Study Design and Setting

The study was a cross-sectional survey conducted from June 2013 to August 2013. The study was conducted in Bhangel area of district Gautam-Budh Nagar, UP (i.e., urban field practice area of the Department of Community Medicine of the University). The Bhangel area is an urban resettlement colony consisting of a population of approximately 10,000 residing in 2,313 households. Majority of the population residing in Bhangel is migrating labour population.

Sample Size Estimation

The target population in the community under study were children in the age group of 12–59 months. To estimate the sample size, the desired confidence interval was taken to be 95% (z = 1.96). The desired level of precision of the estimates was ± 10% (d = 0.1). Considering the coverage of complete VAS in India as per the latest UNICEF report to be 53% (p = 0.53) and taking design effect (DE) as two, the following sample size formula was used[9,11]:

$$n = [\text{DE} \times z^2_{1-\alpha/2} \times p \times (1-p)]/d^2$$

Using this formula, the total sample size came out to be 191, and considering the 10% nonresponse rate, sample size of 210 was reached. Using the WHO 30-cluster sampling technique, the size of the cluster came out to be 210/30 = 7.

Sampling Technique

The 30-cluster sampling technique advocated by the WHO was used to assess coverage of all the doses of VAS due for respective age in 12–59 months children.[12] The 30-cluster sampling technique is a two-stage random sampling technique (i.e., selection of clusters and identification of children in the selected clusters). The first step involved listing of all the clusters (i.e., lanes in Bhangel and, of them, a total of 30 lanes was chosen randomly). In each selected lane, the first household to be visited was chosen randomly. All the eligible children of 12–59 months of age in that household were part of the study frame, but only one child from each household was selected randomly using lottery method. After the first household was visited, the interviewer moved to the next household using the right hand approach, and the same process was repeated. If any household was found to be locked, if any mother refused (five mothers refused) to participate in the study, or if any household did not have eligible child, the interviewer skipped that household and moved to the next household. This process was continued until a total of seven children were covered in each lane, and, in this way, all the 30 selected lanes were covered, thus making a total sample size of 210 (30 × 7).

Inclusion and Exclusion Criteria

All children aged between 12 and 59 months living in the community for more than 6 months were included in the study. The children who were visiting from another community, children aged younger than 12 months, and severely ill children were excluded from the study.

Methodology

The mothers of the study subjects were explained the purpose of the study, and their informed verbal consent was taken before starting their interviews. The study questionnaire comprised two parts. The first part of the questionnaire included the sociodemographic profile of the study subjects such as age, sex, religion, caste, maternal and paternal education, and occupation. The second part of the questionnaire included data regarding all the vitamin A doses due for respective age received by the child and information regarding the immunization status for VPDs, which were collected based on the documentary evidence in the form of card/recall of mothers. The pretesting of questionnaire was conducted on 25 children to ensure the validity and relevance of the questionnaire. The results of the pretesting were evaluated, and required modifications were done in the questionnaire. The results of this pretesting were excluded from the final analysis.

Ethical Consideration

Ethical approval to conduct this study was obtained from the Research and Ethics Committee of the University. Informed consent was obtained from the respondent verbally before being interviewed, and confidentiality was maintained.

Statistical Analysis

Data were analyzed by using the statistical software Epi Info™ 6(CDC, Atlanta, Georgia, USA). Results were expressed in percentages. Bivariate analysis using χ^2-test was applied to find out the association between variables. Multivariate analysis using logistic regression model was done for the variables found to be significant on bivariate analysis. ($p < 0.05$)

Result

Demographic Profile of Study Subjects

Of the 210 study subjects, 62.9% (132/210) were male and 37.1% (78/210) were female subjects.

As per age-wise distribution, 25.7% (54/210) children belonged to 12–23 months age group and 74.3% (156/210) aged 24–59 months. According to religion, 91.0% (191/210) were Hindus, and the remaining 9.0% (19/210) were Muslims. With respect to the maternal education, mothers of 65.7% (138/210) children revealed < 12 years of education, whereas mothers of 34.3% (72/210) children revealed ≥ 12 years of education [Table 1].

Factors Associated with VAS Coverage

Of the total children, 6.2% (13/210) received all doses of vitamin A due for age. A total of 50.5% (106/210) children were partially supplemented with vitamin A due for age, and 43.3% (91/210) children did not receive even a single dose of vitamin A, thus constituting a total of 93.8% (197/210) children with partial/no VAS [Table 1].

Table 1 shows the bivariate analysis showing association of different variables with complete VAS. Among the male subjects, 5.3% (7/132) received all doses of Vitamin A due for age, whereas 7.7% (6/78) female subjects received complete VAS ($p = 0.49$, OR = 0.7, 95% CI = 0.2–2.1). Complete VAS was observed among 20.4% (11/54) of 12–23 months age children, which was significantly higher than the complete coverage of 1.3% (2/156) found among children 24–59 months of age ($p < 0.001$, OR = 19.7, 95% CI = 4.2–92.2). With respect to religion, 4.2% (8/191) of the Hindus and 26.3% (5/19) of the Muslims received complete VAS ($p < 0.01$, OR = 8.2, 95% CI = 2.4–28.3). With respect to mother's education, 8.3% (6/72) of children whose mother's literacy status was ≥ 12 years of education received complete VAS. Whereas, all dose Vitamin A coverage was comparatively low [i.e., 5.1% (7/138) in children whose mother's literacy status was < 12 years of education ($p = 0.35$, OR = 0.6, 95% CI = 0.2–1.8)]. Significant association was observed with respect to the immunization status for VPDs as 10.2% (12/118) of the children who were fully immunized for VPDs also received all doses of VAS, whereas only 1.1% (1/92) of the children who were partially immunized/unimmunized for VPDs received complete VAS ($p < 0.01$, OR = 10.3, 95% CI = 1.3–80.8)

Table 2 shows the multivariate analysis using logistic regression model on the associated factors of VAS coverage found significant on bivariate analysis (i.e., age group, religion, and immunization status for VPDs). Only the age group of the children was observed to be significantly associated with complete vitamin A coverage ($p < 0.01$; adjusted OR = 12.04, 95% CI = 2.05–60.15).

Reasons for Poor VAS Coverage

A total of 93.8% (197/210) children missed one or more doses of vitamin A due for age. Of these children, maximum number [i.e., 28.1% (55/197)] missed 1–2 doses due for respective age [Figure 1]. The most common reason for missing the doses of VAS was ignorance among parents, which was found in the case of 84.8% (167/197) children. The other common reasons of poor vitamin A coverage were migration by parents and loss of immunization card, and both these factors were observed in 5.6% (11/197) of the subjects. Another reason for missing the doses of vitamin A was observed to be fear of side effects among parents, which was found in 4.1% (8/197) of the children.

Discussion

India was the first country in the world to have launched VAS program. In spite of this, the coverage of all doses of vitamin A due for respective age was found to be low (6.2%) in this study. This figure is comparable to the VAS coverage of 5.9% reported in the state of UP but lower than the national average of 20.2% as per the study by Bhutia based on literature review of various studies on VAS coverage conducted in different states of India from 1991–2012.[7] The coverage in this study is far behind the figure reported in the latest UNICEF report, 2013 (i.e., 53%).[9] The low coverage of VAS

Table 1: Association of different variables with complete vitamin A supplementation (VAS) among children using bivariate analysis

Variable	Complete VAS (*n* =13)	Partial/no VAS (*n* = 197)	Total (*n* = 210)	*P**	Unadjusted odds ratio (95% CI)
Sex					
Male	7 (5.3)	125 (94.7)	132 (62.9)	0.49	0.7 (0.2–2.1)
Female	6 (7.7)	72 (92.3)	78 (37.1)		1
Total	13 (6.2)	197 (93.8)	210 (100)		
Age group (months)					
12–23	11 (20.4)[a]	43 (79.6)	54 (25.7)[b]	<0.001	19.7 (4.2–92.2)
24–59	2 (1.3)	154 (98.7)	156 (74.3)		1
Total	13 (6.2)	197 (93.8)	210 (100)		
Religion					
Hindu	8 (4.2)	183 (95.8)	191 (91.0)	<0.01	1
Muslim	5 (26.3)	14 (73.7)	19 (9.0)		8.2 (2.4–28.3)
Total	13 (6.2)	197 (93.8)	210 (100)		
Mother's education (in years)					
<12 years of education	7 (5.1)	131 (94.9)	138 (65.7)	0.35	0.6 (0.2–1.8)
≥12 years of education	6 (8.3)	66 (91.7)	72 (34.3)		1
Total	13 (6.2)	197 (93.8)	210 (100)		
Immunization status for VPDs					
Fully immunized	12 (10.2)	106 (89.8)	118 (56.2)	<0.01	10.3 (1.3–80.8)
Partially immunized/unimmunized	1 (1.1)	91 (98.9)	92 (43.8)		1
Total	13 (6.2)	197 (93.8)	210 (100)		

[a]Figures in parenthesis are row percentages.
[b]Figures in parenthesis of total column are column percentages.
*$p < 0.05$ is significant.

Table 2: Multivariate analysis of significant predictors of complete vitamin A supplementation (VAS) among children using logistic regression model

Variable	Adjusted odds ratio (OR)	95% Confidence interval of OR		*P**
		Upper limit	Lower limit	
Age group (months)				
12–23	12.1	2.1	60.1	<0.01
24–59	1			
Religion				
Hindu	1	0.9	17.3	0.06
Muslim	4.1			
Immunization status for VPDs				
Fully immunized	7.1	0.8	59	0.07
Partially immunized/unimmunized	1			

*$p < 0.05$ is significant.

in this study could be attributed to the low social and economic development status of the state of UP. Wide differentials have been noticed in VAS according to the social and economic development status of the states in India. The study by Agrawal showed that the coverage of VAS varies from less than 10% in Indian states with low social and economic development such as UP (8.6%) and Nagaland to more than 45% in states with the highest socioeconomic development status such as Kerala and Mizoram.[8]

In this study, 43.3% of the children did not receive even a single dose of vitamin A. The studies conducted by Sachdeva and Dutta [4]and Taneja et al.[5] among the children residing in the slums of Delhi also showed that a significant proportion of children did not receive even a single dose of Vitamin A

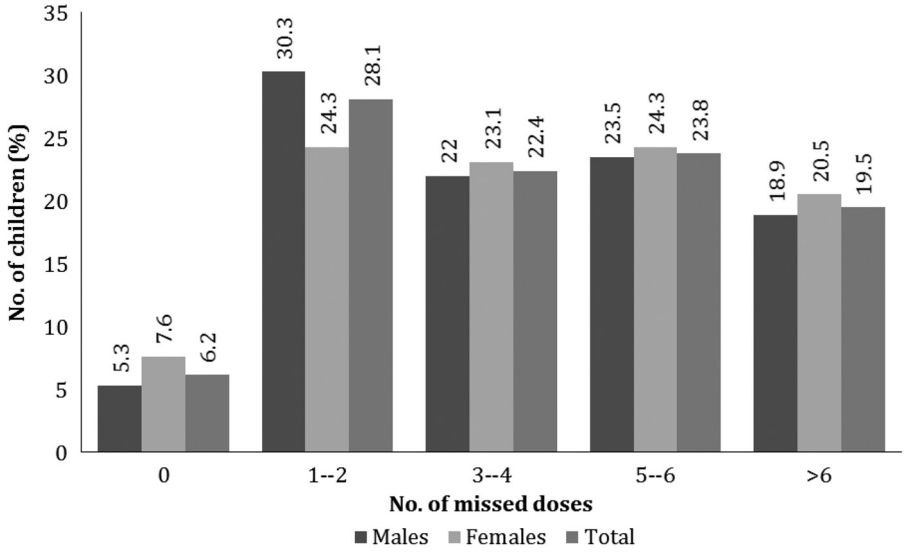

Figure 1: Distribution of children according to the number of missed doses of vitamin A due for age.

(i.e., 62.4% and 62.2%, respectively). Similar are the findings of a study by Agrawal based on NFHS-III data of India reflecting poor supplementation of vitamin A (24.8%) among children of 12–35 months age group.[8] However, the findings of the study by Singh conducted in urban slums of Ahmedabad showed appreciably higher VAS among children aged 12–23 months (71.7%).[6] This finding can be explained by the fact that Ahmedabad city belongs to the state of Gujarat, which has a better socioeconomic development status and better health-care delivery system when compared with the state of UP.

In this study, no significant association was found between gender and VAS. This finding is similar to the study carried out by Singh in the urban slums of Ahmedabad and supported by the study conducted by Agrawal based on NFHS-III data.[6,8] This study shows that the VAS is significantly higher among children in 12–13 months of age when compared with the children of 24–59 months of age. This finding is similar to the study by Agrawal based on NFHS-III data where about one-third of the children aged 12–23 months received VAS when compared with only one-fifth of the children aged ≥24 months.[8] This significantly higher vitamin A coverage in younger children (aged 12–23 months) is because that most of the routine vaccines against the VPDs under the National Immunization Schedule of India are administered up to 24 months of age and, therefore, the vitamin A compliance becomes better during these routine visits. Our study shows significantly higher levels of VAS among the Muslims when compared with the Hindus, which is contrary to that found in a study by Sachdeva.[6] However, this finding may be because of poor representation of Muslims as study subjects as the majority of the people in the study area were Hindus. This study shows that the levels of VAS were higher among children whose mother's literacy status was ≥12 years of education, but the difference is not significant. This finding is well supported in the study by Agrawal reflecting that children whose mothers revealed high school and higher education were 2.4 times more likely to receive VAS than those with illiterate mothers.[8] Overall relationship of literacy status with VAS was also found to be statistically significant in the study by Sachdeva and Dutta.[4] In this study, VAS is significantly higher among children who were fully immunized for VPDs. Similar finding has been noted by Sachdeva and Dutta showing significant association between immunization status and VAS.[4] This finding can be owed to the more frequent access of the fully immunized children to the health centers for their routine immunization, and this opportunity is used for VAS.

In our study, the most common reason for missing the doses of VAS was ignorance among parents. Other reasons for poor vitamin A coverage were loss of immunization card and migration from one periurban area to another in search of work opportunities as majority of the study population were daily wage labourers. Similarly, in the study by Singh, the most common reasons for the low vitamin A coverage were found to be ignorance, followed by the unavailability of vitamin A at the health centers.[6]

The most important strength of this study is that it evaluated all dose VAS due for respective age, whereas most of the previous studies conducted in India took into consideration only the first dose VAS. Defined objectives, standard sampling technique, and proper interpretation of results are the other strengths of the study. Possible limitation of this study is that, although this study has been conducted in one of the largest periurban areas of district Gautam-Budh Nagar, UP, the results of the study may not be representative of the periurban areas in other states of India because of the differences in the social and economic development status and health-care

facilities in different states of the country. Another shortcoming of this study is that owing to resource constraints, the sample size for the study was calculated to give a precise estimate of VAS coverage and was not calculated for risk factor analysis. For this reason, the study sample may not be large enough to detect significant differences for some of the variables.

Conclusion

According to UNICEF, effective coverage (70%) with two annual doses of vitamin A in children of 6–59 months of age is required in order to achieve a reduction in mortality rates.[10] However, poor coverage of all dose VAS has been deciphered in our study. In order to increase the overall VAS coverage and reduce the state-wise disparities in India, it is suggested that, in addition to routine VAS, mass VAS campaigns should be organized in the form of national/subnational immunization days prioritizing states with low social and economic development and poor health-care delivery system. Furthermore, the VAS program in India should be strengthened at implementation level by training the health workers to trace dropped out children, organize outreach sessions, and regularly monitor outreach sessions along with the information, education and communication activities.

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