

India's vitamin A supplementation programme is reaching the most vulnerable districts but not all vulnerable children. New evidence from the seven states with the highest burden of mortality among under-5s

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Abstract

Objective: To characterize the coverage of India's national vitamin A supplementation (VAS) programme and document its performance in reaching children in the districts with higher concentration of poor households (2006–2011).

Design: Analysis of VAS programme coverage data collated and collected using standardized bottom-up procedures, data from India's Office of the Registrar General and Census Commissioner, and data from India's District Level Household Survey to compute exposure (poverty) and outcome (full VAS coverage) variables.

Setting: Seven Indian states with the highest burden of mortality in children (74% of all deaths among under-5s in the country in 2006).

Subjects: Children 6–59 months old.

Results: Between 2006 and 2011, the mean full VAS coverage (two VAS doses per child per year) in these seven states increased from 44.7% to 67.3% while the number of districts with high ($\geq 80\%$) full VAS coverage increased from twenty-four (9.4%) to 131 (51.4%). The highest increases in full VAS coverage figures were recorded in the districts with the highest concentration of poor households. The estimated number of poor children (i.e. children living in households classified as poor) who did not receive two VAS doses annually decreased from 8.5 million in 2006 to 5.1 million in 2011 (40.3% decrease); 2.5 million (49.1%) of these children lived in the districts with the lowest proportion of poor households.

Conclusions: Despite significant improvements in VAS, a large number of Indian children are not benefitting yet from this life-protecting intervention, particularly among those who are potentially the most vulnerable. Future programme action needs to give priority to sub-district level units – blocks and villages – with higher concentrations of poor households.

Keywords
Vitamin A deficiency
Vitamin A supplementation
Poverty
India

A recent Cochrane review concluded that vitamin A supplementation (VAS) reduces mortality in children 6–59 months old by about 24%^(1,2). Thus, the WHO recommends that in settings where vitamin A deficiency (VAD) is a public health problem, children 6–59 months old be given vitamin A supplements every 4–6 months to reduce morbidity and mortality⁽³⁾.

In India, VAD has long been recognized as a public health problem^(4–6). Surveys carried out in 2002–2005 found that 62% of children of pre-school age were vitamin A deficient (serum retinol <20 µg/dl) and that the prevalence and severity of VAD were significantly higher among children from socio-economically disadvantaged households^(7,8). Furthermore, India's National Family

Health Survey 2006 indicated that the proportion of children 6–59 months old who had received vitamin A supplementation in the 6 months preceding the survey was significantly lower in states with lower levels of social and economic development and among children from households in the lowest wealth quintile^(9–11). Since 2006, the Government of India and India's State Governments have made a concerted effort to increase the coverage of the national VAS programme by strengthening the implementation of biannual VAS rounds.

The objective of the present paper is to characterize the coverage of India's national VAS programme between 2006 and 2011 in the seven states with the highest burden of child mortality in 2005–06 – Bihar, Chhattisgarh,

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Jharkhand, Madhya Pradesh, Odisha, Rajasthan and Uttar Pradesh – and document its performance in reaching children who live in the poorest districts of these states.

Methods

Population and study setting

The seven states included in our analysis (Fig. 1) comprise 255 districts that are home to 59.4 million children aged 0–59 months and represent 52.4% of India's under-5s population. The mean under-5s mortality rate in these states is eighty-four deaths for every 1000 live births (sixty-three in India), while the mean prevalence of child underweight is 48.3% (42.5% nationally in India). These seven states are home to 58% of India's stunted children,

59% of wasted children, 60% of underweight children, 72% of infant deaths and 74% of under-5s deaths^(11–13).

Data collection and analysis

India's national VAS programme is managed by the Ministry of Health and Family Welfare. The programme aims at delivering preventive VAS to all children 6–59 months old. The first VAS dose (30 mg retinol equivalents; 100 000 IU) is administered with the measles vaccination at ~9 months while the subsequent nine doses (each 60 mg retinol equivalents; 200 000 IU) are administered every 6 months up to the age of 59 months through biannual VAS rounds as the main delivery platform⁽¹⁴⁾.

For the purpose of our analysis, the number of children 6–59 months old who benefitted from the VAS programme in each district (numerator) was determined



Fig. 1 Indian states included in the analysis

using a standardized bottom-up data collection and collation procedure – common to all districts and states – with data flowing up from the VAS site in the village to the block, from the block to the district, and from the district to the state. In a given calendar semester (semester 1: 1 January–30 June; semester 2: 1 July–31 December), data collection and collation took into account the number of children 6–11 months old who received the VAS dose through the routine immunization programme (measles vaccination at ~9 months) and the number of children 12–59 months old who received VAS through the VAS round. The number of children 6–59 months old targeted by the VAS programme in each district (denominator) and the district population size and composition were determined using the projected age-group population by India's Office of the Registrar General and Census Commissioner of India on the basis of the national census 2001 as the base year⁽¹⁵⁾.

Following international recommendations, 'VAS coverage' was defined as the proportion of eligible children who received at least one VAS dose in a given calendar year while 'full VAS coverage' was defined as the proportion of eligible children who received two VAS doses per calendar year. As recommended globally, the VAS coverage in a given district and calendar year was computed as that of the semester with the highest VAS coverage whereas full VAS coverage was computed as that of the semester with the lowest VAS coverage, thus assuming that all children who benefitted from the VAS programme in the semester with the lowest VAS coverage also did in the semester with the highest VAS coverage⁽¹⁶⁾.

Data from India's District Level Household Survey 2007–08 were used to compute a wealth index that combined household amenities, assets and durables⁽¹⁷⁾. The wealth index was computed at the national level and divided into wealth quintiles. In each district, the households that fell in India's lowest wealth quintile were categorized as poor. For each district, the proportion of poor households was computed and used as an indicator of district poverty.

The statistical software package Stata 12 was used for all data analyses.

Results

In the seven states included in the analysis, the percentage of households classified as poor was 32.9%, ranging from 22.4% in Odisha to 48.3% in Madhya Pradesh. Within states, the lowest inter-district disparity was observed in Bihar, where the proportion of poor households by district ranged from 14.4% to 32.6% while the highest was observed in Uttar Pradesh, where it ranged from 1.8% to 30.7% (Table 1).

Between 2006 and 2011, the number of districts with high ($\geq 80\%$) VAS coverage increased from fifty-six (22%)

Table 1 Number of districts, poverty concentration and coverage of the vitamin A supplementation (VAS) programme by state, India, 2006–2011

	No. of districts by state	Proportion of poor households in state (%)	Intra-state disparity				No. of districts with high ($\geq 80\%$) VAS coverage in 2006	No. of districts with high ($\geq 80\%$) VAS coverage in 2011	No. of districts with high ($\geq 80\%$) full VAS coverage in 2006	No. of districts with high ($\geq 80\%$) full VAS coverage in 2011
			Lowest proportion of poor households by district (%)	Highest proportion of poor households by district (%)	(highest/lowest proportion of poor households by district) (%)	No. of districts with high ($\geq 80\%$) VAS coverage in 2006				
Bihar	37	32.6	14.4	52.2	3.6	0	37	0	36	
Chhattisgarh	16	35.2	11.5	67.0	5.8	0	0	0	0	
Jharkhand	22	41.9	11.0	65.0	5.9	21	20	14	0	
Madhya Pradesh	48	28.6	4.5	69.2	15.4	24	46	4	33	
Odisha	30	48.3	17.8	85.0	4.8	0	29	0	29	
Rajasthan	32	22.4	2.3	66.9	29.1	8	30	5	26	
Uttar Pradesh	70	30.7	1.8	64.1	35.6	3	29	1	7	
Seven states	255	32.9	1.8	85.0	47.2	56	191	24	131	

Table 2 Vitamin A supplementation coverage (at least one vitamin A dose per child per year) by district poverty concentration quintile and state, India, 2006–2011

State	Year	District poverty concentration quintile					All
		Lowest	Lower	Middle	Higher	Highest	
Bihar	2006	62.0	67.1	65.1	67.0	68.1	65.9
	2007	107.4	113.0	110.1	114.9	117.0	112.5
	2008	106.9	115.0	113.7	116.5	117.7	114.1
	2009	100.3	116.3	115.9	119.3	123.8	115.4
	2010	98.6	114.3	114.0	116.5	123.0	113.6
	2011	110.4	118.5	117.6	118.4	125.4	118.2
	2006–2011	97.9	107.6	106.3	109.0	112.6	106.8
Chhattisgarh	2006	30.4	18.5	22.2	25.7	24.6	24.3
	2007	76.6	81.1	70.8	71.0	59.2	70.9
	2008	103.2	108.1	96.2	83.8	84.0	94.4
	2009	99.0	111.3	101.1	90.3	93.5	98.7
	2010	101.3	96.4	97.1	91.3	92.8	95.6
	2011	10.6	14.5	11.5	13.0	12.1	12.3
	2006–2011	70.2	71.6	66.5	62.5	61.0	66.0
Jharkhand	2006	98.4	119.0	121.9	113.7	110.5	111.9
	2007	81.8	93.8	80.7	90.5	76.2	85.8
	2008	92.0	98.8	96.2	109.1	111.1	102.9
	2009	98.5	100.5	95.9	99.7	106.5	100.5
	2010	100.0	94.6	77.4	93.1	106.6	95.1
	2011	106.0	77.5	101.9	77.0	100.8	93.2
	2006–2011	96.2	97.2	95.7	97.1	102.0	98.2
Madhya Pradesh	2006	99.2	81.6	74.3	74.6	77.0	81.3
	2007	103.5	92.1	85.3	98.7	80.3	91.2
	2008	107.9	92.3	93.3	89.9	92.6	94.6
	2009	109.4	91.4	81.9	80.2	82.1	89.3
	2010	100.3	94.6	86.5	107.2	100.7	98.3
	2011	105.3	97.2	105.0	118.3	128.3	110.4
	2006–2011	104.2	91.5	87.8	94.7	93.4	94.1
Odisha	2006	56.2	56.6	58.4	58.2	55.0	56.9
	2007	91.4	99.7	105.5	109.8	103.7	102.0
	2008	96.3	104.0	110.0	103.4	102.5	103.3
	2009	95.2	100.4	105.3	100.5	95.3	99.3
	2010	94.6	100.5	106.9	101.3	94.5	99.6
	2011	95.2	103.2	102.1	102.0	95.6	99.6
	2006–2011	88.1	94.0	97.9	95.7	91.0	93.4
Rajasthan	2006	80.5	75.6	77.8	93.6	68.9	78.9
	2007	99.3	86.8	85.6	100.3	76.6	89.2
	2008	99.6	97.9	114.9	101.7	107.3	104.7
	2009	98.1	96.1	102.1	95.5	116.6	102.2
	2010	100.1	95.0	93.4	89.4	103.8	96.5
	2011	95.6	98.7	92.9	101.1	96.4	96.8
	2006–2011	95.6	91.7	94.5	97.0	94.8	94.7
Uttar Pradesh	2006	35.0	40.7	20.6	17.4	20.9	26.9
	2007	45.0	56.8	26.8	19.1	26.5	34.8
	2008	69.6	82.3	58.5	45.6	50.8	61.4
	2009	84.2	105.3	82.5	65.0	79.3	83.3
	2010	73.6	63.4	49.8	51.9	60.0	59.7
	2011	80.8	95.3	74.4	63.5	74.0	77.6
	2006–2011	64.7	73.8	51.9	43.4	51.7	57.1
Seven states	2006	63.0	63.2	56.1	57.7	55.4	60.0
	2007	81.9	84.8	74.2	77.4	71.7	78.1
	2008	92.8	96.3	92.2	85.3	89.1	91.3
	2009	96.2	102.6	95.1	88.0	96.7	95.8
	2010	91.6	89.4	84.1	87.7	92.7	89.4
	2011	90.6	93.9	90.6	88.7	94.1	91.9
	2006–2011	86.0	88.3	82.0	80.7	83.2	84.4

to 191 (75%) while the number of districts with high ($\geq 80\%$) full VAS coverage increased from twenty-four (9%) to 131 (51%; Table 1). As a result, the average VAS coverage in the seven states increased from 60.0% in 2006 to 91.9% in 2011 while the average full VAS coverage increased from 44.7% in 2006 to 67.3% in 2011

(Tables 2 and 3). With the exception of Odisha and Rajasthan, the VAS programme experienced significant coverage fluctuations over the 6-year period, including one (Madhya Pradesh and Uttar Pradesh), two (Bihar and Chhattisgarh) or four (Jharkhand) years with only one VAS round and therefore zero full VAS coverage (Table 3).

Table 3 Full vitamin A supplementation coverage (two vitamin A doses per child per year) by district poverty concentration quintile and state, India, 2006–2011

State	Year	District poverty concentration quintile					All
		Lowest	Lower	Middle	Higher	Highest	
Bihar	2006	57.8	59.2	58.4	64.3	60.0	59.9
	2007	0.0	0.0	0.0	0.0	0.0	0.0
	2008	97.5	112.5	111.4	113.7	114.9	110.2
	2009	96.5	111.6	113.4	116.2	118.8	111.6
	2010	0.0	0.0	0.0	0.0	0.0	0.0
	2011	93.8	113.5	109.0	112.1	117.1	109.3
	2006–2011	57.8	66.4	65.6	67.9	68.6	65.4
Chhattisgarh	2006	0.0	0.0	0.0	0.0	0.0	0.0
	2007	47.8	38.2	36.3	43.8	44.4	42.2
	2008	92.5	80.8	81.5	75.2	75.6	80.8
	2009	90.9	96.6	92.3	87.2	84.1	89.8
	2010	94.2	91.2	95.2	82.6	92.2	91.2
	2011	0.0	0.0	0.0	0.0	0.0	0.0
	2006–2011	54.2	51.0	50.9	48.2	49.3	50.6
Jharkhand	2006	77.2	88.3	90.1	90.0	88.1	86.0
	2007	0.0	0.0	0.0	0.0	0.0	0.0
	2008	78.7	89.4	88.5	91.2	105.7	91.5
	2009	0.0	0.0	0.0	0.0	0.0	0.0
	2010	0.0	0.0	0.0	0.0	0.0	0.0
	2011	0.0	0.0	0.0	0.0	0.0	0.0
	2006–2011	25.5	29.2	29.6	29.9	32.3	29.3
Madhya Pradesh	2006	72.0	59.1	54.2	49.2	52.0	56.2
	2007	88.9	63.5	76.0	67.1	55.4	70.0
	2008	0.0	0.0	0.0	0.0	0.0	0.0
	2009	78.1	60.6	63.7	48.7	58.9	61.2
	2010	89.8	83.3	78.3	96.3	95.4	88.4
	2011	93.8	83.6	68.9	98.2	89.4	87.6
	2006–2011	70.4	58.2	56.9	59.8	58.5	60.5
Odisha	2006	54.0	55.3	56.6	55.9	53.0	54.9
	2007	80.7	94.3	94.6	93.1	85.5	89.6
	2008	88.6	99.0	100.7	96.5	90.5	95.1
	2009	91.0	96.1	101.9	96.5	92.2	95.5
	2010	91.2	99.2	104.5	98.2	92.3	97.1
	2011	92.3	99.0	100.8	100.1	93.9	97.2
	2006–2011	82.9	90.4	93.1	89.9	84.4	88.1
Rajasthan	2006	70.9	70.8	60.1	76.5	66.1	68.5
	2007	55.5	78.2	78.6	81.9	69.6	72.8
	2008	94.9	95.1	106.2	98.2	93.1	97.6
	2009	92.3	91.7	89.6	89.3	106.9	94.2
	2010	86.2	91.4	90.2	75.1	99.8	89.0
	2011	90.2	96.0	76.8	96.8	88.6	89.3
	2006–2011	81.8	87.2	83.6	86.3	87.2	85.2
Uttar Pradesh	2006	13.7	18.2	13.5	2.8	5.0	10.6
	2007	26.3	46.3	12.0	14.8	17.1	23.3
	2008	40.5	39.4	24.9	22.5	20.9	29.6
	2009	73.3	90.5	70.0	55.5	67.1	71.3
	2010	0.0	0.0	0.0	0.0	0.0	0.0
	2011	37.2	45.1	44.4	41.1	57.2	45.0
	2006–2011	31.8	39.8	27.4	22.6	27.8	29.9
Seven states	2006	46.4	47.2	43.5	42.6	41.4	44.7
	2007	44.4	48.3	41.6	40.6	36.9	41.9
	2008	59.7	63.3	62.0	58.6	60.2	60.5
	2009	78.7	81.8	79.5	69.5	78.1	76.0
	2010	44.9	44.2	45.0	44.0	47.7	45.0
	2011	64.9	68.3	65.1	69.9	71.7	67.3
	2006–2011	56.5	58.8	56.1	54.1	55.9	55.8

The performance of the VAS programme was analysed by dividing the districts in each state into five poverty concentration quintiles. The lowest quintile comprised the 20% of districts in the state with the lowest proportion of poor households while the highest quintile comprised the 20% of districts in the state with the highest proportion of poor households.

In 2006, the full VAS coverage was highest in the lowest poverty concentration quintile (46.4%) and lowest in the highest poverty concentration quintile (41.4%). Between 2006 and 2011, the highest increase in full VAS coverage (+30.3 percentage points) was recorded in the quintile with the highest concentration of poor households while the lowest increase (+18.5 percentage points) was recorded in

Table 4 Pooled vitamin A supplementation coverage (at least one dose per child per year) and full vitamin A supplementation coverage (two doses per child per year) by district poverty concentration quintile in seven Indian states, 2006–2011

Indicator	Year	District poverty concentration quintile					Mean
		Lowest	Lower	Middle	Higher	Highest	
VAS coverage	2006	64.4	56.3	61.9	64.0	52.3	60.0
	2007	81.3	74.3	80.9	94.0	60.2	78.1
	2008	95.6	87.1	94.4	100.6	79.3	91.3
	2009	95.8	95.7	99.3	98.4	89.9	95.8
	2010	92.9	87.9	83.6	96.6	85.2	89.4
	2011	88.8	86.2	96.2	98.7	88.9	91.9
	2006–2011	86.5	81.2	86.0	92.0	75.9	84.4
Full VAS coverage	2006	50.0	41.3	47.2	47.5	37.7	44.7
	2007	43.5	34.6	42.9	46.0	41.2	41.9
	2008	72.1	59.9	62.8	64.4	47.3	60.5
	2009	68.8	74.8	81.2	80.4	76.2	76.0
	2010	52.2	26.5	39.4	52.1	52.1	45.0
	2011	57.7	59.9	71.2	73.4	72.4	67.3
	2006–2011	57.3	49.4	57.4	60.6	54.4	55.8

the quintile with the lowest concentration of poor households. By 2011, the full VAS coverage was highest (71.7%) in the quintile with the highest concentration of poor households and lowest (64.9%) in the quintile with the lowest concentration of poor households (Table 3).

Similar findings were observed when the performance of the VAS programme was analysed by pooling the 255 districts and categorizing them into five poverty concentration quintiles (fifty-one districts per quintile). In 2006, the full VAS coverage figures were lowest (37.7%) in the quintile with the highest concentration of poor households. Between 2006 and 2011, the average full VAS coverage increased in all quintiles and this increase was positively correlated with the quintile rank: higher increases were observed in the quintiles with higher concentration of poor households. By 2011, the full VAS coverage in the middle, higher and highest quintiles was >70% while it was ≤60% in the lower and lowest quintiles (Table 4).

The estimated number of children who did not receive the two recommended VAS doses annually decreased from 31.4 million in 2006 to 16.1 million in 2011 (48.7% decrease). This reduction was largest in the districts with the highest concentration of poor households and lowest in the districts with the lowest concentration of poor households (61.5% *v.* 23.3%; Table 5).

For each district we estimated the number of poor children (i.e. children living in households classified as poor) who were not covered (zero VAS doses) or were only partially covered (one VAS dose) per year by combining the population of children 6–59 months old, the proportion of households classified as poor and the VAS coverage/full VAS coverage in the district in a given year, assuming homogeneous coverage/full coverage across population groups within the district. The estimated number of children living in poor households who did not receive the two recommended VAS doses annually decreased from 8.5 million in 2006 to 5.1 million in 2011 (40.3% decrease). This reduction was significantly larger in

the districts with the highest concentration of poor households than in the districts with the lowest concentration of poor households (54.8% *v.* 15.0%; Table 5).

Discussion

In the seven states included in our analysis, the average full VAS coverage – the indicator of choice to measure the performance of national VAS programmes⁽¹⁶⁾ – increased significantly between 2006 and 2011 (from 44.7% to 67.3%) and so did the proportion of districts with high (≥80%) full VAS coverage (from 9.4% to 51.4%).

A recent review has indicated that the critical success factors of the VAS programme in the states of Bihar and Odisha include: strong leadership and ownership by the State Government; close coordination between the two departments (Health and Family Welfare and Women and Child Development) involved in the VAS programme; effective micro-planning prior to each biannual round; flexible dosing mechanisms that enhance coverage in hard-to-reach areas; a stable procurement and distribution mechanism to ensure an adequate, timely and sustainable supply of VAS; intensive social mobilization and communication; and appropriate training and supervision of staff (JH Rah, R Houston, BD Mohapatra *et al.*, unpublished results).

Our analysis indicates that in these seven states, the VAS programme evolved to be a social equalizer as the most significant increases in the proportion of children receiving two VAS doses per year were observed in the districts with the highest proportion of poor households; to the extent that, by 2011, the highest full VAS coverage figures (≥70%) were recorded in the three district quintiles with higher proportions of poor households.

However, despite such significant increases in full VAS coverage, only two states – Odisha and Rajasthan – managed to expand the VAS programme steadily and reach and

Table 5 Estimated number of children 6–59 months old not benefiting from the vitamin A supplementation programme by district poverty concentration quintile in seven Indian states, 2006–2011

		All children by district poverty concentration quintile					
	Year	Lowest	Lower	Middle	Higher	Highest	All
Non-covered (zero dose)	2006	3 069 854	5 615 217	4 348 964	4 134 307	7 016 428	24 184 770
	2007	1 732 880	3 539 933	2 324 593	734 443	6 236 943	14 568 792
	2008	478 466	2 080 012	793 567	85 484	3 773 671	7 040 231
	2009	497 616	753 631	107 243	246 360	1 988 828	3 593 678
	2010	751 586	1 890 350	2 227 581	463 962	2 581 363	7 914 842
	2011	1 007 110	1 827 219	435 085	149 477	1 630 374	5 049 265
	2006–2011	1 256 252	2 617 727	1 706 172	940 511	3 871 268	10 391 930
Partially covered (one dose)	2006	4 095 694	7 164 946	5 725 119	5 727 291	8 705 134	31 418 184
	2007	5 040 906	8 673 074	6 690 878	6 364 057	8 871 547	35 640 461
	2008	2 140 253	4 561 243	3 718 789	3 578 071	6 777 462	20 775 818
	2009	2 303 813	2 752 568	1 795 045	1 880 850	2 920 787	11 653 062
	2010	4 598 023	1 0434 395	7 479 721	5 939 665	7 591 819	36 043 623
	2011	3 142 230	4 386 266	2 724 095	2 526 680	3 348 978	16 128 249
	2006–2011	3 553 486	6 328 749	4 688 941	4 336 102	6 369 288	25 276 566
		Poor children by district poverty concentration quintile					
	Year	Lowest	Lower	Middle	Higher	Highest	All
Non-covered (zero dose)	2006	1 062 590	1 352 189	1 347 840	1 254 448	1 162 614	6 179 682
	2007	558 627	794 101	675 689	207 454	970 064	3 205 934
	2008	131 559	398 059	198 108	20 745	507 807	1 214 787
	2009	125 698	132 517	24 523	54 889	249 369	586 996
	2010	212 703	372 444	574 540	116 639	367 754	1 644 080
	2011	335 886	424 285	131 820	44 246	275 816	1 212 053
	2006–2011	404 510	578 932	492 087	276 155	588 904	2 340 589
Partially covered (one dose)	2006	1 492 401	1 816 328	1 867 873	1 829 404	1 518 466	8 524 472
	2007	1 687 829	2 020 786	2 019 991	1 867 086	1 433 159	9 028 852
	2008	834 204	1 237 377	1 316 001	1 230 894	1 292 822	5 911 298
	2009	933 757	776 609	658 619	672 389	587 622	3 628 996
	2010	1 432 000	2 262 367	2 122 995	1 643 236	1 190 232	8 650 830
	2011	1 268 571	1 232 885	999 056	905 342	685 812	5 091 667
	2006–2011	1 274 794	1 557 725	1 497 423	1 358 058	1 118 019	6 806 019

sustain full VAS coverage $\geq 80\%$ from 2007–08 onwards in all quintiles. As a result, a large number of children are not yet benefitting from this life-protecting intervention across states, particularly children who are potentially the most vulnerable, as about one-third (32%) of the children who did not receive two VAS doses in 2011 lived in poor households. Importantly, half (49%) of these children lived in districts with low concentration of poor households. Efforts aiming at scaling up the coverage of the VAS programme seem to have emphasized a geographic focus and given priority to the districts with a high concentration of households of scheduled-caste and scheduled-tribe families, which are traditionally left out by economic growth and mainstream development (VM Aguayo, N Badgaiyan and JH Rah, unpublished results).

Thus, specific state-wide programme efforts will be required in the states with lower and/or erratic full VAS coverage to ensure that all children 6–59 months old receive two VAS doses annually. Additionally, in all states priority needs to be given to the sub-district level units (blocks and villages) with higher concentrations of poor households, regardless of the poverty concentration at the district level.

As India makes progress in achieving its national and international commitments to child survival, it will

be important to reassess the prevalence of clinical and sub-clinical VAD in pre-school aged children and evaluate the impact of the national VAS programme. This will address recent concerns by some investigators and practitioners about the extent and severity of VAD in India and the relevance of the national VAS programme⁽¹⁸⁾, and build the evidence base to design the way forward post 2015.

Finally it will be important that states ensure that their VAS efforts be part of an integrated programme to control VAD that puts increasing emphasis on food-based strategies for the general population and strategies aiming at improving the quality of foods and feeding practices for young children in particular. Evidence shows that 42% of Indian children 6–36 months old are not fed vitamin A-rich foods regularly and that the vast majority of children do not meet even 50% of the recommended vitamin A dietary requirements because of poor diets^(7,8,11,19,20).

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