

# High and Equitable Coverage of Vitamin A Supplementation Program in Nepal

Shyam Thapa\*

Nepal Public Health Foundation, Nepal

## Abstract

**Background:** This paper examines the coverage and equity aspects of the vitamin A supplementation program in Nepal program followed by a review of factors that led to the gains over time.

**Data and methods:** Data from the 1996 and 2001 Nepal Demographic and Health Surveys are used. Variations in coverage by child's age, sex, mother's education, residence, and ecological-development sub-regions are analyzed by using descriptive and multivariate logistic regression techniques.

**Findings:** The percentage of children ages 6-35 months dosed with the supplementation was 32% in 1996; that increased to 78% by 2001. The differences in coverage rates for various subgroups were relatively small by 2001. The most important factors contributing to the achievement were a systematic and incremental approach to scale-up, the role played by Female Community Health Volunteers, an effective public-private partnership, and sustained donor support.

**Conclusion:** The vitamin A program's success offer valuable lessons for Nepal and elsewhere.

**Keywords:** Vitamin A; Coverage; Equity, Child survival; Nepal

## Introduction

Vitamin A, a micronutrient, prevents night blindness and decreases morbidity due to measles and other communicable diseases [1]. Studies carried out in several countries have also established that the vitamin A intervention (bi-annual dosing with high-dose capsules) significantly reduces mortality among children 6-59 months of age. A meta-analysis of six community-based trials in Asian countries showed an overall 34 percent reduction in mortality among children 6-71 months [2,3]. Included in the six trials in Asia were two districts of Nepal that showed between 29 and 30 percent reduction in mortality for children ages 6-71 months, net of other factors [4,5]. Another meta-analysis of eight trials, including two in Ghana and Sudan, found a 23% reduction in mortality among children 6-59 months old [6,7].

The research findings from Nepal and elsewhere led Nepal's Ministry of Health to launch, with assistance from the United States Agency of International Development (USAID), the National Vitamin A Program with the aim of providing vitamin A supplementation to the child population "at risk" (6-59 months in age) in a phase-wise manner nationwide. The twice-yearly distribution-- within April and October of each year-- with of vitamin A capsules (100,000 and 200,000 International Units for children ages 6-11 months and 12-59 months, respectively) was initiated in October 1993, with the anticipation that the program would be gradually phased in across the 75 districts within a decade. The Nepal Technical Assistance Group (NTAG), a private sector consortium of professionals, has provided technical support for the implementation and oversight of the program, hand-in-hand with the Ministry of Health from the beginning. In contrast to many other countries, where vitamin A supplementation is delivered from the "platform" of polio or other immunization campaigns [8], the program in Nepal itself became a platform for the delivery of similar other interventions [9].

Fiedler in 2000 noted that Nepal's vitamin A program was "widely recognized and highly regarded, but remarkably unknown" [10]. More recently, UNICEF [9] undertook a review of the program dynamics and documented the program's experiences and elements of success. The analyses and discussions in the otherwise fairly comprehensive reviews of the program conducted in recent years [9,11,12] did not focus on

equity aspects of the coverage. Multiple rounds of monitoring surveys ("mini-surveys" data used in UNICEF report) show coverage of over 90% of eligible population. In a program of this kind, characterized by community mobilization utilizing local mobilizers, an important outcome would be minimization of socio-economic differentials across population subgroups in terms of access to and use of program services. Equitable coverage may be a key indicator of success for a highly participatory program that many [9,12,13] have claimed the program to be. Guided by this proposition, this paper examines the coverage and equity aspects of the supplementation program, using primarily two nationally representative surveys carried out in 1996 and 2001. Following this, the paper provides a review of factors that led to the achievements over the years.

## Materials and Methods

This study uses data from the 1996 and 2001 Nepal Demographic and Health Surveys. Both surveys were part of the global Demographic and Health Surveys ([www.measuredhs.com](http://www.measuredhs.com)). Given their wide scope, these surveys included only a few questions aimed at assessing the prevalence of various micronutrients, including vitamin A. The surveys included information on all children born to the sampled women during the five-year period preceding each survey. These data permit analysis of the extent of coverage for the vitamin A program for different population subgroups at the two points in time.

For both the surveys, the eligible respondents were defined as ever-married women ages 15-49, and the fieldwork occurred over a 21-week period, January through June of each survey year. In the 1996 survey,

**\*Corresponding author:** Shyam Thapa, PhD, Nepal Public Health Foundation, PO Box 11218, Kathmandu, Nepal, Tel: +977-985-113-7203; E-mail: [sthapa22181@gmail.com](mailto:sthapa22181@gmail.com)

**Received** November 09, 2013; **Accepted** February 14, 2014; **Published** February 17, 2014

**Citation:** Thapa S (2014) High and Equitable Coverage of Vitamin A Supplementation Program in Nepal. J Community Med Health Educ 4: 272. doi:10.4172/2161-0711.1000272

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8,429 women were successfully interviewed with a response rate of 98% [14]. It recorded 23,458 live births and 5,343 dead children (or a total of 28,801 births) among the respondents. The total number of children 6-35 months old who received vitamin A was 3,386. Similarly, in the 2001 survey, 8,726 eligible women were interviewed with a response rate of 98.2% [15]. The total number of live births and dead children recorded were 24,360 and 4,414, respectively. Among the surviving children 6-35 and 6-59 months of age, 3,411 and 6,293 children, respectively, were reported by their mothers to have received vitamin A.

By the time of the 1996 survey, the distribution of vitamin A capsules had covered 27 districts in the country. The 1996 survey included a question aimed at eliciting from each eligible respondent whether each of her surviving children ages 6-35 months (n=3,386) had received vitamin A during the last six months. The interviewer was also instructed to show, for verification, a vitamin A capsule to the respondent. The survey collected information regarding vitamin A supplementation only among children ages 6-36 months although the program provided the supplementation to children up to 60 months. Because of this, the actual coverage was slightly underestimated, as pointed out below.

By mid-2001 the program covered 72 of 75 districts and by October of 2002 covered all 75 districts. The 2001 survey included a slightly expanded set of questions. First, the mother of under-five children was asked if she knew of the vitamin A distribution campaign that took place in the last six months. If she responded “yes”, she was then asked whether her child (6-59-month old) received vitamin A during that distribution campaign. If she reported affirmatively, she was asked four additional descriptive questions to validate and verify the information initially reported. Further, unlike in the previous survey, the status of vitamin A supplementation was ascertained for all children up to 60 months of age. Because this survey included children up to 60 months, we also tabulated the data for comparison with the 1996 survey results that covered children only up to 36 months [16-18].

For this analysis, coverage is defined as the percentage of eligible children (ages 6-35 or 6-59 months) who received vitamin A supplementation in the six months preceding the survey, and equity refers to similarities in coverage between and among various sub-groups of the eligible population. Equity or equitable is used here specifically with reference to reducing social gaps or disparities in access and utilization of healthcare services in the same sense as used by WHO/EURO [19]. The variables/co-variables included in the analysis is child’s age, child’s sex, mother’s education, urban-rural residence, and ecological-development subregion. The data analysis presented includes descriptive statistics and multivariate logistic regression [20].

For the regression results, children who received vitamin A and those who did not were coded as 1 and 0, respectively. Bivariate and multivariate logistic regressions were performed to obtain odds ratios to assess the effects of risk factors. Data were analyzed using SPSS version 18 (IBM, Armonk, NY, USA). A P value of 0.05 or less was considered to be statistically significant.

## Results

Table 1 shows coverage by selected background characteristics in the two surveys. Data from the 2001 survey are shown in two panels— one limited to age up to 36 months, to allow for direct comparison with the 1996 survey, the other including coverage for all children up to 60 months. The difference in coverage between 36 months and 59

Characteristic	1996 Survey (6-35 months)	2001 Survey (6-35 months)	2001 Survey (6 to 59 months)
Child's age (in months)	P=0.0001	P=0.0001	P=0.0001
6-9		44.2	44.2
10-11	{18.1	72.9	72.9
12-23	34.9	83.4	83.4
24-35	36.6	85.5	85.5
36-47	na	ni	84.4
48-59	na	ni	84.0
Child's sex	P=0.748	P=0.784	P=0.761
Male	32.0	78.1	80.9
Female	32.5	78.5	81.2
Residence	P=0.0001	P=0.0001	P=0.002
Urban	18.4	67.9	75.4
Rural	33.2	79.0	81.4
Ecological and development sub-region	P=0.0001	P=0.001	P=0.0001
Eastern Mountain	3.8	80.9	80.2
Central Mountain	1.1	78.7	81.2
Western Mountain	15.9	80.2	80.4
Eastern Hill	5.7	79.0	82.0
Central Hill	6.9	75.6	78.8
Western Hill	3.1	81.6	85.8
Mid-western Hill	15.8	83.1	83.1
Far-western Hill	61.5	77.4	77.3
Eastern Terai	49.0	74.3	78.2
Central Terai	49.9	73.4	77.6
Western Terai	71.4	83.2	86.3
Mid-western Terai	52.2	85.2	84.2
Far-western Terai	47.8	83.8	85.6
Mother's education	P=0.004	P=0.351	P=0.031
No education	33.6	78.1	80.2
Primary	28.1	76.8	83.3
Some secondary	27.2	80.5	83.2
High school and above	20.5	82.9	85.0
Total	32.2	78.3	81.0
(Number of children)	(3,385)	(3,411)	(6,293)

Data source: Nepal Family Health Survey 1996 and Nepal Demographic and Health Survey 2001 data files (www.measuredhs.com)

Note: In some cases, the figures, which are calculated from raw data, slightly different from those reported in the survey reports. P values are based on  $\chi^2$  test. NA=Not Available; NI=Not Included

Table 1: Percentage of children ages 6-59 months who received Vitamin A supplementation by selected background characteristics, Nepal, 1996 and 2001.

months is 2.7 percentage points, suggesting that the actual coverage for all children 6-59 months could have been as high as 34.9% nationally in 1996.

As shown in Table 1, there existed in 1996 considerable differentials by socio-demographic and ecological-development strata. Children in rural areas, compared to those in urban areas, were 1.8 times as likely to get the vitamin A capsule. Coverage among the 13 ecological-development sub-regions of the country ranged from less than 1% to as high as 71.5%. It was the highest in the Western Terai (low-land belt stretching east to the west and bordering India in the south) sub-region, where nearly three-fourths of the children received the supplement. In the Far-western Hill sub-region, about 62% of children were covered by the program. The children in the Western Terai were 10 times more likely to have received the supplement than those in the Central Hill sub-region.

The regional differences are consistent with the program’s strategy of initiating the dosing in the western part of the country, Terai in particular. Accordingly, proportionally more children living in the

rural and less developed regions, with mothers from less educated groups, received the capsules. The data reveal no differences in coverage between boys and girls in program districts.

Over the next five-year period, by 2001, the coverage among children 6-35 months of age increased by 46.1 percentage points or a 2.4-fold increase such that nearly three-fourths of the children (and 81% among children 6-59 months old) were dosed with vitamin A. As mentioned earlier, the 2001 survey also included some additional questions for purposes of verification. Among children who had received vitamin A, the overall percentage with correct verification was 81.4%, ranging between 71.4% and 95% [15].

The substantial increase in coverage was not limited to certain groups. Rather, the expansion of coverage appears fairly equitable, and the large gaps in coverage that existed five years prior to that point virtually disappear. As before, the coverage did not vary between boys and girls. The coverage level was over 85% in all population subgroups, except in the Central Mountain region (comprising 2.4% of the country's population), where it stood at 72%, among children 10-11 months old (80%) and among children 6-9 months old (43.8%). It has been pointed out [15] that one factor influencing the relatively

low coverage among children 6-9 months could be that the children were not yet six months of age to receive vitamin A supplementation at the time of its latest distribution. The survey did not ascertain the age of child at the time of vitamin A dosing but only noted it on the day of the interview. This may have led to slight underestimation in the age-specific coverage.

For purposes of assessing the net effect of background characteristics on the outcome measure (the probability of a child having received the supplementation in the six months preceding the survey), multivariate logistic regression was carried out. The results are presented in Table 2. For 2001 the pattern of results for children ages 6-35 months was very similar to those for 6-59 months old. For this reason, only results for the full age-range (6-59) are presented. Of the five variables, only three, child's age, urban/rural residence and ecological-development sub-region, show significant effects on the outcome measure. The relative effects of the categories within each variable are different, however. Whereas in 1996, the rural population, compared to urban, was 2.1 times more likely to have received the supplementation, the difference was further reduced by the year 2001 (OR of 2.14 v. 1.65), suggesting that the program was gradually expanding to urban areas over time. Significant changes were found regarding coverage in the 13 sub-regions. In 1996 seven sub-regions, comprising 45% of the country's total population, had significantly lower levels of vitamin A coverage (with odds of receiving vitamin A [OR] ranging between .01 and .18) compared to Central Terai, the reference sub-region that comprised the highest concentration (17%) of the country's population. Only two sub-regions (Far-western Hill and Western Terai) had higher levels of coverage (OR of 1.57 and 2.68, respectively). Three sub-regions (representing 26% of the population) had the same level of coverage as the reference sub-region.

By 2001 the coverage landscape had changed considerably. Seven of the 13 sub-regions achieved coverage level equal to that of the reference sub-region. The eight regions contained just over 61% of the country's total population. The remaining five regions had significantly higher coverage, with OR between 1.77 and 1.86 in three sub-regions and between 1.42 and 1.53 in the remaining two sub-regions. In both time periods, there were no significant differences by mother's education or child's gender. Further, there was no difference in coverage between children 12 months old and older, while younger children compared to 12-23 months old had lower coverage, most probably for the reason stated earlier.

## Discussion and Conclusion

The results presented here clearly show that Nepal made significant gains in vitamin A supplementation coverage over the years. Thapa [18] has analyzed data from a similar survey carried out in 2006 when the overall coverage reached 88% (among the at risk population) with narrow differences between population sub-groups. However, analyses of the data from earlier periods are critical in understanding how the supplementation of the program was scaled up and what factors led to the success. For this reason, the data from the two time periods analyzed here assume importance.

As of 2001 the coverage remained high at 81% and, although it continued to vary and differences remained statistically significant for certain subgroups of the eligible population, the absolute levels of difference in coverage were relatively small. By 2001 none of the 13 ecological-development sub-regions had a coverage rate lower than the reference sub-region, which comprised the highest proportion (17%) of the country's population and had a coverage rate of 78% among children 6-59 months old. These high levels of coverage and, more

Characteristic	1996 Survey		2001 Survey	
	OR (95% CI)	P	OR (95% CI)	P
Child's age (in months)				
6-9	.32 (.25-.41)	.0001	.15 (.12-.19)	.0001
10-11			.55 (.39-.77)	.0001
12-23	1.00	-	1.00	-
24-35	.98 (.81-1.18)	.829	1.19 (.97-1.47)	.096
36-47	na	-	1.10 (.90-1.35)	.344
48-59	na	-	1.07 (.87-1.30)	.527
Child's sex				
Male	1.00	-	1.00	-
Female	1.03 (.87-1.23)	.732	1.03 (.90-1.17)	.682
Residence				
Urban	1.00	-	1.00	-
Rural	2.14 (1.41-3.24)	.0001	1.65 (1.27-2.14)	.0001
Ecological and development sub-region				
Eastern Mountain	.05 (.01-17)	.0001	1.10 (.64-1.90)	.721
Central Mountain	.01 (.00-.08)	.0001	1.26 (.82-1.94)	.292
Western Mountain	.18 (.11-.31)	.0001	1.16 (.80-1.67)	.436
Eastern Hill	.06 (.03-.10)	.0001	1.19 (.90-1.57)	.215
Central Hill	.08 (.05-.12)	.0001	1.12 (.88-1.44)	.363
Western Hill	.03 (.02-.06)	.0001	1.77 (1.34-2.33)	.0001
Mid-western Hill	.18 (.12-.25)	.0001	1.42 (1.09-1.86)	.009
Far-western Hill	1.57 (1.07-2.32)	.022	1.00 (.73-1.38)	.981
Eastern Terai	1.00 (.77-1.29)	.981	1.05 (.84-1.30)	.696
Central Terai	1.00	-	1.00	-
Western Terai	2.68 (1.96-3.67)	.0001	1.86 (1.39-2.50)	.0001
Mid-western Terai	1.10 (.80-1.52)	.563	1.53 (1.08-2.18)	.017
Far-western Terai	1.09 (.74-1.61)	.646	1.81 (1.21-2.72)	.004
Mother's education				
No education	.99 (.74-1.32)	.924	.82 (.66-1.00)	.052
Primary	1.00	-	1.00	-
Some secondary	.96 (.61-1.52)	.865	1.15 (.85-1.57)	.368
High school and above	1.07 (.54-2.14)	.840	1.36 (.88-2.11)	.165

Note: OR=Odds of receiving vitamin A supplementation in the six months preceding the survey relative to the reference group which has an OR of 1.00. NA=Not Available.

**Table 2:** Multivariate logistic regression results for Vitamin A supplementation of children by selected background characteristics, Nepal, 1996 and 2001.

importantly, equity attained by the supplementation program stand in sharp contrast to achievements in several other child and maternal health services implemented over the years in Nepal [14,15,19] and many other countries [20].

The introduction of vitamin A supplementation seems to have contributed to a faster rate of decline in mortality. According to one estimate [21], child mortality (the probability of dying between the exact ages 12 and 60 months conditional on survival to 12 months) declined from 39 per 1,000 live births in the period 1991-1995 to 17 in 2001-05, representing a decline by 56% during the decade. Based on the past trends, child mortality levels for the quinquennial periods 2006-10 and 2011-15 are projected to reach 11 and 7 per 1,000 live births, respectively. Fiedler [11] estimated that the cost in 2000 US dollars of vitamin A supplementation (including two capsules, training, promotion and monitoring and evaluation) was US\$0.74 per child in the initial years of the program but went down to US\$0.19 per child once the program was fully implemented. This cost estimate makes vitamin A supplementation “one of the most cost-effective health interventions available” [10].

The 2001 survey finding that nearly four of every five children ages 6-59 months received vitamin A capsule meant that just over three million children were reached nationally as of 2001. The 2001 survey-based percentage coverage (81%) is about 10 percentage points lower than the coverage reported on the basis of multiple rounds of the “mini-survey” [9]. Similarly, the absolute number of children estimated to have received the supplementation in 2002, as reported by the NTAG, is only slightly higher than what was estimated in the present analysis (3.2 million versus 3 million, that is, a difference of just over 6%). The congruence between these numbers is reassuring. The high levels of both coverage and equity associated with vitamin A supplementation are a remarkable achievement for a country characterized by difficult geographic terrain and major communication and transportation infrastructure challenges. These challenges include the extreme disparities that many indicators of development and infrastructure in the 75 districts of the country have shown [22-24]. The “human development index,” which is a relative ranking of the districts in terms of their levels of deprivation and disparity, showed Mugu district, for example, to be 83 times worse-off than Kathmandu district in 1991. The vast majority of the districts were found to belong to the “low level” human development category (as defined by the prevailing international classification scheme). Disparities among the districts have lessened some in recent years and the relative ranking may have changed somewhat, but regional disparities and inequities persist [25,26].

Another contextual factor relevant to the vitamin A supplementation intervention was the prolonged state of political instability and armed conflict (“People’s War”) prevailing in the country for over a decade since 1996 [27-29]. An assessment conducted in 2005 in purposively selected areas of the country [30] reported that the overall working environment in health sector was affected by the general insurgency factors, including “intimidation, harassment, extortion and threats,” and that this situation hampered mobility and “management and supplies of commodities, drugs and vaccines.” At the same time, the report noted that special national campaigns pertaining to immunization and vitamin A were not disrupted or stopped, and that the general environment seemed to be supportive of these specific activities to the extent that drugs and supplies flowed uninterrupted to the campaign sites and that people, including service providers, felt safe to move about and carry out their activities. That the support for the vitamin A program continued is confirmed by coverage

data as assessed through the mini-surveys (summarized in UNICEF [9]), during 1999-2002 was over 90% in four districts (Pyuthan, Salyan, Rukum and Jajarkot) that have been widely recognized to be the bastion of the forces leading the People’s War.

Several factors seem to have facilitated the success achieved by the vitamin A supplementation program. First and foremost, is the concentrated approach adopted as opposed to the sprinkler approach to the introduction and expansion of the program. The phase-wise, incremental approach to introducing and scaling up the program provided the opportunity to learn from the systematically implemented activities through close monitoring, evaluation and supervision. The role of systematic planning for gradual expansion with specific time horizon, engagement of stakeholders, and sustained support are at the heart of the successful program scale-up [31].

The program instituted biannual “mini-surveys” as a means of self-evaluating the program and its coverage on an ongoing basis so that modifications could be made to program inputs as and where necessary [13]. A heavy concentration of efforts and resources helped saturate each geographic area of concentration with service, create awareness and mobilize communities. The program became the communities’ campaign and a bi-annual community event that made the community members assemble in one place to have their children receive vitamin A supplement. The program thus helped create a strong sense of community solidarity around a common cause. In this sense, community mobilization seems to have evolved into an effective social capital for helping minimize inequities in access to and utilization of services [32,33].

The role of the community-based health workers, known as Female Community Health Volunteers (FCHV), has been critical in generating community-level support and participation for the program [34,35]. Currently, there are over 46,000 FCHVs serving up to 5,000 community members throughout the country. Since they are from the same community, they are not only most trusted [9] by the community but often the first contact-person regarding health matters for the community. FCHVs are the primary source of information for vitamin A capsule distribution. By the same token, the FCHVs have first-hand knowledge of community’s problems, strengths, weaknesses, challenges and relationships; this helps them formulate effective strategies for mobilizing households and individuals to participate in community events that aim to benefit all or most. The FCHVs represented the trust factor and, most probably, the hope factor as well.

Further, it has been noted that because of FCHVs’ high social status (higher than paid health workers working in government health facilities), communities respond to FCHVs’ calls to bring their children for services, and often more than they would from the government health staff [36]. The vitamin A program appears to be fully owned by the FCHVs and is, in some ways, considered to be FCHVs’ program. Because of the community ownership, it is perceived to be something much more permanent than a program that is dependent in the hands of the government health workers that are characterized by frequent transfer.

The program had strong media support and advocacy inputs from the grassroots to the national level [9]. Because the program dealt with the least controversial of themes,--children’s health, it did not have the usual polarizing and dividing effect that issues and projects tend to have. Further, because it targeted each and every child in a community, every household saw value in participating in the program, understood how it served their own interest and acted to benefit from

it. This very nonpolitical and high social-value aspect of the program probably helped make the program highly acceptable to not only the communities but also the various political parties, including Maoists.

The National Vitamin A program represents a successful case of public-private partnership in the health sector. NTAG provides technical support, oversight and works hand-in-hand with the Ministry of Health in planning, implementing, monitoring and evaluating the program. As a corollary, the program also has had sustained financial support, high visibility, oversight and monitoring from both the government– Ministry of Health – and the donors, principally, USAID, UNICEF, AusAID, CIDA and MI (Micronutrient Initiative) [9].

Some of these factors (e.g., FCHVs) have been examined in greater detail while others have not been. Further, very likely there are other related factors. Although the review in this paper was limited to two surveys, through 2001, evidence from the 2006 round of the national survey has confirmed the program's continued sustained gains in coverage and equity. The 2006 survey has shown that the coverage among children 6-59 months old has increased to 87.5% nationally, and that the percentage of coverage varied narrowly, between 71.7% and 93.1%, except in the very young age-group, 6-9 months [18,19]. There was thus a 6.5 percentage-point gain in the 5-year period. The analysis also revealed that the children (12.5%) still missed by the program represented the poorest of the poor families, mothers with no education, and residents of rural areas and selected ecological and development sub-regions. The most recent 2011 round of NDHS [37] showed 90.4% coverage among all the eligible children, thus confirming sustained and very high coverage. Given the past performance of the program, the program is most likely to reach coverage for all "at risk" children in a few years.

In conclusion, the vitamin A supplementation program seems to be one of most successful public health programs in recent decades in Nepal. In terms of the strategy adopted, program-support elements identified and the process implemented to achieve high levels of coverage and equity, as well as challenges and constraints tackled the program's success offer valuable lessons for Nepal and elsewhere.

#### Acknowledgements

The author thanks Jake O'Sullivan for his review and many useful comments on an earlier version of the paper.

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