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**Original Research Article**

# Intensive monitoring and interpersonal counselling by lady health worker improves the coverage of vitamin A among children between ages 6 and 59 months in selected low performing provinces of Pakistan

**Tausif Akhtar Janjua[1], Khalid Nawaz[2], Deepika Nayar Chaudhery[3], S. Kaushik[4], Manoj Kumar Raut[5]***

[1]Technical Director, Food Fortification Project, Nutrition International (Formerly known as the Micronutrient Initiative), Pakistan
[2]Health Specialist Immunization, UNICEF, Pakistan
[3]Former Deputy Regional Director, Asia, Micronutrient Initiative (Now known as Nutrition International), New Delhi, India
[4]Director, Monitoring, Learning and Evaluation, Digital Green
[5]Regional Manager, Research and Evaluation, Asia, Nutrition International (Formerly known as the Micronutrient Initiative), Asia Regional Office, New Delhi, India

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***Correspondence:**
Dr. Manoj Kumar Raut,
E-mail: rautmanojkumar@gmail.com



## ABSTRACT

**Background:** Nutrition International, previously known as Micronutrient Initiative, has been supporting the government of Pakistan to address vitamin A deficiency in 24 districts of Balochistan and Khyber Pakhtunkhwa and 78 union councils of Lahore and Karachi. The program aims to improve capacity of health managers and frontline workers on supply chain management and monitoring; monitoring of stock-outs at health facilities and frontline distribution points; and focus on regular monitoring and supervision through EPI and health departments. Challenge however remains in achieving meaningful coverage. The Nutrition International piloted an intensive monitoring strategy in a sub-set of four districts of Balochistan and KPK and 14 union councils in Karachi and Lahore with an aim to improve coverage of vitamin A. The study assessed the changes in coverage of vitamin A supplementation 2011 to 2012 due to the intensive monitoring.
**Methods:** Two rounds of repeated cross-sectional mixed-methods surveys were conducted on a sample of 2,579 and 2,580 caregivers during baseline and end-line respectively. Low performing districts identified in each of the four provinces constituted the study domain. The sample of households in each region was selected using a two stage cluster sampling strategy.
**Results:** The coverage of Vitamin A registered an absolute increase of 35.7 percent points in the intensive monitoring districts compared to the other districts, where it was 29.6 percent points in the end-line over the baseline.
**Conclusions:** It was observed that intensive monitoring and interpersonal counselling by lady health worker is instrumental in improving the coverage of Vitamin A in certain programmatic settings in Pakistan.

**Keywords:** Vitamin A, Intensive program monitoring strategy, Coverage survey, Program evaluation

## INTRODUCTION

According to the World Bank estimates about 29.5 per cent of the population lives below the poverty line in 2016.[1] There are approximately 25 million children under-five in Pakistan (UN estimates, World population prospects, 2017). Nutritional deficiency affects all, although women and children are especially vulnerable. The Pakistan National Nutrition Survey (NNS) 2011 reports that almost two thirds of the children in Pakistan are malnourished and a similar proportion was reported to be suffering from anaemia.[2] Vitamin A deficiency impairs numerous functions and, as a result, can lead to many health consequences, to which infants, young children and pregnant women appear to be at greatest risk. Vitamin A is essential for normal functioning of immune system as well as growth, reproduction and vision. Vitamin A deficiency (VAD) can result in increased risk of childhood mortality due to infections such as diarrhoea and measles.[3] It is a leading cause of night blindness among children and approximately 0.25 to 0.5 million of the 250 million vitamin A deficient children become blind each year; half of them die within one year of losing their vision. VAD is a significant public health problem in Pakistan, the prevalence of night blindness among pregnant women and under five children being 10 per cent and 1.2 per cent, respectively, while 13 per cent of children and 5.9 per cent mothers have evidence of sub-clinical VAD.[2] The recent NNS 2011 shows worsening of these figures with 15 per cent women reporting night blindness while 56 per cent children were reported to have mild or severe vitamin A deficiency. Vitamin A supplementation (VAS) programs targeted at children aged 6–59 months are implemented in many countries. By improving immune function, vitamin A (VA) reduces mortality associated with measles, diarrhoea, and other illnesses.

Vitamin A supplementation (VAS) has been undertaken by many countries to reduce night blindness and mortality due to minor illnesses like diarrhoea and measles. In the past decade, Vitamin A supplementation gained momentum as it was added to the Expanded Program for Immunization (EPI), especially within the poliomyelitis eradication initiative that has since continued as national child health week campaigns during which high-potency vitamin A is distributed twice yearly in many countries.[4] This paper documents a vitamin A supplementation program by nutrition international, (previously known as Micronutrient Initiative).

### *Literature review*

Agarwal and Agarwal, (2013) have shown that rural children and children of educated mothers were more likely to receive vitamin A supplementation than others. Children born in a higher birth order (6+) and those residing in states with low levels of social and economic development were only about half as likely to receive vitamin A supplementation as their counterparts in a cross-sectional study of 20,802 children aged 12-35 months whose mothers participated in the third round of the National Family Health Survey (NFHS-3) conducted during 2005-2006, where the association between the socio-economic and demographic characteristics of the children, the social and economic development status of the state in which they reside and vitamin A supplementation status were examined by means of unadjusted and adjusted logistic regression models.[5] Semba et al found that maternal education is an important factor relating to receipt of a vitamin A capsule in the BDHS 2004 data. A higher level of formal education achieved by girls may be a key factor in breaking the intergenerational cycle of malnutrition and poverty. Since younger maternal age was also associated with the lower coverage, further efforts are, thus, required by the vitamin A supplementation programmes to reach young, uneducated primigravida mothers. Also, children of households of higher socioeconomic status were more likely to have received a vitamin A capsule.[6] Thapa et al, 2005 have analysed the data of Nepal Demographic & Health Survey, 2001 and found that the beneficial effect of vitamin A supplementation on child mortality is larger than that found in most earlier clinical studies. This larger effect may be due mainly to the other health related activities undertaken by the female community health volunteers who distribute vitamin A capsules.[7]

### *Program description*

A program supported by Micronutrient Initiative, focussed on 14 districts of Balochistan, 8 districts of Khyber Pakhtunkhwa and 39 union councils each in Lahore and Karachi, which included the strategies of capacity building of health managers and frontline workers on supply chain management and monitoring, monitoring of stock-outs at health facilities and frontline distribution points, focus on regular monitoring and supervision through EPI and health departments. In a sub-set of two districts each in Balochistan and KPK and seven union councils each in Karachi and Lahore were identified for piloting an intensive monitoring strategy. In these districts, in addition to the overall strategy, the strategies of modification of tally sheet to include a column to record vitamin A supplementation (VAS) in addition to polio and recording of children missed out of vitamin A capsule (VAC), double door marking to identify children missed out of VAS (in addition to polio) and supportive supervision and monitoring by field officers were implemented. The program by MI focused on the districts having the lowest coverage; 14 districts of Balochistan, eight districts of Khyber Pakhtunkhwa and 39 union councils each in Lahore and Karachi. It included the strategies of capacity building of health managers and frontline workers on supply chain management and monitoring, monitoring of stock-outs at health facilities and frontline distribution points and a focus on regular monitoring and supervision through EPI and health departments. The Program was initiated in September 2011. A sub-set of two districts each in Balochistan and KPK and 7 union councils each in Karachi and Lahore

were identified for piloting an intensive monitoring strategy. In these districts, in addition to the overall strategy, the following strategies of modification of tally sheet to include column to record VAS in addition to polio and recording of children missed out of VAC, double door marking to identify children missed out of VAS (in addition to polio) and ensuring supportive supervision and monitoring by field officers. A program evaluation was planned to measure the change in the coverage of vitamin A supplementation prior to the intervention and following the intervention. Baseline and end-line quantitative surveys were conducted to estimate the coverage of vitamin A in these areas.

### *Objectives*

The objective of the program evaluation was to measure the change in the coverage of vitamin A.

## METHODS

### *Study area, design and methodology*

Two rounds of repeated cross-sectional surveys were conducted in which both the quantitative and qualitative methods were adopted. The low performing districts identified in each of the four provinces constituted the study domain.

### *Sampling design and sample size*

In order to compare the finding of the end-line survey with the baseline, this study used the same methodology to estimate sample size that was used to determine the sample size for the baseline survey. A total sample of 2,579 and 2,580 care givers was achieved in the baseline and end-line surveys respectively. The sample of households in each region was selected in a two stage cluster sampling strategy. In the first stage, union councils (UC) were selected through probability proportional to population size (PPS) methodology. In the second stage, a village (cluster) in each of the selected UCs was selected randomly using the micro-plans developed for National Immunization Days (NIDs). Within each selected village, a sample of 15 households was selected through systematic sampling with a random start. Similarly in urban areas (Lahore and Karachi), towns were selected in the first stage and then within the towns, slum areas were selected randomly and 15 households were interviewed in each selected urban slum. All caregivers in the selected households who had children between 6 to 59 months of age at the time of the visit were eligible to participate in the survey.

### *Data collection*

The quantitative data was collected from caregivers from households, vaccination teams and area in-charges of the selected clusters, and EPI Coordinator of each study district. The qualitative information was gathered from caregivers regarding their perceptions about vaccination teams and repeated campaigns and visits. This information was collected at the time of interviews and through applying qualitative techniques and getting responses using probes. In each of the study districts, audit of the supply chain for stock-outs, personnel issues, training issues, and absenteeism was conducted. The purpose was to identify gaps in supply chain management, stock-outs and other reasons for limitations in VAS coverage. The tool used was a mix of internationally accepted instruments specifically designed for this purpose and the WHO Vaccine Management Module.

### *Data analyses*

All the analyses were performed using PASW 18.0 version. In addition to bivariate analysis, multivariate analyses was performed to control for the effects of other correlated factors, as results from bivariate analyses sometimes could be thoroughly misleading. For analysis purpose, a sample of respondents was selected from the two states of those who are either reporting receipt of Vitamin A or not was considered as the dependent variable. So, as the dependent variable is categorical and dichotomous in nature with two categories; reporting non receipt of Vitamin A =0 and reporting receipt of Vitamin A=1, Binary Logistic regression was carried out to explore factors associated with the coverage of Vitamin A. The multiple logit model can be expressed as:

$$\ln\left(\frac{\mathrm{P}}{1-\mathrm{P}}\right) = \alpha + \beta_1 x_1 + \beta_2 x_2 + \cdots \beta_i x_i + e$$

- p is the probability that the event Y occurs, p(Y=1)
- p/(1-p) is the "odds ratio"
- ln[p/(1-p)] is the log odds ratio, or "logit"
- $\beta_1$, $\beta_2$, $\beta_i$ here refers to beta coefficients.
- $x_1$, $x_2$, $x_i$ here refers to the independent variables.
- *e* is the error term
- Interpretation of bi

Increase in log-odds for a one unit increase in $x_i$ with all the other $x_i$s constant.

Measures association between $x_i$ and log-odds adjusted for all other $x_i$.

## RESULTS

It was observed that there was a considerable improvement in the coverage of vitamin from the baseline to the end-line in the intensive monitoring as well as other districts. It was higher in the intensive monitoring districts. The coverage of vitamin A has registered an absolute increase of 35.7 percent points in the intensive monitoring districts compared to the other districts, where it was 29.6 percent points in the end-line over the baseline. Bivariate analysis was carried with the receipt and non-receipt of vitamin A with socio-demographic variables and covariates.

**Table 1: Coverage of vitamin A in the intensive monitoring and other districts in Pakistan, vitamin A baseline and end-line survey, 2011-12 (%).**

| | Intensive monitoring districts | | Absolute Difference in per cent point (%) | Other districts | | Absolute Difference in per cent point (%) |
|---|---|---|---|---|---|---|
| | Baseline% (95% CI: LL, UL) (n=496) | End-line% (95% CI: LL, UL) (n=481) | | Baseline% (95% CI: LL, UL) (n=2,083) | End-line% (95% CI: LL, UL) (n=2,099) | |
| **Coverage of Vitamin A** | 60.1 (55.77-64.39) | 95.8 (94.05-97.62) | 35.7 | 59.1 (56.95-61.21) | 88.7 (87.35-90.06) | 29.6 |

CI: Confidence Interval

**Table 2: Percentage distribution of the predictors used in the model in Pakistan, vitamin A end-line survey, 2012.**

| Predictors used in the models | Definition of categories | Intensive Monitoring districts (%) | Other districts (%) |
|---|---|---|---|
| **N** | | 481 | 2,099 |
| **Place of residence** | 0 for Rural | 58.2 | 53.7 |
| | 1 for Urban | 41.8 | 46.3 |
| **Education of the father** | 0 for Illiterate | 45.1 | 43.4 |
| | 1 for Primary | 9.1 | 6.2 |
| | 2 for Middle | 8.3 | 10.0 |
| | 3 for Secondary | 20.2 | 23.1 |
| | 4 for Higher Secondary | 10.0 | 8.2 |
| | 5 for College and University Education | 7.3 | 9.1 |
| **Education of the mother** | 0 for Illiterate | 59.6 | 62.8 |
| | 1 for Primary | 7.5 | 7.3 |
| | 2 for Middle | 8.2 | 4.2 |
| | 3 for Secondary | 15.3 | 15.3 |
| | 4 for Higher Secondary | 5.1 | 5.3 |
| | 5 for College and University Education | 4.3 | 4.2 |
| **Communication exposure** | | | |
| Mass media | 0 for Did not hear about Vitamin A campaign on TV | 76.1 | 81.5 |
| | 1 for Heard about Vitamin A campaign on TV | 23.9 | 18.5 |
| Interpersonal communication | 0 for Did not hear about Vitamin A campaign from Lady Health Worker | 64.2 | 71.7 |
| | 1 for Heard about Vitamin A campaign from Lady Health Worker | 35.8 | 64.2 |
| **Socio-economic covariates** | | | |
| House ownership | 0 for Tenant | 24.3 | 21.4 |
| | 1 for Owner | 75.7 | 78.6 |
| Possession of selected household assets | 0 for does not possess an AC | 89.6 | 93.0 |
| | 1 for possesses an AC | 10.4 | 7.0 |
| | 0 for does not possess a TV | 19.3 | 28.7 |
| | 1 for possesses a TV | 80.7 | 71.3 |
| | 0 for does not possess a Radio | 60.1 | 82.5 |
| | 1 for possesses a Radio | 39.9 | 17.5 |
| | 0 for does not possess a refrigerator | 47.6 | 52.0 |
| | 1 for possesses a refrigerator | 52.4 | 48.0 |
| | 0 for does not possess a gas stove | 49.5 | 44.9 |
| | 1 for possesses a gas stove | 50.5 | 55.1 |
| | 0 for does not possess a washing Machine | 33.7 | 36.7 |
| | 1 for possesses a washing machine | 66.3 | 63.3 |
| Dependent variable | 0 for non-receipt of Vitamin A | 4.2 | 11.3 |
| | 1 for receipt of Vitamin A | 95.8 | 88.7 |

[ref]Refers to reference category.

**Table 3: Receipt and non-receipt of vitamin A by socio-demographic variables in intensive monitoring and other districts of Pakistan, end-line survey, 2012.**

| Predictors used in the model | Definition of categories | Intensive monitoring districts | | Other districts | |
|---|---|---|---|---|---|
| | | Non-Receipt of Vitamin A (%) | Receipt of Vitamin A (%) | Non-Receipt of Vitamin A (%) | Receipt of Vitamin A (%) |
| **N** | | 20 | 461 | 237 | 1862 |
| **Place of residence** | 0 for Rural | 2.9 | 97.1 | 13.3 | 86.7 |
| | 1 for Urban | 6.0 | 94.0 n.s. | 9.0 | 91.0* |
| **Education of the Father** | 0 for Illiterate | 1.8 | 98.2 | 12.4 | 87.6 |
| | 1 for Primary | 11.4 | 88.6 | 7.6 | 92.4 |
| | 2 for Middle | 2.5 | 97.5 | 13.3 | 86.7 |
| | 3 for Secondary | 5.2 | 94.8 | 10.3 | 89.7 |
| | 4 for Higher Secondary | 4.2 | 95.8 | 10.5 | 89.5 |
| | 5 for College and University Education | 8.6 | 91.4 n.s. | 9.4 | 90.6 n.s. |
| **Education of the Mother** | 0 for Illiterate | 3.6 | 96.4 | 12.3 | 87.7 |
| | 1 for Primary | 2.9 | 97.1 | 9.5 | 90.5 |
| | 2 for Middle | 10.0 | 90.0 | 9.9 | 90.1 |
| | 3 for Secondary | 6.7 | 93.3 | 10.0 | 90.0 |
| | 4 for Higher Secondary | 0.0 | 100.0 | 11.3 | 88.7 |
| | 5 for College and University Education | 5.6 | 94.4 n.s. | 7.8 | 92.2 n.s. |
| **Communication exposure** | | | | | |
| Mass media | 0 for Did not hear about Vitamin A campaign on TV | 3.8 | 96.2 | 12.7 | 87.3 |
| | 1 for Heard about Vitamin A campaign on TV | 5.2 | 94.8 n.s. | 4.9 | 95.1** |
| Interpersonal communication | 0 for Did not hear about Vitamin A campaign from Lady Health Worker | 6.5 | 93.5 | 14.3 | 85.7 |
| | 1 for Heard about Vitamin A campaign from Lady Health Worker | 0.0 | 100.0** | 3.7 | 96.3** |
| **Socio-economic covariates** | | | | | |
| House ownership | 0 for Tenant | 6.8 | 93.2 | 12.9 | 87.1 |
| | 1 for Owner | 3.3 | 96.7 n.s. | 10.9 | 89.1 n.s. |
| Possession of selected household assets | 0 for Does not possess an air conditioner | 4.2 | 95.8 | 11.4 | 88.6 |
| | 1 for Possesses an Air conditioner | 4.0 | 96.0 n.s. | 9.5 | 90.5 n.s. |
| | 0 for Does not possess a TV | 3.2 | 96.8 | 15.1 | 84.9 |
| | 1 for Possesses a TV | 4.4 | 95.8 n.s. | 9.8 | 90.2* |
| | 0 for Does not possess a Radio | 4.2 | 95.8 | 12.5 | 87.5 |
| | 1 for Possesses a Radio | 4.2 | 95.8 n.s. | 5.4 | 94.6* |
| | 0 for Does not possess a refrigerator | 3.9 | 96.1 | 12.7 | 87.3 |
| | 1 for Possesses a refrigerator | 4.4 | 95.6 n.s. | 9.7 | 90.3* |
| | 0 for Does not possess a gas stove | 3.8 | 96.2 | 15.8 | 84.2 |
| | 1 for Possesses a gas stove | 4.5 | 95.5 n.s. | 7.6 | 92.4** |
| | 0 for Does not possess a washing Machine | 4.3 | 95.7 | 12.5 | 87.5 |
| | 1 for Possesses a washing machine | 4.1 | 95.9 n.s. | 10.6 | 89.4 n.s. |

*p<0.05: Statistically Significant at 5% level **p<0.01: Statistically Significant at 1% level, n.s.: Not significant.; [ref] Refers to Reference Category.

**Table 4: Adjusted odds ratios (AOR) from the multivariate binary logistic regression analysis of receipt of vitamin A in selected districts of selected provinces in Pakistan, Vitamin A end-line survey, 2012. Dependent variable: receipt of Vitamin A.**

| Covariates | AOR (95% CI: LL, UL) |
|---|---|
| **Communication exposure** | |
| **Mass communication** | |
| Did not watch about Vitamin A campaign on Television[Ref] | 1.000 |
| Watched about vitamin A campaign on Television | 3.321**( 95% CI: 2.119, 5.207) |
| **Interpersonal communication** | |
| Did not hear about vitamin A campaign from Lady Health Worker[Ref] | 1.000 |
| Heard about Vitamin A campaign from Lady Health Worker | 6.334** (95% CI: 4.006, 10.013) |
| **Intensive program monitoring strategy** | |
| Other districts[Ref] | 1.000 |
| Intensive monitoring districts | 2.453** (95% CI: 1.509, 3.987) |

Adjusted for place of residence (rural and urban), father's and mother's education, house ownership, possession of selected household assets; CI: Confidence Interval; *p<0.05: Statistically Significant at 5% level **: p<0.01: Statistically Significant at 1% level, n.s.: Not significant. LL: Lower limit of the 95% CI; UL: Upper Limit of the 95% CI; [ref]refers to reference category.

Multivariate binary logistic regression analyses was performed to determine the factors influencing receipt and coverage of vitamin A. these were was carried out with receipt of vitamin A as the dependent or outcome variable. The independent covariates were; the respondent's place of residence, father's and mother's education, house ownership, possession of household assets and exposure to communication messages on vitamin A. The overall model explained 14.6 percent of the variance in the dependent variable. It revealed that the independent covariates, which were found to be significant are mass media channel of television, interpersonal communication by the Lady health worker after controlling and adjusting for the background characteristics of their place of residence (rural and urban), father's and mother's education, house ownership and possession of household assets like; AC, television, radio, refrigerator, gas stove and washing machine. The likelihood of receipt of Vitamin A increased with interpersonal and mass media communication. Those who had been exposed to the vitamin A campaign through TV are 3.321 times more likely to receive vitamin A compared to the reference category of those who had not seen it on TV. It was significant at five per cent level of significance. It was observed that after adjusting for background socio-economic covariates, interpersonal communication [6.334 (95% CI: 4.006-10.013), p<0.01] and intensive monitoring strategies [2.453 (95% CI: 1.509-3.987), p<0.01] were found to be significant predictors of the receipt of Vitamin A. Those who had heard about it from the lady health workers were more than six times more likely to receive vitamin A compared to their reference counterpart. It was also observed that after controlling for all these variables, those who hailed from the intensive monitoring districts were two times more likely to receive vitamin A supplementation compared to the other districts.

## DISCUSSION

In Pakistan as well, vitamin A is administered twice a year with six months interval along with the poliomyelitis eradication campaigns through the EPI Program. This paper documents a vitamin A supplementation program by Nutrition International, (previously known as Micronutrient Initiative), a leading organization working exclusively to eliminate vitamin and mineral deficiencies in the world's most vulnerable populations, which supports the government of Pakistan in Pakistan to improve the coverage of vitamin A in the low coverage districts in selected provinces. Overall, there was a remarkable improvement in the coverage of Vitamin A in the end-line over the baseline in all the study areas. It was found to be higher in the intensive monitoring districts compared to the other districts. The interpersonal communication by lady health workers (LHWs), exposure to media along with the intensive monitoring strategy was found to be statistically significant predictors of vitamin A coverage.

## CONCLUSION

The multivariate regression analyses revealed that exposure to television and interpersonal communication by the lady health worker and intensive program monitoring strategy are important factors determining and predicting the receipt of vitamin A among children 6-59 months of age. Controlling for all other relevant factors, it was observed that the intensive program monitoring strategy and interpersonal counselling and communication was found to be significantly associated with the coverage of vitamin A.

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