Primary Care Based Interventions are associated with Improvement in Nutritional Status of Children: Evidence from Community Based Study in India

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Abstract- Health is basic requirement of any society to develop and progress. Nutrition has major effects on health. Nutrition refers to the availability of energy and nutrients to the body's cells in relation to body requirements. Growth and development of any country is reflected by the growth and development of its children. The present community based interventional study was carried to assess impact of health interventions in the form of health and nutritional education on nutritional status of malnourished children. It was conducted during January 2010 to December 2010 at urban slum of Cheetah Community, Mumbai, India. Total of 190 children registered under six Anganwadis were included. The information was gathered by personal interview of mothers using semi-structured questionnaires. Out of 190 children 102 were malnourished which later divided into study/intervention (50 children) and control group (52 children). Health interventions were given only to intervention group for six months. Significant difference was seen between the weight gains by both groups. Similarly, significant improvement in mothers' knowledge about nutrition was seen after six months of intervention. Thus it was evident from the study that health and nutritional education should be considered as major interventions to reduce the problem of malnutrition.

Index Terms- Health education, Malnutrition, Nutritional education, Urban slum

I. INTRODUCTION

Malnutrition is the major problem in developing countries especially in underserved areas such as urban slums. Most slum dwellers in India belong to the category of permanent necessitation, which are forced to live in the existing eco-cultured situations on account of poverty and social discard. Being the most vulnerable segment of the community the preschoolers (1-6 years) are at the greatest risk of malnutrition because of their growing period that demands high intake of protein and calories.[1]

Surveys carried out in different parts of India show that the diet and nutrition of a large majority of the people are inadequate in several aspects. Consequently, varying types of nutritional deficiencies result. Today malnutrition is the most debilitating health problem affecting millions of children. Malnutrition is not a pathological condition due to the deficiency of a single nutrient or calories, but a consequence of several interacting factors.[2]

Malnutrition is usually the result of a combination of inadequate dietary intake and infection. In children, malnutrition is synonymous with growth failure. Malnourished children are shorter and lighter than they should be for their age. To get a measure of malnutrition in a population, young children can be weighed and measured and the results compared to those of a 'reference population' known to have grown well.[3]

Globally, malnutrition has been responsible, directly or indirectly, for 60.0% of the 10.9 million deaths annually among under-five children. Well over two-thirds of these deaths, which are often associated with inappropriate feeding practices, occur during the first year of life. No more than 35.0% of infants worldwide are exclusively breastfed during the first four months of life; complementary feeding frequently begins too early or too late, and foods are often nutritionally inadequate and unsafe. Malnourished children who survive are more frequently sick and suffer the life-long consequences of impaired development (WHO, 2003).[4]

Malnutrition is more common in India than in Sub-Saharan Africa. One in every three malnourished children in the world lives in India.[4] The prevalence of child malnutrition in India is among the highest in the world, nearly double that of Sub-Saharan Africa, with the dire consequences of morbidity, mortality, productivity, and thereby the economic growth. Decline in child malnutrition over the last 15 years has been very slow; from 51.1 % in 1992-93 (National Family Health survey - NFHS I) to 47 % in 1998-99 (NFHS II) to 45.9 % in 2005-06 (NFHS III). What is worse is that child malnutrition has gone up to 50 % in 2007-08. Also, inequities in undernutrition do exist between demographic, socioeconomic and geographic groups in India, as can be seen from NFHS I, II, and III data. It may not be possible for India to achieve the nutrition Millenium Development Goal (MDG) by 2015 in spite of economic growth, unless urgent measures are taken for more and better investments in child development. Population is increasing by over 16 million every year and hence the number of malnourished children is actually increasing. This is a matter for serious national concern. Although preventing malnutrition needs to be the focus of our policy and program action, we have many children currently suffering from severe acute malnutrition.[5]

II. MATERIALS AND METHODOLOGY

The present study was a community based interventional study carried out during January 2010 to December 2010 in of Cheetah Camp urban slum. Community of Cheeta camp is situated in the peripheral part of Eastern Mumbai coming under M/East Ward of Mumbai Municipal Corporation. The population of Cheeta camp is approximately 87000 (Census 2001) and comprises of migrant people from Uttar Pradesh, Bihar, Tamilnadu, Kerala, Maharashtra, Bengal and Andhra Pradesh The whole area is divided in to 11 sectors and. There were around 9300 (Census 2001) children aged less than 5 years. It is the field practice area under the Department of Preventive and Social Medicine, of TN medical college which provide preventive, promotive, curative and rehabilitative health care services to the community in coordination with the Urban Health Centre, Health Post, and Municipal Dispensary under M/East Ward of Brihanmumbai Municipal Corporation.

The Anganwadi centre was considered as a sampling unit. There were total 57 Anganwadi at Cheetah camp. Out of these, 10 percent Anganwadis (i.e. 6 Anganwadis) were selected by using simple random sampling method. All the children aged 1-3 years registered in these Anganwadi were included in the study. Children having Grade IV malnutrition according to Indian academy of Paediatrics (IAP) were excluded from the study. As per the record of the selected Anganwadis and the distribution of children according to their nutritional status is as follows:

Sr. no	Sector and Anganwadi (AW) no.	Children between 1yr to 3 yr age group	Grades of malnutrition (A/c to IAP classification)				
			Normal	1	2	3	4
1	F, AW No. 20	24	15	7	2	0	0
2	A, AW No. 35	30	17	8	5	0	0
3	B, AW No. 22	31	11	8	9	3	0
4	J, AW No. 3	36	19	9	7	1	0
5	D, AW No.49	31	10	9	10	2	0
6	E, AW No. 61	39	16	12	8	3	0
Total		191	88	53	41	9	0

Out of these 103 malnourished children 1 child was untraceable. These 102 Malnourished children were divided into intervention/study group and control group (3 Anganwadis in each group). Baseline data collected for both intervention group (50 children) and control group (52 children). Health measures like complete immunization, treatment of acute ailments, Vitamin A supplementation and de-worming were given to both groups. In addition to these health measures, health interventions such as one to one health education sessions (total 6 sessions) to every mother for six months and focus group discussion (FGD) one per two months for six months (total 3 FGDs) were given only to Intervention group. Post intervention data collected after 6 months from baseline data collection. There were loss of 2 children from intervention group and 3 children from control group. Study was implemented in six phases:

2.1 Preparatory Phase
2.1.1 Administrative approvals

The necessary approvals were obtained from the following authorities to carry out the study.

The Dean of TN Medical College, Mumbai

Ethics committee of TN Medical College, Mumbai

Professor and Head, Department of Preventive and Social Medicine, TN Medical College, Mumbai

In Charge of Urban Health Center, Cheeta Camp, Mumbai

2.1.2 Constructing tools for data collection

Data collection tools were prepared (i.e. consent forms and preformed, pretested, semi-structured, open-ended questionnaires). To reduce bias, the information was collected maintaining utmost privacy as per the convenience of the respondents. Time required to complete one interview was 30 minutes.

2.1.3 Pilot study

Initially a pilot study was conducted, which helped to test and restructure the instrument required for the actual study.

2.2 Phase of baseline data collection

Total 6 Anganwadis were selected by using simple random sampling method. Inclusion and exclusion criteria were pre-determined and each participant was chosen keeping them in mind. Home visits were done to interview the mother of the children to know sanitary practices followed in the family.

Initially informed consent was obtained from study participants. Nutritional status among 1-3 years old children was assessed by computing weight for age and grading the children using the IAP classification. Association of nutritional status with gender, maternal education, father's occupation and birth order was determined. Dietary intake of protein and calories for 1-3 year old children was determined using the 24-hour dietary recall method from the child's mother at her home. Two more visits were paid by the investigators to the home of the child if the mother was not available during the first visit. Child was considered non traceable if the mother was not available for interview at home even on the third visit. Apart from dietary history, mothers were interviewed for breast feeding, complementary feeding practices. Medical examination and anthropometric measurements of the children were taken at Anganwadi. The grade of malnutrition was decided by using WHO growth standards and IAP grade of malnutrition.

These children were followed up every month for next 6 months. On each visit child's health assessment was done by clinical examination. At the end of 6 month again anthropometric measurements were taken to measure the outcome.

Standard of Sanitation according to Briscoe's Scale [6]

Behaviour		Points		
		3	2	1
Water	Drinking	tube well/tap	ring well	pond
	Washing	tube well/tap	ring well	pond
	Bathing	tube well/tap	ring well	pond
Defecation Children < 5 years		Latrine/ disposed off	open within compound	Anywhere
Hand washing by mother before eating /handling food		Yes	occasional	No
Hand washing by mother after defecation		Yes with soap	Yes with sand or ash	Yes with water
Appearance of mothers hands and cloth		Clean	one clean	unclean
Drinking water storage		direct use	clean, covered	Unclean, uncovered
Water for washing		direct use	clean, covered	Unclean, uncovered

Maximum score to be achieved was 21, which was grouped as

- 7-12 : Poor
- 13-17 : Fair
- 18-21 : Good

Assessment of Knowledge of mother about child's nutrition

The nutrition knowledge of mothers was evaluated. Each mother was asked a set of four questions about nutrition. The aspects of nutrition knowledge studied were: age for introducing weaning foods into a child's diet; diet during diarrhea; preparation of oral rehydration solution (ORS); growth-chart interpretation. A score of 2 was given for each valid answer. A mother's overall knowledge of nutrition was rated on a scale of 0 to 8 by calculating the total of all the valid responses she made.

Mother's responses were considered valid if she provided the following information: Soft and semisolid foods (weaning food) should be introduced to children after completion age six months or less. A child should be given as same or more food during diarrhoeal episodes as when the child is not ill. Diarrhoea should be managed by giving ORS or fluids to the affected child. ORS should be made with three standard tablespoons of sugar and one-half standard teaspoon of salt per liter of water or by dissolve one ORS packet in one liter of boiled and cooled water.

Three growth charts were shown to the mothers. One chart showed weight gain every month (normal growth); the second showed no weight gain for six months (growth faltering); and the third showed continuous loss of weight (grade IV malnutrition). A mother's response was considered valid if she could interpret three charts correctly. If a mother had more than one child in this age group, questions concerning her nutrition knowledge were asked with reference to the youngest child.

Scoring for Knowledge of mother regarding nutrition

1. Introduction of solid foods in diet: < 4 months (0 mark) / 4-6 months (0 mark)/ > 6months (2 marks)
2. Diet During diarrhoea: No or less food to be given (0 marks)/ same or more food is given (2 marks)
3. Preparation of ORS: not at all knows (0 mark) / partly correct (1 mark)/ correct (2 marks)

4. Growth chart interpretation: none Correct (0 marks)/ 1 correct   or 2 correct (1 mark)/ 3 correct (2 marks)

Questions	Points		
	Valid	Partially correct	Invalid
Introduction of solid food	2	0	0
Knowledge about preparation of ORS	2	1	0
Growth Chart interpretation	2	1	0
Diet during diarrhoea	2	0	0

Maximum score to be achieved was 8, which was grouped as
- 0-2 : Low
- 3-6 : Medium
- 7-8 : High

2.3 Phase of Interventions
For the intervention group health education was given in the form of
- One to one talks
- Explained with the help of audio-visual aids i.e. posters and flip chats
- Discussions with the mothers (Focus Group Discussion)
-

Health educator initially established a contact with the women individually at home and talked about causes, symptoms and prevention of childhood malnourishment. This group of mothers was educated on the problems due to malnutrition, the importance of immunization, good sanitary practices, and dietary modifications to improve nutritional status of child. Then mothers were motivated to participate in group discussion (GD's) sessions to be conducted in their locality. The purpose and importance of the group discussion (GD's) activity was explained to them. On a fixed day of the week, a lecture cum discussion session was organized for these mothers in groups comprising of 6-8 women at a time. A total of 3 sessions were organized to cover all aspects of malnutrition. Flip charts were used to demonstrate the dietary modification.

Follow up visits were done every month for a period of six months for both the groups. During each follow up visit health assessment of child was done. Morbidity, such as gastrointestinal and respiratory infections were identified and treated accordingly. Immunization of children was advised, in order to improve their immunization status. Vitamin A is administered as per Expanded program of Immunisation.

Interventions given
- Health education and nutritional education were given individually to mothers to improve their knowledge regarding infant feeding, in order to improve their babies' weights.
- Mothers were also given health education and nutritional education, in groups.
- Special attention was given to grade 3 babies, in order to improve their grade of malnutrition.
- Mothers were trained to make homemade ORS solution, if the ORS packets were not available.
- Mothers were convinced for regular visits to growth and development clinic.
- The babies were referred for pediatricians' opinions, whenever necessary

All these interventions were not applicable to control group.

2.4 Phase of data analysis
The comparison of Quantitative variables between and within the groups was done using student's t-test, while the Qualitative data was compared using chi-square test. The median values of mothers' nutritional scores within the two groups and between them was compared using Wilcoxon Signed Rank test. The confidence limit for significance was fixed at 95% level with p-value < 0.05

2.5 Phase of interpretation and discussion
The findings of the present study were compared and discussed with other relevant studies done before and finally conclusion & recommendations were drawn as feasible

2.6 Phase of documentation
The analysed data was compared with various studies done previously and is presented in the form of tables and is documented.

IAP classification for malnutrition [7]

Nutritional Status	% of Standard weight for age (W/A)
Normal	More than 80% of (W/A)
Grade I	71 to 80% of (W/A)
Grade II	61 to 70% of (W/A)
Grade III	51 to 60% of (W/A)
Grade IV	Less than 50% of (W/A)

WHO classification for malnutrition[7]

	Normal	Moderate Undernutrition	Severe Undernutrition
Weight for height (W/H)	Standard deviation up to 2 of expected W/H; (i.e. > 79% of expected W/H)	Standard deviation score between 2 to 3 of expected W/H; (i.e.70-79% of expected W/H) - Wasting	Standard deviation score below 3 of expected W/H; (i.e. < 70% of expected W/H) - Severe wasting
Height for age (H/A)	Standard deviation up to 2 of expected H/A (i.e. > 89% of expected W/H)	Standard deviation score between 2 to 3 of expected H/A; (i.e. 85- 89% of expected W/H) - Stunting	Standard deviation score below 3 of expected H/A; (i.e. < 85% of expected H/A) – Severe Stunting

III. RESULTS

Total 190 children were included in this study. Table 1 shows, 97 (51.05%) were male children and 93 (48.9%) children were in the age group of 12-23 months. Out of 190 children, 130 (68.42%) were Muslims and 89 (46.84%) children belonged to nuclear family. According to Modified Prasad classification 104 (54.74%) children were from socio-economic class II & III, 78 (41.05%) mothers had completed their education up to secondary level, while 4 (2.11%) fathers were found illiterate as compared to mothers 13 (6.18%). 57 (30%) fathers completed education more than S.S.C. compared to mothers 34 (17.89%). Table 2 shows nutritional status of children. Table 3 reveals significant association of mother's knowledge about nutrition and nutritional status of children. Tables 4, 5 and 6 show initially there was no significant difference between weights of intervention and control groups; but after six months of health intervention significant difference noted between these two groups in terms of weight gain. Similarly, health intervention has shown significant effect on mother's knowledge regarding nutrition (Table 7).

Table 1: Socio-demographic Profile

Socio demographic profile		Male (n-97)	Female (n-93)	Total
Children's Age group	12-23 months	51(52.6%)	42 (45.2%)	93 (48.9%)
	23-35 months	46 (47.4%)	51 (54.8%)	97 (51.1%)
Religion	Muslim	70 (72.2%)	60 (64.5%)	130 (68.4%)
	Hindu	27 (27.8%)	32 (34.4%)	59(31.1%)
	Other	0.00 (0%)	1 (1.1%)	1(0.5%)
Type of	Nuclear	39 (40.2%)	50 (53.8%)	89 (46.8%)

family	Joint	10 (10.3%)	9 (9.7%)	19 (10%)
	Three generation	48 (49.5%)	34 (36.6%)	82 (43.2%)
Socio-economic Class	I Upper	6 (6.2%)	6 (6.4%)	12 (6.3%)
	II Upper Middle	40 (41.2%)	34 (36.6%)	74 (38.9%)
	III Lower Middle	39 (40.2%)	43 (46.2%)	82 (43.2%)
	IV Upper Lower	12 (12.4%)	10 (10.8%)	22 (11.6%)
	V Lower	0 (0%)	0 (0%)	0 (0%)
Mother's Education	Illiterate	7 (7.2%)	6 (6.2%)	13 (6.8%)
	Primary	33 (34%)	32 (34.4%)	65 (34.2%)
	Secondary	38 (39.2%)	40 (43%)	78 (41.1%)
	>S.S.C.	19 (19.6%)	15 (16.1%)	34 (17.9%)
Father's Education	Illiterate	3 (3.1%)	1 (1.1%)	4 (2.1%)
	Primary	27 (27.8%)	31 (33.3%)	58 (30.5%)
	Secondary	34 (35.1%)	37 (39.8%)	71 (37.4%)
	>S.S.C.	33 (34%)	24 (25.8%)	57 (30%)
Total		97 (51.1%)	93 (48.9%)	190 (100%)

Table 2: Indices of Nutritional Status

Indices	Normal	Malnourished
Weight for Age (W/A) [A/c to IAP classification]	88 (47.4%)	102 (52.6%)
Height for Age (H/A) [A/c to WHO classification]	107 (56.3%)	83 (43.7%)
Weight for Height (W/H) [A/c WHO classification]	156 (82.1%)	34 (17.9%)

Table 3: Mother's Knowledge Vs Malnutrition

Mother's Knowledge		Normal	Malnutrition (A/c IAP classification)			Association
			Grade I	Grade II	Grade III	
About growth chart interpretation	None correct	28 (29.5%)	31 (32.6%)	28(29.5%)	8 (8.4%)	p value < 0.01; Significant
	1 correct	32 (56.1%)	16 (28.1%)	9 (15.8%)	0 (0%)	
	2 correct	16 (66.7%)	3 (12.5%)	4 (16.6%)	1 (4.2%)	
	3 correct	12 (85.7%)	2 (14.3%)	0 (0%)	0 (0%)	
Diet in Diarrhoea	Valid	54 (52.4%)	30 (29.1%)	14 (14.6%)	4 (3.9%)	p value- 0.06; Non-significant
	Invalid	34 (39.1%)	22 (25.3%)	26 (29.9%)	5 (5.7%)	
ORS preparation	Invalid	19 (25%)	22 (28.9%)	27 (35.5%)	8 (10.5%)	p value < 0.01; Significant
	Partially correct	41 (55.4%)	22 (29.7%)	11(14.9%)	0 (0%)	
	Valid	28 (70%)	8 (20%)	3 (7.5%)	1 (2.5%)	
Weaning food	Valid	64 (54.7%)	28 (23.9%)	23 (19.7%)	2 (1.7%)	p value < 0.01; Significant
	Invalid	24 (32.9%)	24 (32.9%)	18 (24.6%)	7 (9.6%)	
Mother Knowledge Score	Low	14(24.6%)	18 (31.6%)	20 (35.1%)	5 (8.7%)	p value < 0.01; Significant Association
	Medium	53 (51.5%)	28 (27.2%)	19 (18.4%)	3 (2.9%)	
	High	21 (70%)	6 (20%)	2 (6.7%)	1 (3.3%)	

Table 4: Baseline weight for intervention and control group

Baseline weight	n	Mean (kg)	Standard error	unpaired t value	p value	Association
Intervention group	50	8.53	0.123	0.23	0.759	Not significant
Control group	52	8.59	0.195			
Intervention Group (females)	27	8.43	0.169	0.61	0.546	Not significant

Control Group (females)	27	8.63	0.275			
Intervention Group (males)	23	8.65	0.181	0.32	0.754	Not significant
Control Group (males)	25	8.54	0.282			

Table 5: Weight gain by intervention group children after intervention

		Mean weight	Standard Deviation (SD)	Paired t test (Two tailed)
Intervention group (n-48)	Pre-intervention	8.49 kg	0.86	t value- 27.4; p value < 0.001; Significant Difference
	Post-intervention	9.96 kg	0.9	
Control Group (n-49)	Pre-intervention	8.56 kg	1.3	t value- 30.3; p value < 0.001; Significant Difference
	Post-intervention	9.76 kg	1.3	

Table 6: Weight gain by children after intervention in both groups

Weight gain	n	Mean weight gain (kg)	Standard error (S.E.)	Unpaired t- test
Intervention group	48	1.47	0.054	t value- 4.05; p value < 0.01; Significant Difference
Control group	49	1.2	0.04	

Table 7: Effect of intervention on mother's knowledge about child's nutrition

		Mean	SD	Percentile			Wilcoxan signed Ranked test	Association
				25th	50th	75th		
Intervention group	Pre-intervention	3.83	1.74	2	4	5	4.81	p-value < 0.01; Significant Difference
	Post-intervention	5.1	1.15	4	5	5.75		
Control group	Pre-intervention	3.53	2.15	2	3	5.5	1.49	p-value = 0.136; Non-significant Difference
	Post-intervention	3.84	1.8	2	4	6		

IV. DISCUSSION

The present community based interventional study was carried out during the period of Jan 2010 to December 2010, by selecting 6 Anganwadis where we have found 102 (52.63%) undernourished children. Whereas 83 (43.68%) children were stunted and 34 (17.89%) children were wasted. Similar findings were found by Kumar et al.[8] According to NFHS III [9] in urban slum of Mumbai in the age group of 12 months 35 months, there were 35.26% undernourished children, 51.92% were stunted and 14.16% were wasted .

In this study according to IAP grades of nutritional status 88 (46.32%) children were normal, while 52(27.37%) were in Grade I of malnutrition, 41 (21.58%) in Grade II and 9 (4.74%) children were in grade III malnutrition. Similar findings were noted by Verma et al.[10], Chakraborty et al.[11], Mittal et al.[12] and Harishankar et al.[13]

This study revealed that 48 (51.61%) children from the age group 12 months to 23 months were malnourished while 54 (55.61%) children belonging from age group 24 to 35 months were malnourished. Whereas Mittal et al.[12] found 66 (40.74%) children from the age group 12 to 23 months were malnourished; while 49(40.16%) children from the age group 24 to 35 months were malnourished. Similarly Harishankar et al [13] found

33(32.1%) children in the age group of 12-23 months age group were malnourished while 23(21.7%) children in the age group of 24-35 months were malnourished. Mahajan et al.[14] noted more prevalence of malnutrition between one to three year age group compare to below one year age group.

In this study no significant association was seen between sex of the children and their nutritional status, though percentage of malnutrition was more in female children compare to male children. In contrast to this study, Kumar et al.[8], Chakraborty et al.[11] and Prinja et al.[15] found more percentage of malnutrition among male children. Whereas Mahajan et al[14] found more percentage of malnutrition among female children as compare to male children.

In this study we found that poor the social class more the chances of child being malnourished. Out of 22 children from class IV socioeconomic class 19 (86.36%) were detected malnourished compared to 4 (33.33%) of class I. Significant association was seen between nutritional status and socioeconomic status of the family. Similar was the finding of study conducted by Mahajan et al.[14] and Avachat et al.[16]

Present study revealed that as the educational level of mother increased, improvement in nutritional status of the child was seen. 11(84.62%) children were malnourished whose mothers were illiterate as compared to 4 (12.12%) whose mother

completed 10 or more years of education. The association between education of mother & children' nutritional status was found to be statistically significant. Similar finding was noted by Verma et al.[10] Chakraborty et al.[11] Mittal et al.[12] Harishankar et al.[13] and Mahajan et al.[14]

In this study significant association was seen between mother's knowledge about child's nutrition and their ability to interpret a growth chart correctly with nutritional status of children. But no significant relationship was seen between mother's knowledge about diet during diarrhoea and nutritional status of children. These findings were similar to findings of Abbi et al.[17]

Overall statistically significant association was seen between score of mother's knowledge about child's nutrition and nutritional status of children. This finding was different from the finding of Lakshmi et al.[18] They found no significant relationship between mother's knowledge score and nutritional status of children.

After six month of intervention more weight gain was seen in intervention group compared to control group. The difference was statistically significant. Mean weight gain by intervention group was 1.47 kg compare to control group (i.e.1.2 kg). This finding was similar to study conducted by De Silva et al.[19] and Banerjee et al. [20] They also noted more weight gain among intervention group compared to control group.

V.   CONCLUSION AND RECOMMENDATION

Improvement in nutritional status of malnourished children was seen after six months of health intervention, therefore health and nutritional education should be considered as major interventions to reduce the problem of PEM. Use of non expensive, culturally acceptable nutritious recipes should be promoted and demonstrated. With the help of social worker, health volunteers and community health workers regular health education programmes should be conducted in the community.

Appropriate dietary modifications should be done to ensure increased calorie & protein intake as per the recommendations. Growth monitoring should be made compulsory for all under five children and mothers should be taught the importance of regular weight checkups and early treatment of sick children to avoid the vicious cycle of infection –malnutrition –infection.

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