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The status of infant health in India

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ABSTRACT

This paper investigates the present status of infant health in India through percentages of infants who are undernourished, not immunized or diseased and finds its relationship with socio-demographic variables. The relevant data have been obtained from the Third National Family Health Survey which was carried out in 2005-2006 in India. The sample consists of 7562 infants (*i.e.*, children of less than 1 year). For socio-demographic data, places of residence, sex of infants, ethnic composition, religion and wealth index were considered. Considering the different types of under-nutrition, it has been found from our data that the percentages of undernourished infants range from 22 to 28 only. There are considerable variations in the different types of immunization status ranging from 17.9% opting for measles vaccination to 73.2% taking BCG vaccination. Prevalence of morbidity also varies from 15 to 22 percent depending on the three types of morbidity considered in this paper. Among the socio-economic variables, mother's education and wealth index have been found to have profound effect on the nutritional status and also on morbidity of infants but there is no impact found on the status immunization. Thus it gives clear cut indications for the government and NGOs to take actions to ameliorate poverty and to improve the level of education, especially of female population in India.

Keywords: Height-for-Age; Weight-for-Height; Weight for Age; Morbidity; Immunization Status; Infants; India

1. INTRODUCTION

India is home to the largest number of undernourished children. Globally, the status of under-nutrition is improving over time; still, India contributes to the largest number of underweight children in the world. Physical growth and malnutrition situation are the comprehensive reflections of child nutritional status. The main indicator of malnutrition among children is the protein-energy malnutrition and this is usually reflected by the anthropometric measures of relative values of height, weight and age of children. Underweight, wasting and stunting of children can be measured through weight-for-age, weight-for-height and height-for-age respectively. Under weight and wasting are the effects of acute deficiency and stunting is the result of chronic deficiency. Growth during infancy depends on children's duration of breast-feeding and their birth weight. Data from last five decades prove that exclusive breast-feeding first six months is most effective for normal growth of babies. However, exclusive breastfeeding beyond six months should not be practiced as it causes poor growth among infants. Infants are likely to suffer from various types of morbidity if they are not brought up in a hygienic condition and semi-solid food is not introduced from six months onwards. Malnutrition has also been seen to cause morbidity among children in developing countries [1-6].

In India, Universal Immunization Programme (UIP) for six vaccine-preventable diseases (Tuberculosis, Diaptheria, Whooping Cough, Tetanus, Polio and Measles) are launched in 1985 with the objective of reducing morbidity, mortality and disabilities among the children. This programme envisaged immunization to all eligible children by 1990. Immunization was chosen as the most effective way to tackle disease because measles in a healthy child is not very serious but mortality due to measles is 400 times greater in an undernourished population. Similarly, if an adequate drinking water is made available, poliomyelitis will cease to be a problem and it inhibits morbidity.

From many studies, it becomes clear that a number of factors affect the child nutrition either directly or indirectly. These factors are food availability, dietary intake, breast-feeding, prevalence of infectious and parasitic disease, water supply and sanitation, socio-economic status. Several studies also show that repeated episodes of infectious diseases adversely affect children nutri-

tional status [7,8]. Thus, the objectives of the present study are 1) to assess the status of infant health through three dimensions of health namely nutritional, morbidity and immunization and 2) to find the most effective socio-economic factors towards prevention of malnutrition, morbidity and lack of immunization of infants.

2. METHODOLOGY

The data on growth and nutritional status of children was accessed from the third round National Family Health Survey (NFHS-3) of 2005-2006. The survey was coordinated by International Institute for Population Sciences (IIPS) [9] in collaboration with the Ministry of Health and Family Welfare. Children of age 0 - 11 months (*i.e.*, less than one year as it is taken last birth day) are taken for our study. The sample sizes for India is 8225. For assessing the nutritional status, this survey collected data on weight and height of the infants as well as computed "Z" scores through weight for age, height for age and weight for height indices.

Z-score value "−2" was used as a cut-off point for prevalence estimation [10]. Z-score is defined as the deviation of the value observed for an individual from the median of the reference population, divided by the standard deviation (SD) of the reference population *i.e.*

$$\text{Z-score} = \frac{(\text{Observed value}) - (\text{Median of the ref. population})}{(\text{SD of the reference population})}$$

The classifications of Z-score (followed by NCHS/ WHO) are "below normal" (<−2), "normal" (2 to +2) and "above average" (>+2).

The infant is considered as fully vaccinated if the infant has taken one dose for BCG, three doses for DPT and Polio and single dose of measles before one year. Data on immunization status are verified from vaccination cards and in case, where a vaccination card was not available or a vaccination was not recorded on the card, the mother's recall of vaccination was accepted.

For assessing three morbidity statuses of infants like diarrhea, fever and cough, mother of infant was asked if the children was suffering from the disease during the two weeks preceding the survey by recall method. It should be noted that the morbidity data collected on the basis of mother's perceptions of illness without validation by medical personnel.

For socio-demographic data, places of residence are taken as "rural" and "urban". Sex of infants has also been considered. Ethnicity wise four groups have been taken namely Scheduled Castes, Scheduled Tribes, Other Backward Classes and "Others". Religions are grouped into four categories as Hindus, Muslims, Christians and "Others". Mother's educational status have four categories namely Illiterate (those who can neither read nor write), Primary (literate up to Class IV standard), Secondary (Class V to Class X standard) and Higher (*i.e.* Higher Secondary, Graduate or Post Graduate, etc.). Wealth index is a measure of the economic status of the household [11]. Though it is an indicator of the level of the wealth in the household, it is consistent with expenditure and income measure. It is based on 33 household assets and housing characteristics like household electrification, type of windows, sources of drinking water, types of toilet facility, flooring, roofing, cooking fuel and house ownership, material of exterior walls, number of household members per sleeping room, ownership of a bank or post-office account, ownership of a mattress, a pressure cooker, a chair, a cot/bed, a table, an electric fan, a radio/transistor, a black & white television, a colour television, a sewing machine, a mobile telephone, and any other telephone, a computer, a refrigerator, a watch or clock, a bicycle, a motorcycle or scooter, an animal-drawn cart, a car, a water pump, a thresher, and a tractor. Here each household was assigned a score for each asset and the scores were summed for each household and divided into five quintile groups starting from lower strata to higher strata like poorest, poorer, medium, richer and richest. These categories were however supplied along with the data.

To see the relative and effective intervention, the risk of Z-score value for under-nutrition, immunization status and morbidity were regressed on socio-economic variables using categorical logistic regression analysis. Dependent variables are taken as binary. Children whose Z-scores are below −2 are coded as "1" and those with Z-scores −2 or higher are coded as "0". For immunization status, not-immunized has taken as "1" and immunized is coded as "0". For morbidity status, morbidity was considered as "1" and others are coded as "0". An estimated odd ratio of "1" indicates that the nature of dependent variable is not different from the reference category. If the estimated odd ratio is >1, the probability of becoming affected is more in this category compared to the reference category and if it is <1, then it is just opposite to that of ">1" case.

3. RESULTS

Table 1 indicates that in India, according to third phase of national family health survey data, 27.8% infants are underweight, 22.5% are stunted and 26.7% are wasted. By gender differences, underweight boys are 28.0% while girls are 27.6%. 23.5% boys and 21.5% girls are stunted while 26.5% boys and 26.9% girls are wasted. Percentages of underweight and stunted infants have an increasing trend over ages in months, whereas percentage of wasted children has a decreasing trend.

Table 2 presents the non-immunization status of in-

Table 1. Percentages of under-weight, stunted and wasted infants by gender and age in months in India, 2005-2006.

Age in months	Nutritional status											
	Total				Boys				Girls			
	N	Under-weight	Stunted	Wasted	N	Under-weight	Stunted	Wasted	N	Under-weight	Stunted	Wasted
00	184	16.8	17.9	27.2	104	11.5	16.3	27.9	80	23.8	20.0	26.3
01	490	24.7	20.4	32.0	232	26.7	22.8	29.3	258	22.9	18.2	34.5
02	628	26.1	19.6	28.5	307	25.4	20.2	29.6	321	26.8	19.0	27.4
03	627	26.5	18.5	30.6	321	27.1	18.7	32.7	306	25.8	18.3	28.4
04	691	24.9	17.2	25.8	330	22.1	17.0	23.3	361	27.4	17.5	28.0
05	726	28.0	19.4	26.2	349	29.8	22.3	26.1	377	26.3	16.7	26.3
06	710	27.5	21.8	25.4	365	28.2	22.2	24.9	345	26.7	21.4	25.8
07	744	28.6	22.2	25.7	364	29.1	23.1	26.1	380	28.2	21.3	25.3
08	760	28.3	24.2	25.7	414	25.1	22.5	24.6	346	32.1	26.3	26.9
09	703	30.3	25.3	27.2	354	32.2	26.8	28.5	349	28.4	23.8	25.8
10	690	30.4	28.1	25.8	347	33.4	30.8	25.6	343	27.4	25.4	25.9
11	609	32.7	32.0	22.2	297	34.0	35.4	20.9	312	31.4	28.8	23.4
Total	7562	27.8	22.5	26.7	3784	28.0	23.5	26.5	3778	27.6	21.5	26.9

Source: NFHS-3, India.

Table 2. Percentages of non-immunized infants by gender and age in months in India, 2005-2006.

Age in months	Non-immunized status													
	Total					Boys					Girls			
	N	BCG	DPT3	Polio3	Measles	N	BCG	DPT3	Polio3	Measles	N	BCG	DPT3	Polio3	Measles
00	184	79.3	100.0	100.0	100.0	104	78.8	100.0	100.0	100.0	80	81.3	100.0	100.0	100.0
01	490	64.5	99.8	99.2	99.1	232	67.2	100.0	99.6	99.4	258	62.0	99.6	98.8	99.6
02	628	38.7	99.0	98.4	98.7	307	34.9	98.7	98.0	98.7	321	42.4	99.4	98.8	98.7
03	627	29.7	95.8	93.0	98.4	321	25.3	95.3	92.2	98.2	306	34.3	96.4	93.8	98.0
04	691	28.2	80.4	75.1	97.0	330	23.6	76.1	73.0	97.7	361	32.4	84.4	77.0	98.3
05	726	22.0	60.6	51.4	96.8	349	20.6	61.3	52.1	96.6	377	23.3	59.9	50.7	96.3
06	710	21.1	54.6	47.0	95.3	365	21.4	53.0	47.7	95.6	345	20.9	56.2	46.4	95.9
07	744	21.2	48.7	37.9	91.8	364	20.1	47.8	37.6	92.5	380	22.4	49.5	38.2	93.2
08	760	20.2	44.6	32.4	86.9	414	18.8	40.8	30.5	88.4	346	21.7	49.1	34.7	90.2
09	703	18.9	42.7	33.3	74.0	354	18.1	40.1	31.9	74.4	349	19.8	45.3	34.7	74.8
10	690	18.0	38.5	30.4	54.3	347	17.3	39.3	28.8	55.6	343	18.7	37.6	32.1	56.9
11	609	17.6	35.1	23.8	45.1	297	16.5	33.0	22.9	44.5	312	18.6	37.2	24.7	43.9
Total	7562	26.8	60.9	53.3	82.1	3784	26.6	60.4	52.5	81.7	3778	27.1	61.4	54.2	82.4

Source: NFHS-3, India.

fants of India by gender over ages. It is seen that among all infants, BCG was not taken by only 26.8% infants in India while most of infants have not taken measles (82.1%), DPT triple doses (60.9%) and Polio-triple doses (53.3%). When seen separately for boys and girls the picture is more or less same. As expected, in this case, the percentages of non-immunized infants decrease as age increases.

Table 3 describes the morbidity status of all infants as well as by each gender. It is seen that among Indian infants, 15.5% suffer from diarrhea, 17.3% from fever and 22.1% from cough. These percentages are 16.4, 18.9 and 23.4 respectively for boys and 14.6, 15.6 and 20.7 respectively for girls. The maximum occurrence of diarrhea is at the age of six month and afterwards it goes down. It may be due to introduction of rice or other semisolid food at this age. Occurrences of fever and cough are also high after six months of age. From six or seven months onwards, the infants are allowed to go out from home and face climatic changes. The situation is similar when taken separately for boys and girls.

Table 4 describes the zone- and state-wise distribu-

Table 3. Morbidity statuses of infants by gender and age in months in India, 2005-2006.

Age in months	Morbidity											
	Total				Boys				Girls			
	N	Diarrhea (recently)	Fever (Last 2 weeks)	Cough (Last 2 weeks)	N	Diarrhea (recently)	Fever (Last 2 weeks)	Cough (Last 2 weeks)	N	Diarrhea (recently)	Fever (Last 2 weeks)	Cough (Last 2 weeks)
	No.	(%)	(%)	(%)	No.	(%)	(%)	(%)	No.	(%)	(%)	(%)
00	184	6.0	3.3	4.9	104	8.7	2.9	4.8	80	2.5	3.8	5.0
01	490	6.7	8.6	12.7	232	7.3	9.5	14.7	258	6.2	7.8	10.9
02	628	12.3	9.4	18.2	307	12.1	10.1	18.2	321	12.5	8.7	18.1
03	627	12.6	13.4	20.1	321	15.6	13.4	21.8	306	9.5	13.4	18.4
04	691	14.2	15.6	22.6	330	17.9	17.9	23.9	361	10.8	13.6	21.3
05	726	14.0	15.7	20.4	349	14.6	17.5	23.5	377	13.5	14.1	17.5
06	710	20.0	19.3	25.4	365	20.5	19.7	26.3	345	19.4	18.8	24.3
07	744	18.3	22.7	26.5	364	19.5	26.6	28.3	380	17.1	18.9	24.7
08	760	17.5	20.5	23.2	414	20.3	24.2	26.1	346	14.2	16.2	19.7
09	703	19.8	20.9	25.9	354	18.9	20.9	26.6	349	20.6	20.9	25.2
10	690	16.7	22.0	25.4	347	17.0	22.5	23.6	343	16.3	21.6	27.2
11	609	17.4	21.5	23.5	297	14.1	25.3	25.6	312	20.5	17.9	21.5
Total	7562	15.5	17.3	22.1	3784	16.4	18.9	23.4	3778	14.6	15.6	20.7

Source: NFHS-3, India.

tion of nutritional status of infants in India. It is seen that in India, 27.8% infants are underweight, 22.5% are stunted and 26.7% are wasted though there is a great variation according to different zones and states in India. It is seen that in India lowest underweight, stunted and wasted infants are found in the north-east zone and highest percentage is found in the central zone. The state with the least percentage of underweight infants is Mizoram (7.3%), which is followed by Sikkim (7.6%), Manipur (11.0%), Kerala (11.5%) and Nagaland (13.9%). The states with less than 15% stunted infants are Manipur (11.9%), Kerala (12.8%) and Goa (14.5%). There are only two states with less than 15% wasted infants, namely Mizoram (11.0%) and Punjab (13.1%). High prevalent States (>35%) are Jharkhond (39.4%), Chhattisgarh (41.5%), Bihar (42.6%), and Madhya Pradesh, (45.5%) for underweight, only Chattisgarh (35.5%) for stunted and Jharkhond (36.7%), Bihar (37.2%) and Madhya Pradesh (43.6%) for wasted.

Table 5 describes the state- and zone-wise non-immunization status of infants in India. Only 26.8% of Indian infants have not taken BCG vaccine. In case of DPT, Polio and Measles, these percentages are alarmingly very high. The non-immunized percentages of infants are 60.9%, 53.4% and 82.2% respectively for DPT, Polio and Measles. Thus most of the infants are not immunized. The variation in the non-immunization status over zones is not expected to be much as each zone consists of a number of states. For BCG, it ranges from 25.4% in the North Zone to 30.0% in the West Zone. Corresponding lowest and the highest percentages are 60.0% (North-East Zone) and 62.0% (East Zone) for DPT, 51.2% (North-East Zone) and 56.0% (East Zone) for Polio and 80.8% (East Zone) and 83.2% (North-East Zone) for Measles. Variation of these percentages among the states is also not much. These percentages are 21.5% (Sikkim) and 35.4% (Arunachal Pradesh) for BCG; 55.7% (Madhya Pradesh) and 68.0% (New Delhi) for DPT; 44.3% (Sikkim) and 62.4% (New Delhi) for Polio and 78.0% (Bihar) and 86.3% (Tripura) for Measles.

Zone- and state-wise morbidity patterns of infants are given in **Table 6**. Overall percentages of occurrences of diarrhea, fever and cough are 15.5%, 17.3% and 22.1% respectively. South Zone has the minimum occurrences for Diarrhea (11.2%) and Cough (16.8) and North Zone has the minimum occurrences of fever (15.1%). So far as diarrhea is concerned North Zone has the maximum occurrence (19.2%), whereas East Zone takes the highest position in both the cases of fever and cough with 22.0% and 27.5% respectively. When seen state wise, Meghalaya can boast of having the lowest percentages of infants to be affected by each of the three types of morbidity considered here, namely Diarrhea (6.0%), Fever (5.2%) and Cough (7.8%). The corresponding highest prevalent states are Gujarat (24.2%), Tripura (34.3%) and Tripura (42.2%).

Table 7 shows the distribution of nutritional status, non-immunization status and morbidity pattern of infants in India among different socio-economic groups. It is seen that socio-economic groups have profound effect on

Table 4. Zone- and state-wise percentages of underweight, stunted and wasted infants in India, 2005-2006.

Zones and States	Nutritional status (%)			
	N	Underweight	Stunted	Wasted
North-East	**1394**	**18.1**	**18.4**	**20.5**
Arunachal Pradesh	127	17.3	16.5	18.9
Assam	230	28.7	27.0	21.7
Manipur	336	11.0	11.9	18.5
Meghalaya	116	34.5	26.7	34.5
Mizoram	109	7.3	15.6	11.0
Nagaland	295	13.9	16.9	19.3
Sikkim	79	7.6	16.5	15.2
Tripura	102	32.4	22.5	28.4
East	**1296**	**35.0**	**25.9**	**30.3**
Bihar	401	42.6	26.9	37.2
Jharkhand	251	39.4	23.5	36.7
Orissa	302	32.1	26.8	24.8
West Bengal	342	25.4	25.7	22.5
Central	**1769**	**36.6**	**25.6**	**33.6**
Madhya Pradesh	488	45.5	22.5	43.6
Chhattisgarh	282	41.5	35.5	33.7
Uttar Pradesh	999	30.8	24.3	28.6
West	**730**	**26.6**	**22.9**	**23.3**
Goa	117	22.2	14.5	24.8
Gujarat	244	29.9	27.0	20.5
Maharashtra	369	25.7	22.8	24.7
North	**1446**	**246**	**21.2**	**23.9**
Haryana	225	31.6	24.4	32.0
Himachal Pradesh	151	26.5	17.9	25.8
Jammu & Kashmir	167	22.2	21.0	25.7
New Delhi	125	20.8	19.2	27.2
Punjab	221	19.0	18.1	13.1
Rajasthan	338	24.9	19.8	25.1
Uttranchal	219	25.1	26.5	20.1
South	**927**	**21.5**	**19.8**	**24.5**
Andhra Pradesh	286	24.1	20.3	21.3
Karnataka	222	25.7	26.6	21.6
Kerala	148	11.5	12.8	20.3
Tamil Nadu	271	20.7	17.7	32.5
India	7562	27.8	22.5	26.7

Source: NFHS-3, India.

nutritional status but has negligible effect on both immunization status and morbidity of infants in India. So far as nutritional statuses are concerned, infants from richer households, from urban areas and of higher educated mothers are found to be least undernourished, stunted or wasted. Infants from Christian families are also least affected by any of the forms of malnutrition. However, the difference between male and female infants is not much.

The findings in **Table 7** is confirmed in **Table 8**, which shows the impact of socio-economic variables on the nutritional, non-immunization and morbidity status of

Table 5. Zone- and state-wise percentages of non-immunized infants in India, 2005-2006.

Zones and States	Non-Immunized				
	N	BCG	DPT	Polio	Measles
North-East	**1394**	**27.8**	**60.0**	**51.2**	**83.2**
Arunachal Pradesh	127	35.4	66.9	54.3	85.8
Assam	230	28.3	58.1	47.4	80.7
Manipur	336	27.4	62.5	51.5	83.0
Meghalaya	116	30.2	60.9	51.7	81.7
Mizoram	109	28.4	57.8	52.3	86.2
Nagaland	295	24.7	56.5	53.6	83.3
Sikkim	79	21.5	57.0	44.3	81.0
Tripura	102	28.4	61.8	52.0	86.3
East	**1296**	**26.6**	**62.0**	**56.0**	**80.8**
Bihar	401	25.5	57.3	52.5	78.0
Jharkhond	251	26.7	67.3	59.4	84.9
Orissa	302	26.2	60.3	58.6	79.5
West Bengal	342	28.1	65.1	55.3	82.4
Central	**1769**	**25.3**	**59.8**	**52.1**	**82.3**
Madhya Pradesh	488	23.4	55.7	50.2	81.7
Chhattisgarh	282	21.6	58.5	50.4	79.7
Uttar Pradesh	999	27.3	62.1	53.5	83.3
West	**730**	**30.0**	**61.4**	**55.2**	**81.5**
Goa	117	26.5	59.8	53.0	78.6
Gujarat	244	31.1	61.5	55.7	82.8
Maharashtra	369	30.4	61.8	55.6	81.6
North	**1446**	**25.4**	**61.9**	**54.4**	**82.3**
Haryana	225	23.6	58.2	53.8	84.3
Himachal Pradesh	151	29.1	66.2	56.3	86.1
Jammu & Kashmir	167	28.1	62.9	56.9	82.0
New Delhi	125	23.2	68.0	62.4	82.4
Punjab	221	26.7	64.7	58.4	84.2
Rajasthan	338	23.4	58.2	49.7	80.7
Uttranchal	219	25.6	61.2	50.7	78.5
South	**927**	**28.6**	**61.3**	**52.3**	**83.0**
Andhra Pradesh	286	30.1	58.2	48.3	80.6
Karnataka	222	30.6	60.8	49.3	83.3
Kerala	148	24.3	60.1	58.1	83.1
Tamil Nadu	271	27.7	65.7	55.7	85.1
India	7562	26.8	60.9	53.4	82.2

Source: NFHS-3, India.

the infants of India through categorical logistic regression. When immunization status is regressed on the socio-economic categorical variables, none of the coefficients is found to be statistically insignificant. This result only shows that the responses to the immunization drives are uniform over all the socio-economic groups. For morbidity status the effective variables are gender on fever, religion on Cough and literacy on all the three types of morbidity. Wealth index do not have any significant effect on any of the types of morbidity. On the other hand the socio-economic variables, namely religion, literacy status of mother and wealth index of the house-

Table 6. Morbidity statuses of infants in different zones and states in India.

Zones and States	Morbidity			
	N	Diarrhea	Fever	Cough
North-East	**1394**	**12.1**	**17.0**	**20.8**
Arunachal Pradesh	127	17.3	22.8	26.8
Assam	230	10.9	17.4	20.0
Manipur	336	11.9	14.3	22.1
Meghalaya	116	6.0	5.2	7.8
Mizoram	109	16.5	20.2	21.1
Nagaland	295	10.2	14.6	14.9
Sikkim	79	19.0	17.7	21.5
Tripura	102	11.8	34.3	42.2
East	**1296**	**15.7**	**22.0**	**27.5**
Bihar	401	15.0	21.4	21.4
Jharkhond	251	23.9	24.3	26.7
Orissa	302	17.2	17.5	22.8
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Madhya Pradesh	488	23.6	15.4	21.3
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Goa	117	12.0	17.9	21.4
Gujarat	244	24.2	17.2	29.9
Maharashtra	369	15.4	15.4	18.4
North	**1446**	**19.2**	**15.1**	**18.2**
Haryana	225	22.2	9.8	12.0
Himachal Pradesh	151	16.6	11.3	11.3
Jammu & Kashmir	167	22.2	24.6	18.6
New Delhi	125	13.6	8.8	16.8
Punjab	221	15.4	16.7	23.1
Rajasthan	338	20.7	13.9	23.4
Uttranchal	219	20.5	19.6	16.9
South	**927**	**11.2**	**15.9**	**16.8**
Andhra Pradesh	286	9.8	8.7	14.3
Karnataka	222	15.3	21.2	20.7
Kerala	148	11.5	25.0	19.6
Tamil Nadu	271	9.2	14.0	14.8
India	7562	15.5	17.3	22.1

Source: NFHS-3, India.

hold, have highly significant effect on all the nutritional statuses of infants. The place of residence, sex of the infant and ethnicity do not have any significant effect on morbidity. Religions have much effect on the nutritional status, especially the Christians and communities other than Hindus and Muslims contribute to much lesser percentages underweight, stunted and wasted infants compared to Hindus and Muslims. Influence on the nutritional status was found to be the highest particularly for the highest categories of the wealth and literacy status.

Table 7. Relationship between socio-economic variables with the nutrition, immunization and morbidity statuses of infants in India.

Variables	Nutritional status			Immunization (not taken) status				Morbidity		
Type of place	**Underweight**	**Stunted**	**Wasted**	**BCG**	**DPT**	**Polio**	**Measles**	**Diarrhea**	**Fever**	**Cough**
Rural	31.3	24.8	27.9	26.9	60.7	54.2	82.2	15.6	17.1	21.7
Urban	21.2	18.2	24.3	26.7	61.5	53.4	82.3	15.2	17.5	22.7
Sex of the child										
Male	28.0	23.5	26.5	26.6	60.5	52.5	81.9	16.4	18.9	23.4
Female	27.6	21.5	26.9	27.1	61.4	52.5	82.5	14.6	15.6	20.7
Ethnicity										
ST, SC & OBC	30.4	23.9	28.2	26.0	60.3	53.4	82.1	15.6	16.9	21.8
General	22.2	19.0	23.7	28.4	62.4	53.3	82.3	15.2	17.4	21.9
Religion										
Hindu & Muslim	29.6	23.3	28.0	26.7	61.0	53.2	82.1	15.8	17.6	22.7
Christian & Others	17.0	18.0	18.3	27.9	60.5	54.6	83.2	13.5	15.0	18.5
Mother's Education										
Illiterate & Primary	24.0	19.8	24.1	27.4	60.9	54.0	82.0	16.6	18.7	23.7
Sec. & Higher	11.4	11.4	18.2	24.8	61.8	50.8	81.2	13.6	11.1	15.8
Wealth Index										
Poorest & Poorer	39.4	28.8	32.6	27.0	60.8	53.7	82.2	14.1	16.9	23.0
Middle	28.2	24.0	26.8	26.9	61.1	53.2	83.0	16.2	17.9	21.5
Richer & Richest	17.8	16.5	21.6	26.7	61.0	53.2	81.9	16.3	17.2	21.5

Source: NFHS-3, India.

Table 8. Categorical logistic regression nutrition, immunization and morbidity statuses of infants on the socio-economic variables in India.

Variables	Nutritional status			Immunization (not taken) status				Morbidity		
Type of place	**Underweight**	**Stunted**	**Wasted**	**BCG**	**DPT**	**Polio**	**Measles**	**Diarrhea**	**Fever**	**Cough**
Rural	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Urban	0.897	0.940	1.110	1.062	1.014	1.019	0.967	0.813	1.024	1.095
Sex of the child										
Female	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Male	1.176	1.075	1.078	1.042	1.013	0.934	1.020	1.129	1.329**	1.120
Ethnicity										
ST, SC & OBC	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
General	0.887	0.953	0.892	1.195	1.179	1.044	1.024	0.915	0.948	0.928
Religion										
Hindu & Muslim	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Christian & Others	0.480**	0.742**	0.524**	1.074	0.951	1.000	1.004	0.843	0.939	0.746**
Mother's education										
Illiterate & Primary	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Sec. & Higher	0.563**	0.648**	0.779*	0.843	1.021	0.856	0.890	0.742*	0.555**	0.639**
Wealth Index										
Poorest & Poorer	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Middle	0.697**	0.851	0.868	1.012	1.082	0.987	1.124	1.035	0.899	0.878
Richer & Richest	0.437**	0.554**	0.688**	1.010	1.049	1.064	1.258	1.352	0.956	0.871

Source: NFHS-3, India.

4. DISCUSSIONS

From the above results, it is seen that percentages of malnourished infants range from 22 to 28 percent when the three types, namely underweight, stunted and wasted infants are considered. In respect of immunization status, where India's moto was all children and pregnant mothers to be immunized by 1990 [12], only 73.2% were immunized by BCG, 17.9 % are from measles, 39.1% from DPT (triple dose) and 46.7% from Polio during 2005-2006. A significant portion (15 to 22 percent) of infants is suffering from diarrhea, fever and cough, though there are considerable variations over states and zones. North-East zone is seen to be in a better condition so far as nutritional and immunization statuses are concerned. It is also interesting to note that even in New Delhi, percentage of non-immunization infants is very high, but the reason is not clear. High occurrences of malnourished infants are seen in most states of east and north zone. This may be because, according to World Bank [13], 421 million poor people are concentrated in the eight North- and East-Indian states. These states are Bihar, Chattisgarh, Jharkhond, MP, Orissa, Rajasthan, UP and West Bengal.

It is also clear from our analysis that mother's education and wealth index have profound effects on nutriational status and also on morbidity but there is no impact of socio-economic variables on immunization because immunization is very much dependent on the infrastructure of state health. Also the responses to immunization drives seem to be uniform over all socio-economic groups. Low immunization status in the east and the central zones is corroborated with the World Bank report that the coverage of ICDS developmental programme for children in Bihar, Rajasthan, UP, Orissa and Madhya Pradesh is very low and it ranks in the bottom ten [11].

Though mother's education and income may be adjudged as the most effective factor to reduce malnutrition, but health infrastructures of the states may also be responsible for bringing good health among children. The health infrastructures are not considered in the present analysis.

To conclude, the results found in this paper give clear cut indications for the government and NGOs to take actions to ameliorate poverty and to improve the level of education, especially of female population in India.

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