

CAUSES OF CHILD MALNUTRITION IN INDIA

Arvind Virmani*

July 2007

* Working paper number WsWp 1/2007

<http://sites.google.com/site/drarvindvirmani/working-papers>.

TABLE OF CONTENTS

	Page
1 INTRODUCTION	1
1.1 Public Health	2
2 CHILD MALNUTRITION.....	3
2.1 Potential Causes	3
2.2 Hypothesis.....	Error! Bookmark not defined.
2.3 Empirical Results	5
2.4 Policy Implications.....	Error! Bookmark not defined.
3 CONCLUSION: Pro-Poor Growth.....	13
3.1 Five Point Program.....	Error! Bookmark not defined.
3.1.1 National Road Grid.....	Error! Bookmark not defined.
3.1.2 Public Health & Town Planning.....	Error! Bookmark not defined.
3.1.3 Water Management.....	Error! Bookmark not defined.
3.1.4 Education and Skills	Error! Bookmark not defined.
3.1.5 Telecom Connectivity.....	Error! Bookmark not defined.
4 REFERENCES	14

TABLES

Table 1: Dependent variable is % of children younger than 3 in 2005-6 who are underweight.....	7
Table 2: Dependent variable Children younger than 3 in 2005-6 who are underweight(%)	9
Table 3: Dependent variable is Children younger than 3 in 2005-6 who are underweight (%).....	12

1 INTRODUCTION

Information/knowledge, personal security and the rule of law (provided by the State), and Roads are among the public goods that impact both investment and growth and the personal welfare of all individuals including the poor. Two of the most neglected Public goods from both these perspectives are appropriate information or knowledge and Urban/civic planning and policy. The quality of life in cities, towns and contiguous rural areas can depend critically on the quality of Planning and policy for these areas. This includes land use planning and public transport and policies that ensure that rental accommodation is profitably built for the poor and lower middle class. It also includes communicable and vector borne diseases. The effect of such neglect (or lack of competence) tends to cumulate over time as more migrants stream into growing towns and urbanisation increases. This may be a factor in the slowdown in the decline of urban poverty rates in several States.

There are three basic aspects of information: The source or repository of the information, access to this source/repository and the ability to understand the information. All three can be different for each type of information. The paradox of information is that the person needing the information does not know where it exists or exactly what it is. If the latter was untrue (s)he would already possess the information. It is therefore in the national public interest to ensure that certain types of information are made available to citizens (or sub-groups of them) in a form that they can understand. Public health information is one such type of information that can have multiple benefits. Literacy and basic education may be an essential complement of this process.

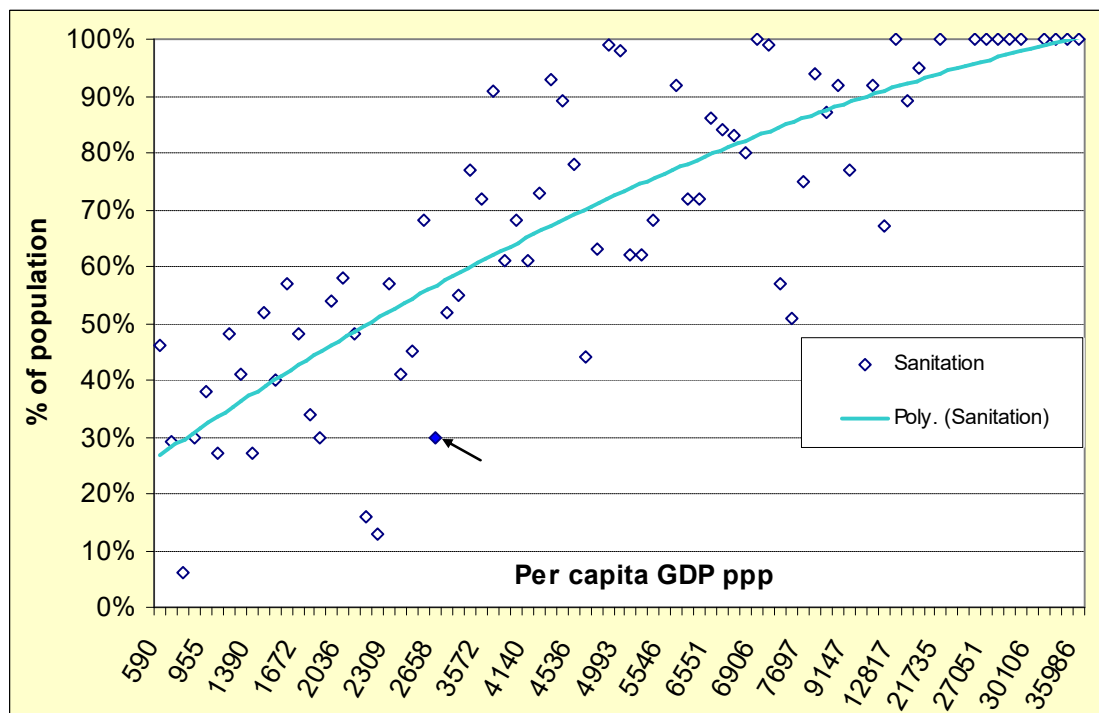
In a low income (poor) country like India Social Welfare must give additional weight to the access of the poor to Public goods. The Supreme Court mandated police reforms will improve the quality of policing and the personal security of the poor.¹ Similarly the creation of a comprehensive road grid that connects every habitation in the country (village, town or city) will be of great benefit to the poor as it will increase availability and reduce the cost of transport.

¹ The media, supported by the public, must carry out a campaign to implement police reform. They must particularly put pressure on those States that have refused to make any reforms, by exposing the pathetic state of law and order!

2 Public Health & Malnutrition

We can enhance social welfare further by adding services that have some public good character or externality and are particularly relevant to the poor, to the list of public goods. The two most important ones are Public health and literacy. Historically the greatest advances in longevity and mortality reduction have come not from treatment of individual disease but from public health. This includes modern drainage and sewerage systems (sewage treatment plants), drinking water systems that produce and deliver disease free water and solid waste disposal systems. The current position is illustrated by the low proportion of the population with access to improved sanitation facilities (In figure 1, India is coloured dot at arrow). The impact of this neglect is reflected in two well known facts; One, ‘Delhi belly’ is infamous throughout the World and the Delhi middle class has to use water filters to protect itself from tap water borne disease. Two, India is still home to communicable and vector borne diseases that have been eliminated in most countries outside sub-Saharan Africa.

Figure 1 : Per cent of Population with Improved Access to Sanitation



Public health also includes public education about nutrition, hygiene and disease to reduce the problem of asymmetric information. Literacy, numeracy and primary education aids in this process, socialises agrarian residents for modern manufacturing and services and contributes to the

general well being and is therefore also a quasi-public good. Together these can contribute immensely to the quality of life of all citizens and particularly the poor. The legacy of neglect of these public and quasi-public goods and services is still reflected in the lack of emphasis by State governments to universal (100%) coverage of a standard that is visible in actual outcomes. This must change radically.

2.1 Child Wasting & Stunting

A study of the nutrition problem in India illustrates the multiple ramifications of Information/knowledge transmission and of Public health policy and programs. In 2004-5 the all India poverty rate was 21.8% using the Mixed (30-365 days) recall period and 27.5% using the Uniform (30 day) recall period. Malnutrition in children under 3 years of age as measured by the National Family health survey 2005-6 (NFHS 3) was much higher. Stunted and Underweight children constituted 38.4% and 45.9% respectively of children under 3. The cross State correlation between poverty rates and malnutrition rates was around 0.7 (using either MRP or URP based estimates). At least 30% of this cross-State variation in nutritional status of children was therefore totally uncorrelated with the variation of poverty rates across States. The malnutrition results are based on norms derived from a US sample and these norms are being revised based on samples from Asia, Latin America and Africa. It is expected that the malnutrition rates resulting from these new norms would be *different*. The broad picture outlined above is not however likely to change significantly.

The improvement in the nutrition status of children has also been disappointing. Over the seven years between 1998-9 and 2005-6 malnutrition has declined by only 1.1 per cent points while stunting has declined by 7.1 per cent points. This compares with a 4.3 per cent point decline in the poverty rate between 1999-2000 and 2004-5 (MRP). Though stunting has declined at a marginally faster annual rate (1.0%) than poverty (0.9%), the decline in percentage of underweight children is minuscule. The implication is drawn that existing policies and programs are not making a significant dent on malnutrition and need to be improved. To do this, however, we need to first find out what are the important factors responsible for malnutrition.

3 Potential Causes & Hypothesis

There are three broad aspects of malnutrition that must be kept in mind when devising strategies for dealing with it.

- 1) The ability to access such food items. This depends on household income or ability to sustain certain levels of consumption. The rate of Poverty (Head count ratio) is the standard indicator. Other possible indicators could include assets such as land and housing.
- 2) Household/family knowledge and information about good nutrition. This includes knowledge about the locally available foods that are good from the nutrition perspective. This can be based on, (a) traditional age old knowledge (old wives tales). (b) Ability to read coupled with availability of appropriate reading material on nutrition. (c) Access to media such as newspapers, radio and TV, coupled with propagation of such information on the radio (d) Special programs that directly educate mothers about child rearing and nutrition such as ICDS.
- 3) State of health. Even if the right kind of food and nutrition is available a child may not be able to consume and/or absorb it properly due to ill health or sickness. For instance a child suffering from diarrhoea much of the time is unlikely to be able to ingest much good and healthy food and absorb the nutrition, even if it is freely available and provided to the child by the mother/parents. Historically it has been demonstrated across many countries that public health measures like clean drinking water, sanitation, sewerage, control of communicable and epidemic diseases and public health education play an important role in reducing mortality rates at every age and across gender. In the Indian environment access to water and toilets, breast feeding (to impart immunity in an unhealthy environment), access to sound health advice/treatment, prevalence of vaccination and availability of vitamin supplements are possible indicators.

Clearly the level of consumption, represented by the poverty rate is a variable that has to appear in any explanation of cross- State differences in malnutrition. In addition based on (2) and (3) above we can build two distinct hypothesis or models to explain malnutrition.

Model 1: Information and Knowledge

In this model, variations in nutrition, beyond those dependent on ability to purchase nutritional food and health services, depend on information and knowledge about appropriate foods, cooking, nutrition, health and hygiene and child rearing practices. Traditional learning about child rearing from mothers and grandmothers, level of education, exposure and access to media

including ownership of radios and/or TV and exposure/access to programs like ICDS would affect nutritional practices. As the first variable is not directly measurable we assume that early marriage or early birth of first child reduces the time that a young female has to learn sound traditional practices by observation, listening and questioning.

+ - -/+ - + +

Malnutrition=f(Poverty, Media exposure, Household TV, education, early marriage/childbirth, govt info programs)

Household TV can be a force for good or bad depending on the programs watched and the time spent. Thus, household TV by increasing access to information may reduce malnutrition. On the other hand watching junk food and other advertising and reducing the time spent on child rearing may increase it.

Model 2: Child health and nutrition

+ - +/- - - -

Malnutrition = f(Poverty, toilet access, Diarrhoea, Breastfeeding, Vaccination, Vitamin supplement)

The prevalence of diarrhoea would clearly increase malnutrition, while the availability of sound treatment would reduce it. Thus available measures may not distinguish clearly between these two effects. Access to toilet facilities and clean drinking water would reduce water borne diseases including diarrhoea and thus tend to reduce malnutrition. However when the even the quality of municipal piped water supply cannot be trusted available measures are not able to distinguish between contaminated and clean water. Breast feeding at birth would tend to minimise the effect of feed based on poor water quality. It is also reported in medical journals to increase long term immunity. Vitamin A and other supplements have been proposed by many to address malnutrition problems.

4 Data & Estimates

We use the NFHS3 data set for States to analyse the effects of the potential causes of nutrition identified above. We start with the commonly used measure of the proportion of children under age 3 who are malnourished, in particular underweight in the State (Underwt). First we

estimate a naïve model that says that malnutrition is the result of poverty. This can also serve as a benchmark.²

$$(1) \text{ Underwt} = 24 - 0.67 \text{ PovUrp}, \quad R^2 = 0.50, \quad R^2 (\text{adjusted})=0.48.$$

(7.3)^{***} (-5.2)^{***}

$$(2) \text{ Underwt} = 25 - 0.77 \text{ PovMrp}, \quad R^2 = 0.49, \quad R^2 (\text{adjusted})=0.47.$$

(8.4)^{***} (-5.1)^{***}

These equations suggest that about 50% of the variation in malnutrition across states can be explained by poverty.³ However, the results can be misleading as they do not take account of the other potential causes of malnutrition discussed earlier.⁴

Given the data available in the NFHS3 survey for 2005-6, model 1 is specified as follows:

$$(3) \text{ Underwt}_{3i} = f(\text{Povurp04}_i, \text{mediaexpfi}, \text{hhtv}_i, \text{erlymrgfi}, \text{eduf8}_i, \text{pcicds}_i)$$

$i = 1 \dots n$ the number of States and where,

Povurp04 = Poverty rate in 2004-5 based on uniform recall period (%)

Mediaexpf = Women 15-49 with regular exposure to media (%)

HhTv = Households that have a TV (%)

Erlymrgf = Women age 20-24 married by age 18 (%)

Eduf8 = Women who have completed 8 years or more of education (%).

Pcicds = Per capita expenditures on ICDS program in State in 2005-6.

To evaluate the effect of the ICDS program we estimate this equation without and with Pcicds. Columns 2 to 4 of the table below show the results of the basic model without ICDS. There is one surprise. Education does not seem to affect the nutrition outcomes as the education variable is not significant at the 10% level. The lack of significance of the education

² One, two and three stars represent significance at the 10%, 5% and 1% level.

³ Asset variables are not significant in this equation. If the consumption shares of lower 40% of urban and rural population are introduced into this equation they are significant at the 1% and 5% confidence level. The sign of the latter is, however, perverse: A higher share of bottom 40% in rural areas leads to greater malnutrition. This could be due to a change in behavior ('keeping up with the Joneses') that results in higher purchase of non-food items at the cost of food once a certain threshold is crossed and discretionary purchases become feasible.

⁴ Missing variable bias.

variables suggests that mere literacy is not enough. The right kind of information regarding nutrition, hygiene etc. has to be made available to and be accessible to the target audience. Thus education system does not seem to impart any knowledge that is directly useful in improving nutrition outcomes. However, education does have an indirect effect in that it seems to be an important determinant of regular media exposure (footnote 1 of Table 1).

Table 1: Dependent variable is % of children younger than 3 in 2005-6 who are underweight

1	2	3	4	5	6	7	8
	Model 1a	Model 1a	Model 1b	Model 1c	Model 1c	Model 1d	Model 1d
		Sure ¹			Sure ¹		Sure ¹
<i>Independent Variables</i>							
Poverty Rate URP (%)	0.289 2.6**	0.290 2.9***	0.285 2.7**	0.186 1.6	0.185 1.9*	0.179 1.6	0.180 1.9*
Media Exposure (female) %	-0.426 -3.4***	-0.424 -3.8***	-0.434 -3.8***	-0.388 -3.3***	-0.367 -3.6***	-0.401 -3.7***	-0.388 -4.1***
Married by 18yr (F 20-24yr) %	0.188 1.6	0.190 1.8*	0.201 2.3**	0.113 0.97	0.126 1.3	0.135 1.5	0.140 1.8*
HH with TV (%)	0.220 2.2**	0.221 2.5**	0.214 2.3**	0.095 0.86	0.095 1.0	0.086 0.8	0.097 1.1
Education(female) 8th or higher %	-0.280 -0.17	-0.027 -0.19		-0.044 -0.3	-0.035 -0.3		
Per capita expenditure on ICDS				-0.067 -2.1**	-0.074 -2.8***	-0.066 -2.2**	-0.073 -2.8***
Constant	46.55 4.2***	46.19 4.7***	45.86 4.5***	58.06 5.0***	55.99 5.7***	56.89 5.4***	55.50 6.0***
F (chi in Sure)	22	142	29	22	177	28	177
Prob > F	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
R-squared	0.84	0.84	0.84	0.87	0.86	0.86	0.86
Adj R-squared	0.80		0.81	0.83		0.83	
Root MSE	4.6	4.1	4.5	4.3	3.7	4.2	3.7
No of observations	28	28	28	28	28	28	28
Notes: Fn ¹ Mediaexpf=19***+0.33*** Hhelect+0.6*** eduf8 (R ² =0.83); Hhtv=-2.6+0.69*** hhelect(R ² =0.71) Numbers in bracket are t statistics, Stars show confidence level *=10%, **=5%, ***=1%							

Poverty and media exposure are highly significant determinants of malnutrition and better nutrition respectively. The presence of a TV seems to have a perverse effect on child nutrition. As noted earlier these could be due to a number factors including promoting junk food and non-food expenditures at the cost of nutritious food, and reduction of time spent on child care. Though household TV may contribute to regular media exposure, it is not a significant determinant of the latter in the subsidiary equations for the sure model estimation.⁵ Our variable for early marriage is not significant in the OLS estimate when the education variable is present but is significant when it is dropped. This suggests that our use of this

⁵ It was therefore dropped from the estimating equation.

variable as an indicator of traditional learning is correct. Overall the model explains 81 to 84% of the interstate variation in malnutrition among children under 3 years of age.

When the ICDS variable is included in the model 1 equation, education remains non-significant, but the size of the impact and the degree of significance of household TV, early marriage and poverty is reduced, with the first becoming non-significant (columns 5 to 8). In the presence of the ICDS program, the residual impact on malnutrition is about 55% for poverty and 70% for early marriage 70% of the impact without ICDS. This means that **the ICDS program has been successful in reversing any misinformation provided by TV and reducing the information/knowledge handicap imposed by early marriage and poverty.**

We find that the available drinking water variable namely access to piped drinking water is not a significant factor in nutrition. This is surprising if we associate municipal piped water supply with better quality of water. The few reported surveys along with our personal experience of the quality of water in the capital indicate that this assumption is not justified. Unless there a source of poisoning or serious pollution nearby, well water may be superior to piped water in many situations as it undergoes natural filtration. Access to water of a defined standard would better capture the public health factor, which is a significant factor in explaining nutrition.

Given the data available in the NFHS3 survey for 2005-6, model 2 is specified as follows:

$$(1) \text{Underwt}_{3i} = f(\text{Povurp}_{04i}, \text{hhtoiltacs}_{i}, \text{cdiar2whf}_{i}, \text{chlddpt}_{i}, \text{chldvita}_{i}, \text{brst1hr}_{i})$$

$i = 1 \dots n$ the number of States and where,

hhtoiltacs = % of households in State that have access to a toilet,

cdiar2hf = Children who got diarrhoea in the last two weeks who were taken to a health facility (%).

Chlddpt = Children 12-23 months who have received 3 doses of DPT vaccine (%)

Chldvita = Children age 12-35 months who received a vitamin A dose in last 6 months (%)

Brst1hr = Children under 3 years breastfed within one hour of birth (%)

We can also see the impact of ICDS in this context by adding PCicds to it.

The estimates for model 2 are given in columns 2 and 3 of Table 2. All variables in the model are found to be significant, and the model explains 82% of the interstate variation in malnutrition, marginally lower than the 84% explained by the model 1 (for both estimates based on SURE procedure). The residual impact of poverty on malnutrition is somewhat lower in this model than in model 1 though the difference is not statistically significant. Household access to toilets, breast feeding of infants and vaccination of children have the expected sign.

Table 2: Dependent variable Children younger than 3 in 2005-6 who are underweight(%)

1	2	3	4	5	6
	Model 2a	Model 2a	Model 2b	Model 2b	Model 2c
		Sure ¹		Sure ¹	Sure ¹
<i>Independent Variables</i>					
Poverty Rate URP (%)	0.250 2.0*	0.242 2.3**	0.193 1.4	0.181 1.6	0.149 1.4
HH access to toilets	-0.175 -3.0***	-0.174 -3.5***	-0.174 -3.0***	-0.178 -3.6***	-0.192 -4.1***
Diahoric chld(2wk):Health facility	0.158 2.2**	0.186 2.3***	0.123 1.6	0.144 2.2**	0.141 2.1**
Chld Breast fed in 1 hr of birth	-0.090 1.4	-0.094 -1.7*	-0.045 -0.6	-0.038 -0.059	
Child vaccination (DPT 3 shots)	-0.282 -3.6***	-0.293 -4.3***	-0.320 -3.7***	-0.035 -4.9***	-0.037 -5.7***
Children receiving Vitamin A	0.226 6.5***	0.259 2.6***	0.226 6.5***	0.287 2.9***	0.290 2.9***
Per capita expenditure on ICDS			-0.053 -1.1	-0.054 -1.3	-0.069 -2.0*
Constant	50.40 6.5***	49.02 7.4***	55.90 6.2***	55.90 7.3***	58.32 7.8***
F (chi in Sure)	17	135	15	148	148
Prob > F	0.0000	0.0000	0.0000	0.0000	0.0000
R-squared	0.82	0.82	0.83	0.83	0.83
Adj R-squared	0.77		0.77		
Root MSE	5.0	4.4	5.0	4.3	4.3
No of observations	29	29	29	29	29
Notes:Fn ¹ hhtoiltacs=135***-0.88***povurp04+2.1*** eduf8-1.2***edu0(R ² =0.7); cdia2hf = -23 + 0.85*** cdia2ors + 0.76** eduf0 - 0.71* eduf8 - 0.24*** pcicds (R ² = 0.65); brst1hrf =144*** - 0.53** erlymrgf + 1.6*** eduf8 - 1.3*** edu0 (R ² =0.65); chlddpt = 71*** + 1.1*** eduf8 - 0.39* eduf0 - 0.17***pcicds (R ² = 0.47); chldvita = 19 + 0.62***erlymrgf + 1.6*** eduf8 - 0.7*** edu0 (R ² =0.4); Numbers in bracket are t statistics, Stars show confidence level *=10%,**=5%,***=1%					

The effect of vitamin A supplements is the opposite of the hypothesised. This suggests that there is something wrong with the process of supplementation. This could be due to the absence of any link between vitamin A deficiency and the receipt of the supplement and/or the replacement of vitamins by spurious products. Alternatively the receipt of these pills could be leading to adverse changes in food consumption behaviour. Similarly the proportion of children with diarrhoea that go to a health facility seems to worsen malnutrition. This implies that a visit to a health facility after a diarrhoea attack has a negative effect on nutrition. It implies that, either (a) the treatment provided by the health facility does not compensate for the effect of inconvenience to the patient even if the staff sincerely does its job and knows what treatment is appropriate, or (b) That the staff is indifferent or incompetent and either provides no treatment or wrong treatment which worsens the situation.

If the ICDS variable is introduced into the model 2 equation and estimated by OLS, it is not significant but also eliminates the significance of poverty, breast feeding of infants and visit of a child with diarrhoea to a health facility (Table 2, column 3). The 'SURE' estimate however shows that the last variable remains significant (column 4). The supplementary equations for this model (given in footnote of table) suggest that ICDS is tending to reduce visits to the health facility visits and reduce vaccination of children. Dropping of the breast feeding variable from the model equation and re-estimation with SURE procedure makes the ICDS variable significant at 10% but leaves poverty non-significant. This suggests that the impact of ICDS on nutrition is not as clear cut in model 2 as in model 1.⁶

As both models seem to work the question, which arises is whether we can sharpen our policy conclusions by integrating them in some way. We do this in an ad hoc way by first dropping the variables that are clearly not significant in either model, namely education and early breast feeding of infants. Then the two models are integrated without the ICDS variables model 3a). The results are shown in column 2 of Table 3. Three variables, toilet access, TV ownership and vitamin A supplements, lose significance completely and are dropped. The modified model is estimated without the ICDS variable (column 3) and then with the ICDS variable (column 4). Both the vaccination variable and the ICDS are found to be non-significant. Column 5 therefore shows the final version of this ad hoc model without these two variables.

⁶ The results for malnutrition up to 5 year olds is similar except that poverty and ICDS are both highly significant.

The combined model therefore contains the poverty rate, two information variables from model 1 (media exposure and early female marriage) and one health variable (children with diarrhoea in the last 2 weeks who were taken to a health facility) from model 2. This model 3 therefore explains a marginally higher proportion of interstate variation (0.86-0.88) than model 1(0.84-0.86) or model 2(0.82-0.83). The co-efficient on poverty is also of the same order of magnitude as in the final versions of models 1 and 2, in the range of 0.14 to 0.18. The co-efficient on regular media exposure (-0.36 to -0.4) and early marriage (0.16 to 0.18) are comparable to those in model 1(-0.39 & 0.14 respectively). The co-efficient on the variable children with diarrhoea in the last 2 weeks who were taken to a health facility (0.11 to 0.2) is also similar to that in model 2 (0.14).

Our conclusions regarding the importance of information, knowledge and education are therefore strengthened. At least as far as child nutrition and health are concerned, the negative aspects of the available health system (mistreatment, negligence, non-treatment) seem to be more powerful than any positive effect that vaccination etc may have. Further even the information benefits of ICDS may be less than more focused and effective public health education through the media and schools.

Table 3: Dependent variable is Children younger than 3 in 2005-6 who are underweight (%)

1	2	3	4	5
	Model 3a	Model 3b	Model 3c	Model 3d
	Sure ¹	Sure ²	Sure ³	Sure ⁴
<i>Independent Variables</i>				
Poverty Rate URP (%)	0.173	0.149	0.141	0.175
	1.8*	1.8*	1.7*	2.1**
Media Exposure (female) %	-0.491	-0.440	-0.398	-0.363
	-3.8***	-4.4***	-4.0	-4.5***
Married by 18yr (F 20-24yr) %	0.181	0.176	0.162	0.178
	2.3**	2.5**	2.3**	2.5**
HH with TV (%)	0.037			
	0.36			
HH access to toilets	0.020			
	0.33			
Diahoric chld(2wk):Health facility	0.158	0.164	0.114	0.200
	2.3**	3.2***	1.9*	4.4***
Child vaccination (DPT 3 shots)	0.100	0.090	0.055	
	0.9	1.3	0.8	
Children receiving Vitamin A	0.006			
	0.06			
Per capita expenditure on ICDS			-0.034	
			-1.2	
Constant	44.94	45.47	49.60	43.07
	5.2***	5.7***	5.6***	5.4***
F (chi in Sure)	192	187	198	177
Prob > F	0.0000	0.0000	0.0000	0.0000
R-squared	0.87	0.87	0.88	0.86
Adj R-squared				
Root MSE	3.7	3.7	3.5	3.8
No of observations	28	28	28	28
Notes: Fn ¹ (subsidiary equations estimated in SURE)				
hhtoiltacs=116***-0.79***povurp04+2.0*** eduf8-1.0***edu0 (R ² =0.7);				
chldvita = 39** + 0.51***erlymrgf + 1.6*** eduf8 - 0.85*** edu0 (R ² =0.41);				
Hhtv=-4.2+0.71*** hhelect(R ² =0.71)				
Mediaexpf=43***+0.31*** Hhelect+0.9*** eduf8 - 0.3* eduf0 (R ² =0.84);				
cdiar2hf =4.3 + 0.73*** cdia2ors - 0.35 eduf8 + 0.45 eduf0 - 0.27*** pcicds (R ² = 0.67);				
chlddpt = 65** + 1.3*** eduf8 - 0.43 eduf0 - 0.16***pcicds (R ² = 0.50);				
Fn ² (subsidiary equations estimated in SURE)				
Mediaexpf=40**+0.27*** Hhelect+0.93*** eduf8 - 0.25 eduf0 (R ² =0.84);				
cdiar2hf =20 + 0.62*** cdia2ors - 0.11 eduf8 + 0.28 eduf0 - 0.31*** pcicds (R ² = 0.67);				
chlddpt = 82** + 1.5*** eduf8 - 0.63 eduf0 - 0.22***pcicds (R ² = 0.51);				
Fn ³ (estimates are almost the same as in Fn ²)				
Fn4 (subsidiary equations estimated in SURE)				
Mediaexpf=37***+0.32*** Hhelect+0.87*** eduf8 - 0.24 eduf0 (R ² =0.84);				
cdiar2hf =15 + 0.70*** cdia2ors - 0.18 eduf8 + 0.33 eduf0 - 0.32*** pcicds (R ² = 0.67);				
Numbers in bracket are t statistics, Stars show confidence level *=10%, **=5%, ***=1%				

5 CONCLUSION & POLICY IMPLICATIONS

The paper demonstrates, by analysing nutrition outcomes, that the greatest social welfare benefits from direct intervention by government to improve the lot of the bottom 40% can come if it focuses on two long neglected quasi-public goods. First, Public health including communicable disease and vector control, quality drinking water, drainage, sewerage and solid waste disposal in every city, town and village in the country. Second universal primary education and literacy to a global standard that is visible in outcomes.

Improvement of public health education and public health facilities clearly has a positive effect on nutrition outcomes. The ICDS program seems to have helped in providing public health education to mothers and thus contributed to the outcome. The policy implications, however, extend beyond nutrition to other health outcomes. A comprehensive program for improving civic amenities of a public health nature to a defined standard is necessary to remove visible symbols of divide between rich and poor that slums and other neighbourhoods with poor drainage and sewage create.

For every existing town, States must plan and install a modern drainage, sewerage and water supply system with water storage and purification, sewage treatment plants and garbage disposal sites. The impact in terms of economic activity, health and nutrition can be enormous. Government should help develop consultancy firms that can Plan and organize such systems and organizations that can compete with each other to build these systems across the country. Once 100% coverage of towns is attained, we should extend the planning effort to semi-urban areas and villages in co-operation with Panchayti Raj institutions and NGOs. We may not be able to match the quality of public health and civic services routinely found in the villages of High income country's, but we must target a quality level equal to that of middle income countries.

This brings us back to the broader question of other quasi-public goods that are of critical importance to the poor. Literacy can help in acquiring knowledge about hygiene, nutrition and sanitation. Government must ensure that every citizen, has the education that (s)he is supposed to acquire with the completion of Primary education. But this education must also be made more relevant by providing information on matters that will improve their lives (health, hygiene, nutrition) and equip them to find useful information.

6 REFERENCES

1. Virmani, Arvind (2006), "Poverty and Hunger in India: What is needed to Eliminate them," The Pakistan Development Review, Volume 46, Number 2, summer 2006 (www.pide.org.pk).
2. _____(2007), "Planning for Results: Public Accountability Information System," Working Paper No. 1/2007-PC, Planning Commission, March 2007.
<http://planningcommission.nic.in/reports/wrkpapers/rpwpf.htm>.