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'*De-stunting*' Bihar?

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'De-stunting' Bihar?[£]

Neetu Choudhary[*] and Abhijit Ghosh[#]

1. Introduction

With around 48.3 % of her children being stunted as per NFHS 4, Bihar is one of the most undernourished states of India. Although this reflects a decline from 55.6% during NFHS 3, it can hardly be considered as satisfactory over a span of ten years. It is well recognized now that child malnutrition has a multidimensional dynamics underlying it, which does not necessarily correspond to levels of economic growth. This is corroborated by the fact that Bihar has recorded fairly decent economic growth rates during last decade, leading to a percentage decline in poverty ratio from 54.40 in 2004-05 to 33.74 in 2011-12. Yet child malnutrition (particularly stunting) during last decade could decline only by around 7 percentage points, thus indicating that an inadequate proportion of each additional growth gain has been diverted towards the cause of nutritional well-being. While this does not mean that poverty reduction is unimportant, it does necessarily imply that the issue of child malnutrition has failed to figure strongly in the list of policy priorities in Bihar.

In terms of research, a surge of interest on Bihar is observable during recent period (see for example - Choithani and Pritchard 2015, Dreze and Khera 2015, Dreze et al 2015, Sikka 2015, Kumar 2014, Fraker et al 2013, Parulkar and Aggarwal 2013, WFP 2009). However, most of these interventions have focused on basic functioning of food and nutrition support machinery and its delivery mechanism. A holistic perspective on the extent and dynamics of child malnutrition in Bihar remains lacking and this could be one of the reasons that the issue does not form an aggressive agenda of governance. Further, the issue of equity has not been at the centre of malnutrition discourse in Bihar though group inequality in food insecurity and hunger is a well-recognized phenomenon (e.g. Kumar 2014, Khera 2008). The dimension of equity is central to the Sustainable Development Goals, as is zero hunger and gender equality. Additionally, it is intrinsically as well as instrumentally important in a highly stratified society that the state of Bihar has. Ostensibly, the understanding on

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[1]Based on Mixed Reference Period (MRP) Consumption, https://www.rbi.org.in/scripts/PublicationsView.aspx?id=15283

UNICEF's conceptual framework on determinants of malnutrition
https://www.unicef.org/sowc98/fig5.htm

malnutrition scenario in the state needs to align itself with that on inequality – across social and income groups. It is in this context that this report has been developed wherein the larger goal is to prepare a ground for nutrition – centric development process.

In fact, failing to give foremost attention to child malnutrition is self-defeating for any agenda of development given the impact child malnutrition has on child growth and subsequently on overall quality of human development. Particularly critical from the perspective of development, is the need to address the level of child stunting - an indicator of long-term cumulative growth deficiency, which is known to cause functional impairment in later adulthood (UNICEF, 1994). These consequences are also irreversible in the sense that the cognitive implications of stunting in childhood cannot be undone. The situation of the girl children suffering from stunting is likely to deteriorate further due to their reproductive role. To the extent these girls are likely to be future mothers, stunting among women would have an inter-generational effect wherein the infants born to them will have low birth weight in all likelihood. This is ostensibly indicative of a vicious circle unless interrupted through conscious policy intervention. Moreover, as a measure of vulnerability, current levels of stunting among children also reflects the proportion of population that may not reach full growth potential and thus has retarding consequences for their productivity and economic contribution. Additionally, for female population stunting represents a multiplier effect in terms of nutritional deprivation and productivity retardation. The potential spill-over effect of child stunting on human and economic development necessarily brings us to the issue of 'economics of nutrition'. This is another aspect that this paper is designed to examine. To be specific, this report may be seen as a comprehensive contribution towards an equity - oriented understanding on malnutrition in Bihar and the cost that it is inflicting to the state.

1.1 Methodological approach and data

Methodologically, this is primarily a quantitative study based on secondary data supported by some reflections from the field. Salient sources of secondary data include but are not limited to:

- Micro-data from the third (2005-06) round, state level data from second (1998-99) round and district level data from the fourth (2015-16) round of National Family Health Surveys, Government of India
- Rapid Survey On Children (RSOC) 2013-14
- Annual Health Survey (AHS – 3 conducted during 2012-13)
- Various rounds of National Sample Surveys

These data have been used as per their latest availability for relevant indicator under consideration. Alongside, qualitative reflections on ground realities and policy perspective

have been obtained through two case studies from the field. Case studies were conducted in two blocks of Purnia district of Bihar viz. Kasba and Jalalgarh. Another case study included Uttar Pradesh Nutrition Mission and ICDS centres in Chinhat and Sarojani Nagar blocks of Lucknow district in Uttar Pradesh.

Data analysis

Nutrition mapping of Bihar has been done using cluster analysis. The technique of cluster analysis is hierarchical agglomerative using Ward's method. Squared Euclidean distances is chosen as the dissimilarity measure because they preserve both profile level and shape for quantitative variable. The Euclidean measure is given by following equation:

$$d_{ij}^{2} = \sum_{k=1}^{p} (x_{ik} - x_{jk})^{2},$$

Where d_{ij} is the distance between the cases i and j, and x_{ik} is the value of the k^{th} variable for the i^{th} case. Usually, the estimation of similarity between cases is considerably influenced by differences in relative sizes of variables. However, in this case, different variables are almost on the similar scale hence we do not need to standardize the variables before running the analysis. The number of clusters is determined on the basis of visual interpretation of dendogram, depicting agglomeration of various cases into a cluster. The nodes of the dendogram represent clusters. In addition, causality analysis (discussed later) is done using logistic regression technique. Cost of malnutrition has been estimated using algorithme followed in existing studies.

2. Bihar's growth dynamics: implications for consumption and food security

Some distinct demographic features distinguish Bihar from the rest of the country. For example - the decadal growth rate of population in Bihar is the highest in the country, population density is almost three times the national average and urbanization level in the state is the second lowest in India. These characteristics put pressure on the limited land and resources of the state, having implications for effective economic engagement. Alongside, the age structure of population forms an almost perfect pyramid, indicating high Total Fertility Rate (TFR) and an early stage of demographic transition, which has potential for demographic dividend. Although, the dependency ratio (both child and old age) is quite high, nearly half of the population belongs to 15-59 age group - implying an overwhelming volume of work force. Associated 'demographic dividend' can be reaped only if this force is utilized meaningfully and productively through a process of human development including health and nutritional well being at the minimum.

But Bihar's performance on basic health indicators is not very satisfactory. Life expectancy at birth (LEB) has improved during the period between 2001-05 to 2006-10 and the gap with the national average has substantially declined. Child and maternal mortality ratio has also declined over the years, although at 208 maternal mortality ratio is still higher than the national average and thus remains a concern.

Table 2.1: Status of IMR and U5MR in 2013

Indicator	Category	Person	Male	Female
IMR	Bihar	48	47	49
	Highest among districts	64 (Madhepura)	63 (Madhepura)	65 (Madhepura)
	Lowest among districts	31 (Patna)	30 (Patna)	33 (Patna)
U5MR	Bihar	70	67	73
	Highest among districts	97 (Sitamarhi)	98 (Sitamarhi)	103 (Sitamarhi)
	Lowest among districts	46 (Patna)	44 (Patna)	48 (Patna)

Source: Annual Health Survey - 3

Bihar has registered consistent and speedy decline in Infant Mortality Rate (IMR) and Under Five Mortality Rate (U5MR), but within the state there is considerable rural-urban and male-female disparity (table 2.1). Further, the reduction in female IMR has registered slower pace than that of male IMR and urban IMR has declined much faster than rural IMR. The scenario on nutrition is worse, as would be seen subsequently. Thus, despite its decent growth performance Bihar is yet to work hard to achieve acceptable human development levels. In this regard, more than growth levels – it is the structure, composition and source of growth that has significant bearing.

According to India Human Development Report, 2011, among major Indian states Bihar ranks at 14. The report depicts that the ratio of HDI of Bihar and India was 0.755 in 1999-00, which improved to 0.786 in 2007-08. On the contrary, Bihar has registered an annual growth rate of 11.95 percent during the Eleventh Plan, surpassing the stagnation of the economy despite the fact that industrial resources went to Jharkhand while three-fourth of the population remained in Bihar (GoB, 2013). For past several years, Bihar has been in news for its high economic growth rates [higher than several developed states of India]. This is reflected in the improved level of total Gross Domestic Product (GDP) of Bihar, which currently stands at 17473357 Lakh Rupees (GOB, 2013-14 quick estimates) at constant prices and is more than double of its own value in 2004-05. Figure 2.1 shows the trend of both total GSDP and per capita GSDP of Bihar during 2004-05 and 2013-14 at constant prices. Bihar's total and per capita domestic products are continuously growing during the period except in 2005-06 during which the GSDP declined by 1.7% over previous year leading to a decline

of 3% in per capita GSDP. The growth in per capita domestic income of Bihar, though has been very high in certain years, has fluctuated significantly (figure 2.2). Figure 2.2 depicts annual growth in national GDP and Bihar's GSDP at constant prices during 2004-05 and 2013-14. While average annual growth of Bihar's real per capita income at approximately 8% has been higher than average annual growth of real per capita national income at 7.6%, growth in per capita GSDP has been far from consistent and has in fact, gone far below the growth rate in national real per capita GDP.

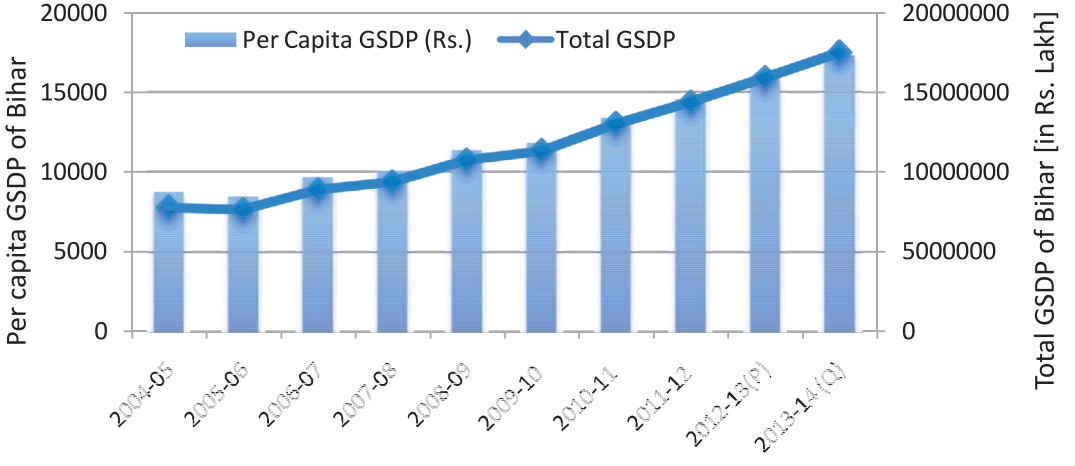


Figure 2.1: Total and Per Capita Gross Domestic Product of Bihar at constant prices [2004-05]
Source: Based on Directorate of Statistics and Economics, Govt. of Bihar

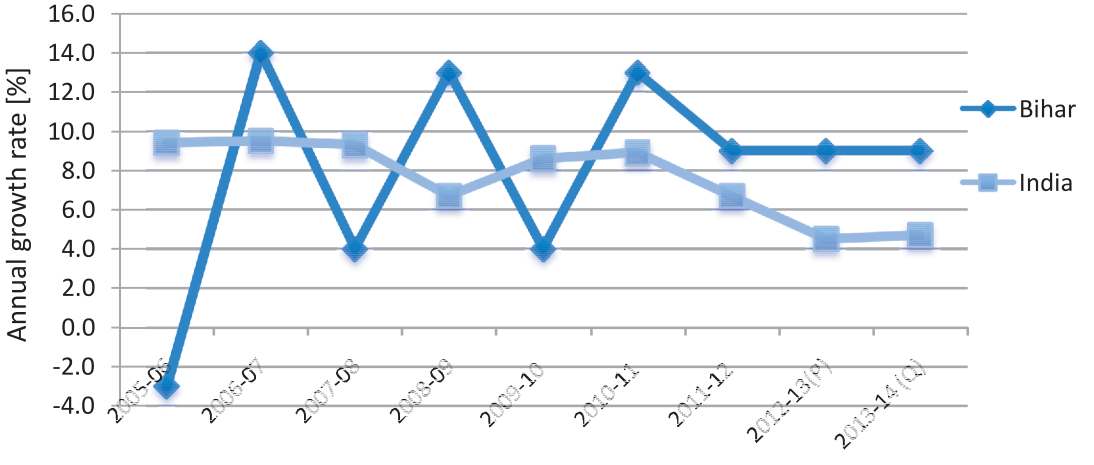
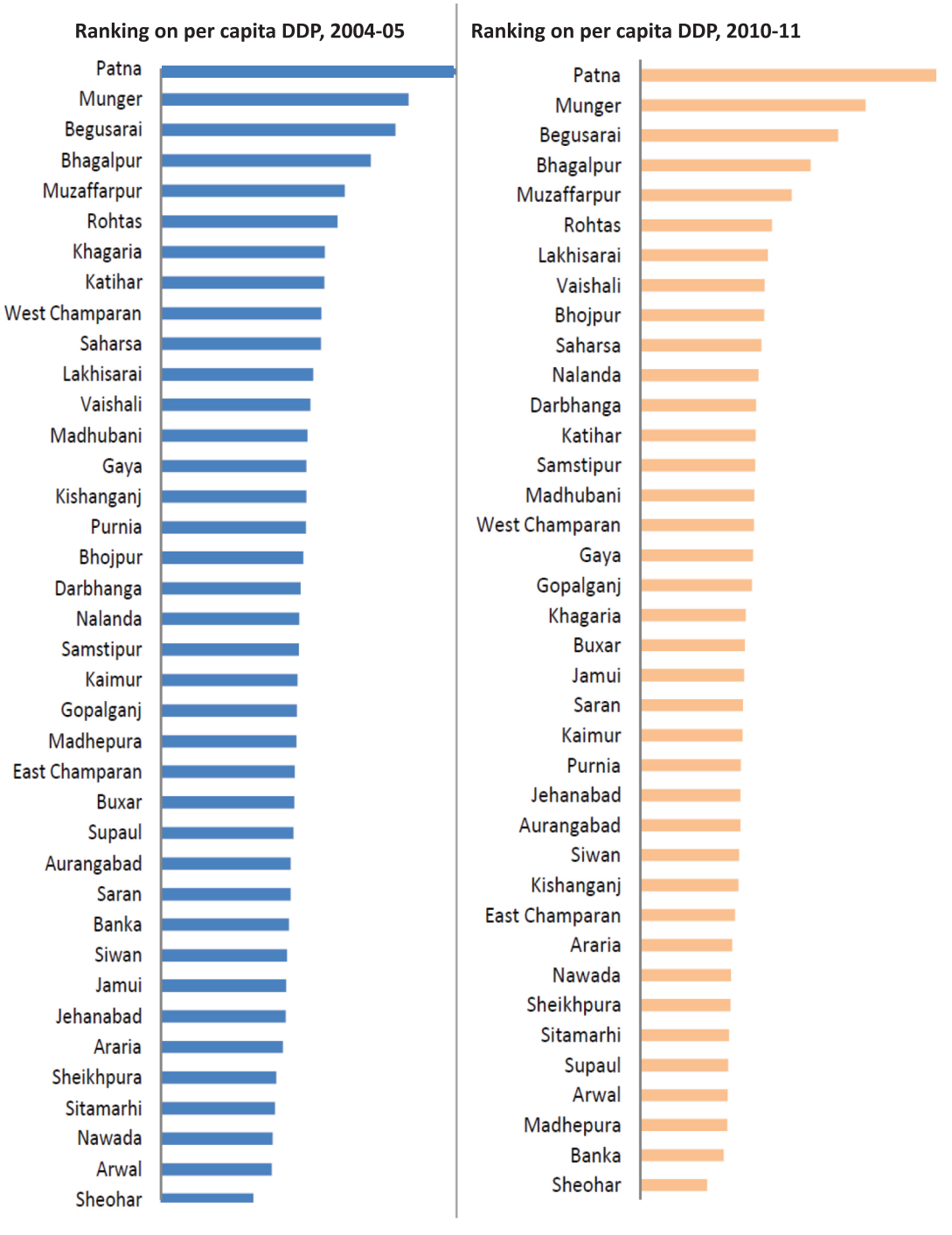


Figure 2.2: Annual Growth rate in National and Bihar Per Capita Gross Domestic Product at constant prices [2004-05]
Source: Planning Commission of India



Source : Planning Commission of India

Figure 2.3: Ranking of districts on per capita District Domestic Product during 2004-05 and 2010-11
Source: Based on Directorate of Statistics and Economics, Govt. of Bihar

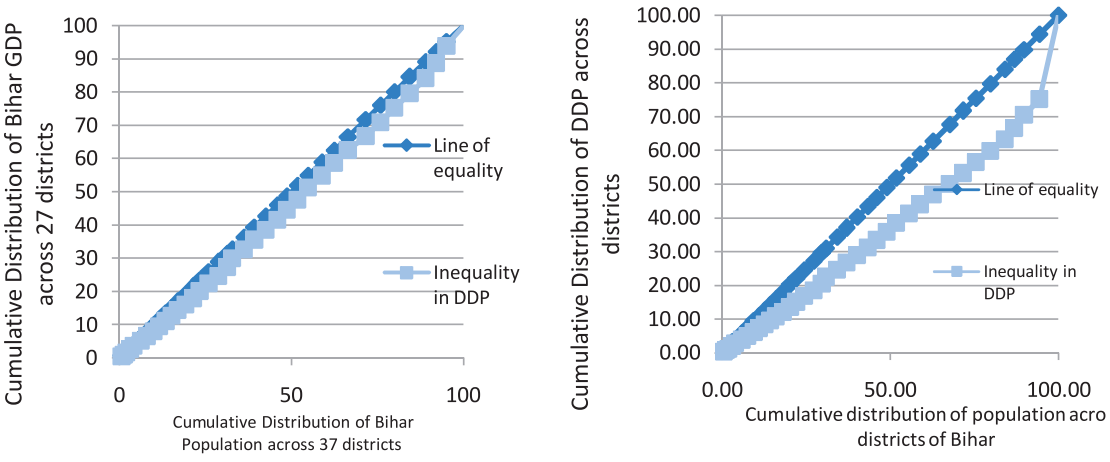


Figure 2.4: Lorenz curve for DDP across districts of Bihar [with and without Patna]
Source: Based on Directorate of Statistics and Economics, Govt. of Bihar

Among districts of Bihar except the five viz. Khagaria, Madhepura, Kishanganj, Banka and Supaul, all other districts of Bihar have registered an average annual growth rate of above 5% during 2004-05 and 2010-11. In fact, some of the districts including Munger, Begusarai, Madhubani, Bhojpur and Samastipur, have recorded an average annual growth of more than 9% during the same period. In terms of ranking on the basis of per capita income, Patna, Munger, Begusarai, Bhagalpur, Muzaffarpur and Rohtas retain their top position between 2004-05 and 2010-11 (figure2.3). Madhepura, Banka and Supaul are poor achievers of growth and rank lower during 2010-11 as compared to 2004-05 while Sheohar, despite achieving annual average growth of 6.31% during 2004-05 and 2010-11, retains its lowest position on per capita DDP ranking. Figure 2.4 shows inequality in distribution of District Domestic Product of Bihar including and excluding the district of Patna. It is apparent that inter-district inequality appears to be visible in Bihar only if Patna is included in the analysis. Once Patna is excluded from the sample, there is good deal of equality in distribution of state's GDP across remaining 37 districts of Bihar. In fact, Patna remains an outlier in Bihar with much higher than average per capita DDP, MPCE and other indicators of human development.

2.1 Structure of growth and employment

Bihar over past decade has witnessed some transformation in structure of its output. In Gross State Domestic Product (GSDP), the contribution of primary sector has declined from 31.59% in 2004-05 to approximately 19% in 2013-14, whereas that of secondary sector and tertiary sectors to 54.70% and 62.73% respectively (figure 2.5). Contribution of secondary sector has increased until 2010-11 and afterward it declines along with that of primary sector. In fact after 2010-11 the decline in contribution of primary sector is being

compensated by increase in that of the tertiary sector. Ostensibly, structural transformation in Bihar has been urban centric i.e. it has occurred in sectors that are located in urban areas, especially the service sector and therefore, has not benefited the rural Bihar. Alongside, agricultural growth rate has been fluctuating while rural non - farm and manufacturing sectors have stagnated

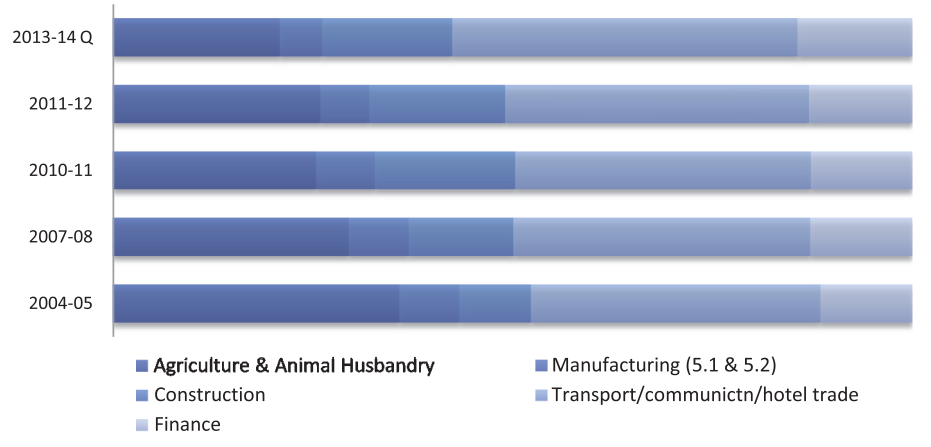


Figure 2.5: Change in relative importance of major sectors in Bihar's GSDP
Source: census 2001 and 2011

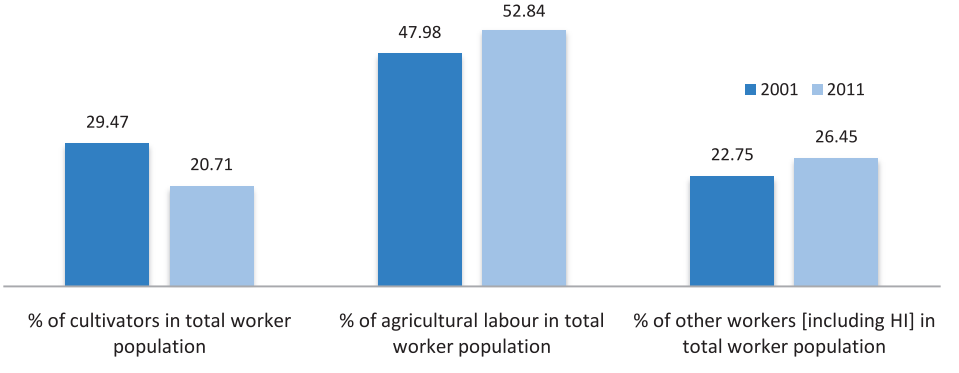


Figure 2.6: Distribution of working [main + marginal] population by occupation groups
Source: Census 2001 and 2011

In terms of occupational structure, despite a near 13% decline in share of agriculture in Bihar's GSDP, it continues to absorb approximately 63-64% of employment in Bihar. As the share of manufacturing remains stagnant in GSDP, so it is in employment in Bihar. At the same time the share of non-manufacturing – mostly construction and of services – mainly trade in hotels and transport, in employment in Bihar has increased. This change in employment structure can further be seen in relation to visible increase in marginalization of work participation, both for male and female workers (table 2.2), which can also be traced to declining trend in agricultural growth rates since 2011-12. There is a 10% of decline in

cultivator's share in agricultural employment, whereas the incidence of agricultural labour has in fact, increased from around 48% to 53% and so has the share of other workers (figure 2.6). Much of the underemployment and marginalization of workforce in rural Bihar can be attributed to underdeveloped structure of agriculture in the state.

Table 2.2: Male and female Work Participation Rate in Bihar

	Rural		Urban	
	2001	**2011**	**2001**	**2011**
Female main WPR	9.38	8.44	4.70	6.36
Male main WPR	40.42	31.18	37.66	36.79
Female marginal WPR	10.79	11.72	2.34	4.08
Male marginal WPR	7.21	15.49	4.04	8.11
Overall WPR	34.43	34	25.59	28.6

Source: Census of India 2011

Although, the government of Bihar has been taking several initiatives in terms of large scale usage of newer seed varieties and technology, agricultural extension services and mechanization drives, to restructure and strengthen agricultural in the state, the sector suffers from structural barriers – absence of land reform being the central one. For example, despite an increase in cropping intensity in Bihar over past few years, it still remains much lower than other major states such as West Bengal. The average size of operational holding in Bihar is 0.39 hectare in 2010-11 and is less than national average for all categories of farmers. Thus, around 70% of total land holding in Bihar continues to be of less than 0.5 hectare size (table 2.3). Such small holding size is indicative of less than subsistence farming in the state and hence under-employment of agricultural workforce. Small operational holding also pose as constrains for farm mechanization and is reflective of lower potential for increase in productivity. Clearly, the agrarian structure of Bihar is dominated by small and marginal farmers and the average size of holding is smaller than the national average for all categories of farmers. The predominance of agriculture in state's occupational structure coupled with inherent structural barriers and its declining contribution to state's income is resulting into greater marginalization of rural workforce and is in turn instrumental to low human development achievements of Bihar including consumption and food security outcomes.

Table 2.3: Average size of operational holding in Bihar (2010-2011)

State	Average Size Per Holding (In Ha.)					
	Marginal	Small	Semi-Medium	Medium	Large	All Size Groups
Bihar	0.25	1.25	2.59	5.09	14.45	0.39
India	0.38	1.42	2.71	5.76	17.37	1.16

Source: Ministry of Agriculture, Govt. of India. (Accessed through www.Indiastat.com)

2.2 *Some reflections on consumption and food security levels*

Lack of consistency could be a factor underlying much lower level of Monthly Per Capita Expenditure of Bihar at around Rs. 1091 than the national average of Rs. 1882 during 68th round of National Sample Survey (NSS). Thus, even though Bihar has registered relatively higher average annual growth rate in real per capita Net SDP during 2004-05 and 2011-12, MPCE level in the state despite having doubled, slides to be at the lowest witnessing a downslide from 2004-05, when it was second lowest after Orissa. Other states that have grown at lower average rate than Bihar have been able to more than double their MPCE levels between 61st and 68th rounds of NSS. Thus, despite being rated as high growth state in the country for past several years, Bihar remains one of the poorest states of India. Between 2004-05 and 2011-12, percentage of population below poverty line in rural and urban Bihar declined from 55.7 and 43.7 to 34.06 and 31.23 respectively, giving the average poverty ratio of approximately 55% and 34% during the two periods. Also, urban poverty remains consistently lower than rural poverty, as observed in case of almost all other major states. During the period 2004-05 to 2011-12, the poverty ratio has reduced by 20.66 percentage point in Bihar, while by 15.28 percentage point at all India level (GoI, 2013). However, there is a considerable amount of inter-district disparity in the poverty reduction.

Table 2.4: Group inequality in MPCE

	61st round [2004-05]		66th round [2009-10]	
	Rural	Urban	Rural	Urban
SC	344.68	639.10	697	980
ST	394.60	937.65	848	1684
OBC	419.58	614.96	759	1051
OTHERS	511.73	856.08	927	1733
All	417.11	696.27	780	1238

Source: NSS 61st and 66th rounds

If we look at social groups' progress with respect to MPCE, between 61st and 66th round of NSS, there is considerable increase in the same for all social categories and both in rural and urban areas (table 2.4). In rural areas, the increase is the highest for the Schedule Tribes category while in urban areas, it is for others' category. However, significant group inequality in level of MPCE persists both in rural and urban Bihar, though in urban areas, Scheduled Tribe category has achieved MPCE level that is comparable to others' category.

Food security and quality of life are dimensions that connect state's income and employment levels to its human development achievements. Table 2.5 gives per capita calorie intake in rural and urban areas of major states of India. Clearly, Bihar does not lag much behind other states of India. In 2009-10, there is a decline in the intake from its

previous levels in 2004-05 for both in rural and urban areas. But this decline is more than made up by increase in daily per capita calorie intake in 2011-12 which is comparable to national average. In fact, for rural areas, only Andhra Pradesh, Punjab, Haryana and Rajasthan have higher daily per capita calorie intake than Bihar.

The relative parity in calorie intake (an important determinant of nutrition) of Bihar with other states may also be attributed to the fact that calorie intake does not increase comparatively as income increases, due to change in food habits and preferences away from calorie consumption as the income progresses (Radhakrishna 2006). Given the lower level of per capita income in Bihar, it is less likely to be the case here. But it is the possibility in other states where increasing MPCE levels may be associated with less calorie intensive consumption.

Table 2.5: Per capita per day calorie intake [Kcal]

	Rural			Urban		
	2004-05	2009-10 sch1	2011-12	2004-05	2009-10 sch1	2011-12
Andhra Pradesh	1995	2047	2365	2000	1975	2281
Assam	2067	1974	2170	2143	2003	2110
Bihar	2049	1931	2242	2190	2013	2170
Gujarat	1923	1982	2024	1991	1983	2154
Haryana	2226	2180	2441	2033	1940	2443
Karnataka	1845	1903	2164	1944	1987	2245
Kerala	2014	1964	2162	1996	1941	2198
Madhya Pradesh	1929	1939	2234	1954	1854	2209
Maharashtra	1933	2051	2260	1847	1901	2227
Orissa	2023	2126	2215	2139	2096	2191
Punjab	2240	2223	2483	2150	2062	2299
Rajasthan	2180	2191	2408	2116	2014	2320
Tamil Nadu	1842	1925	2052	1935	1963	2112
Uttar Pradesh	2200	2064	2200	2124	1923	2144
West Bengal	2070	1927	2199	2011	1851	2130
all-India	**2047**	**2020**	**2233**	**1946**	**2123**	**2206**

Source: NSS 61st, 66th and 68th rounds

National Sample Survey 66th round data explicates that people of Bihar spend most of the income on food consumption. Rural Bihar spends 64.7 percent of monthly per capita expenditure (MPCE) on food component and urban Bihar 52.9 percent. Figure 2.7 shows that percentage of monthly expenditure incurred on food in rural as well as urban Bihar is much higher than the national average. Urban Bihar is the only among major states that

spends more than 50% of income on food, which indicates that Bihar remains relatively more vulnerable to food insecurity in case of income fluctuations. Further, if we look at the share of non cereals in average per capita calorie intake - an important indicator of consumption diversity and food security, both rural and urban Bihar ranks at the lowest in India (Figure 2.8). Only Assam and Orissa are comparable to Bihar wherein the share of non cereal in average calorie intake is just 31.2% and 37.9% for its rural and urban areas. For India on average these percentages stand at 39.6 and 49.6 respectively.

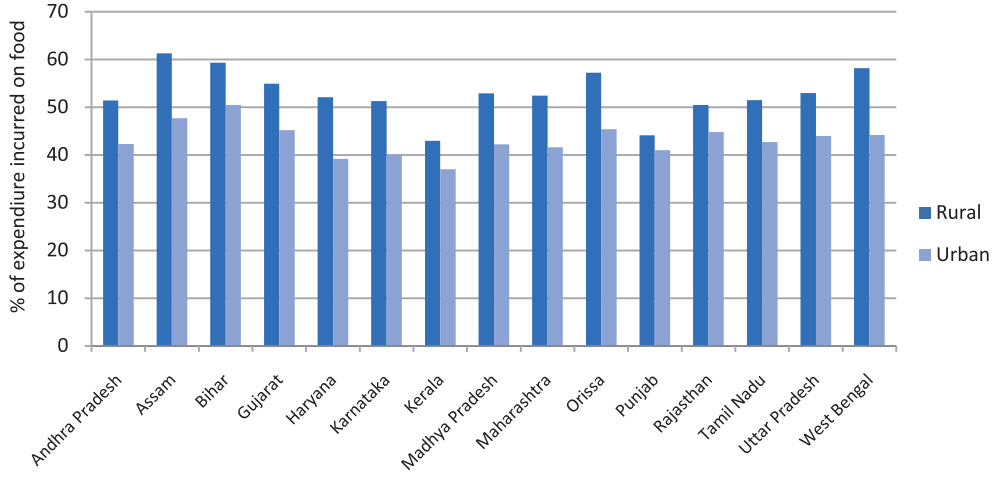


Figure 2.7: Percentage of consumption expenditure incurred on food in rural and urban areas of states
Source: Based on NSS 68th round, 2011-12

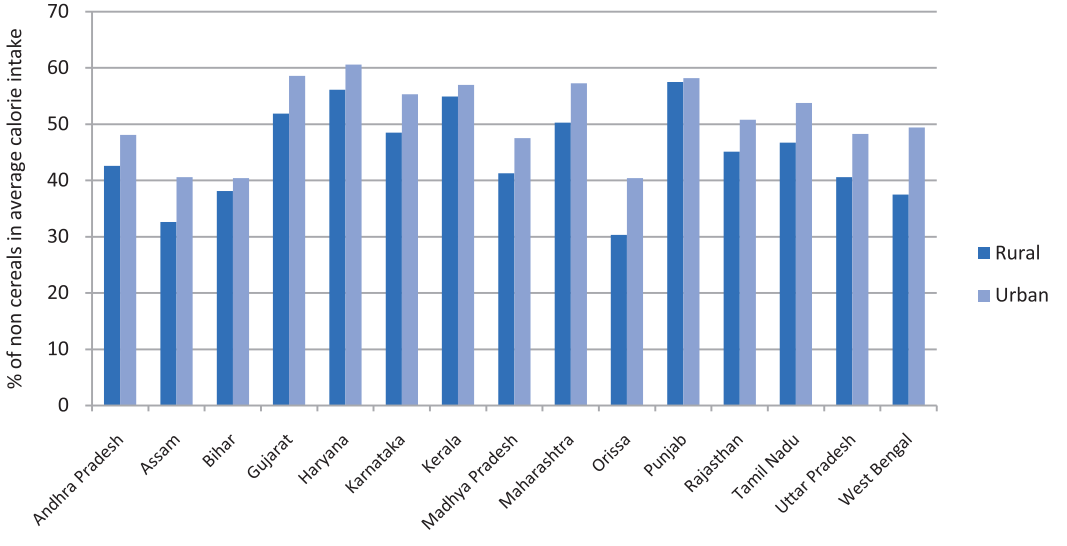


Figure 2.8: Percentage of non-cereals in average calorie intake of rural and urban areas of major states in India
Source: Based on NSS 68th round, 2011-12

If the role of Public Distribution System is looked at in Bihar's food security scenario, it is conspicuous by its low contribution. Table 2.6 shows percentage of households that have reported consumption of rice and wheat from PDS during last 30 days. Given the incidence of poverty in Bihar, the percentage of households relying on PDS for food consumption is rather low and significantly lower than the national averages for both rural and urban areas. The meagre contribution of PDS is particularly striking towards the consumption of wheat. However, recent evidences corroborate a substantial decline in leakages i.e. the proportion of rice and wheat that is released by the Food Corporation of India but fails to reach the consumers – in Bihar from 91% in 2004-05 to 24.4% 2011-12 (Dreze and Khera 2015).

Table 2.6: Percentage of household reporting consumption from PDS

State	Rice		Wheat	
	Rural	Urban	Rural	Urban
Andhra Pradesh	83.9	42.7	1.7	2.8
Assam	29.8	12.1	1.2	1.5
Bihar	12.2	4.2	12.7	5.4
Gujarat	33.8	8.3	34.5	10.5
Haryana	0.4	0.5	20.3	8.5
Karnataka	74.6	24.8	69.2	23.3
Kerala	54.3	42.5	32.8	28.5
Madhya Pradesh	23.0	8.5	45.7	24.0
Maharashtra	46.8	10.0	44.2	10.7
	51.6	18.9	5.2	7.5
Punjab	0.1	0.1	23.8	10.3
Rajasthan	0.2	0.1	17.9	11.6
Tamil Nadu	91.0	67.0	57.3	50.8
Uttar Pradesh	21.1	5.8	21.2	17.2
West Bengal	25.7	6.9	33.1	13.8
all-India	**39.2**	**20.6**	**27.6**	**17.6**

Source: NSS 66th round

3. Malnutrition in Bihar : Some interesting threads

According to the latest and fourth round of the National Family Health Survey (NFHS 4, 2015-16), a stupendous proportion of 48.3% of children in Bihar is stunted. While the disaggregated data from NFHS 4 is underway, the Rapid Survey On Children (RSOC), 2013-14 gives fairly recent account of child malnutrition in rural and urban Bihar as compared to the national average for India. As expected, the incidence of child malnutrition in terms of all the three anthropometric indicators viz. stunting, underweight and wasting

is relatively higher in rural Bihar than its urban parts (Table 3.1). Proportion of stunted children is 45% in urban Bihar as compared to 50% in the countryside. Similarly, incidence of underweight and wasting is higher in rural than urban Bihar by 5.3% and 2.9% respectively. Proportion of stunted and underweight children in Bihar is considerably higher than the average in India. Interestingly, the incidence of wasting among children at 13.1% is lower than the national average of 15.1% and this is true for rural as well as urban levels (table 3.1).

Table 3.1: Incidence of malnutrition among children of 0-56 months (in %)

	Stunted			Underweight			Wasting		
	Rural	Urban	Total	Rural	Urban	Total	Rural	Urban	Total
Bihar	50.0	45.0	49.4	37.7	32.4	37.1	**13.4**	**10.5**	**13.1**
India	41.6	32.0	38.7	31.6	24.3	29.1	15.1	15.0	15.1

Source: Rapid survey on children, 2013-14

Given that wasting is a symptom of recent acute under-nutrition usually as a consequence of low food intake or even bouts of starvation and stunting is a consequence of long term nutrition deprivation (UNICEF 1994, WHO 2010), the figures in table 3.1 appear to imply that Bihar is relatively less disadvantaged in terms of starvation or acute food insecurity and more disadvantaged in terms of long term and cumulative forms of deprivation, as compared to rest of the country. Earlier studies have also noted the lack of a necessary convergence between calories consumption and nutritional status wherein average calorie intake could be considered as poor indicator of population nutrition status (Deaton and Dreze 2009).

Table 3.2: Incidence of low BMI among girls and women (in %)

	Percentage of girls aged 15-18			Percentage of women aged 15-49		
	Rural	Urban	Total	Rural	Urban	Total
Bihar	45.7	42.0	45.2	31.8	22.2	30.4
India	44.9	44.2	44.7	-	-	-

Source: Rapid survey on children, 2013-14; NFHS 4, 2015-16

Table 3.2 gives status of nutrition among adolescent girls and women in Bihar. Based on RSOC, the percentage incidence of adolescent girls with a Body Mass Index (BMI) of less than 18.5 Kilograms per meter square is rather higher in Bihar at 45.2 and is slightly higher than the Indian average of 44.7. While incidence of low BMI among girls in rural Bihar is slightly higher than the average for rural India, the incidence for urban Bihar at 42% is less than the average for urban India at 44.4%. Although, status of nutrition among girls is alarming in Bihar, it is not much worse than the rest of the country. NFHS 4 data in table 3.2

depicts improved status of nutrition among women aged 15-49 years, which is somewhat surprising given the extremely low status among adolescent girls revealed by RSOC data. Percentage of women with low BMI is 30.4 which is relatively much lower than that among young girls. The only explanation this gap can be attributed to could be that if the status of nutrition among girls and women might have improved between the periods of the two surveys viz. RSOC (2013-14) and NFHS 4 (2015-16), which is unlikely. This leaves us with a question mark.

Further, figure 3.1 shows the percentage of the stunted among children in rural and urban Bihar by incidence of intensity. While 45% and 50% of children are stunted in urban and rural Bihar respectively, the incidence of severe stunting i.e. those with a height-age z-score of below 3 standard deviations is 23.3% and 26.4% respectively.

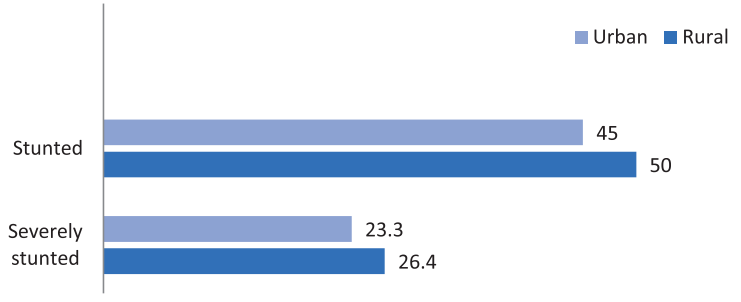


Figure 3.1: Percentage of stunted among children in Bihar by incidence of severity
Source: Based on Rapid survey on children, 2013-14

Table 3.3: Trend of child malnutrition in Bihar (in %)

	Stunting		Underweight		Wasting	
	Rural	Urban	Rural	Urban	Rural	Urban
NFHS 2	55.0	42.2	55.1	47.4	21.4	17.1
NFHS 3	56.5	48.4	57.0	47.8	27.4	25.2
NFHS 4	49.3	39.8	44.6	37.5	20.8	21.3

Source: Various rounds of NFHS

Table 3.4: Trend of malnutrition among women in Bihar (in %)

		NFHS 2	NFHS 3	NFHS 4
Low BMI	Rural	40.3	47.6	31.8
	Urban	31.1	32.0	22.2
Anaemia	Rural	63.9	67.6	60.5
	Urban	59.6	66.7	58.7

Source: various rounds of NFHS

Table 3.3 and 3.4 give trend of malnutrition among women and children through the three rounds of NFHS. It is indeed unfortunate to note that between the second and third rounds of NFHS i.e. during 1998-99 and 2005-06, there is no decline in the incidence of child malnutrition in Bihar and in fact, on the contrary the level has increased. This is true for both

rural and urban Bihar. In rural areas, the incidence of stunting among children below three years of age, increased from 55% to 56% while in urban areas it rose from 42.2% to 48.4%. Similarly the incidence of wasting increased from 21.4% to 27.4% in rural Bihar while in urban Bihar it increased from 17.1% to 25.2%. Further, the increase has been considerably higher in urban Bihar, which indicates that despite its low level of urbanization, the state needs to give attention to urban areas and its challenges. The increase in incidence of underweight among the children is relatively less during this period. Thankfully, the period between the second and the third rounds of NFHS did witness a decline in all indicators of child malnutrition. Significant decline is observed in incidence of underweight from 57% to 44.6% in rural Bihar and 47.8% to 37.5% in urban Bihar. This is followed by nearly similar decline in incidence of wasting (table 3.3). Incidence of stunting among children also reflects a decline both in rural as well as urban Bihar, from 56.5% to 49.3% and from 48.4% to 39.8% respectively. As seen from table 3.4, percentage incidence of low BMI among adult women follows similar pattern as child malnutrition. However, the extent of change in incidence of low BMI among women between various rounds of NFHS has been higher than the change in child malnutrition wherever the latter increases and less than the change in child malnutrition when the latter falls. Level of anaemia among women has also declined during last two rounds of NFHS.

3.1 Maternal nutrition and child stunting: a weak link in Bihar?

Table 3.5 and table 3.6 give a comparative picture on Bihar vis.-a-vis. other states of India. The poor score Bihar obtained on the India State Hunger Index (ISHI), is reflected in the abysmal level of children and women's health in Bihar. Bihar is placed at the bottom among the states on all indicators of nutrition. More than half of the children below 5 years are stunted and underweight (-2SD).

Table 3.5: Child malnutrition: Bihar in comparative perspective

Status	Indicator	Bihar	India	Best Value	Worst Value
Stunting	Percentage below -3SD	29.1 (27)	23.7	1 (Tamil Nadu)	32.4 (Uttar Pradesh)
	Percentage below -2SD	55.6 (28)	48	24.5 (Kerala)	56.8 (Uttar Pradesh)
Wasted	Percentage below -3SD	8.3 (25)	6.4	1 (Punjab, Manipur)	19.9 (Meghalaya)
	Percentage below -2SD	27.1 (26)	19.8	9 (Manipur, Mizoram)	35 (Madhya Pradesh)
Underweight	Percentage below -3SD	24.1 (26)	15.8	4.7 (Kerala, Manipur)	27.7 (Meghalaya)
	Percentage below -2SD	55.9 (28)	42.5	19.7 (Sikkim)	56.5 (Jharkhand)

Note: number in parentheses indicates Bihar's rank among 29 states

Source: based on NFHS 3

Table 3.6 also shows that child stunting scenario in both rural and urban Bihar is worse among the states and it is Madhya Pradesh only which is slightly closer to Bihar. The situation in terms of the incidence of malnourishment among women in rural and urban Bihar at 31.8% and 22.2% respectively is no better. During the NFHS 3, states such as Assam were not much better than Bihar on child nutrition indicators, however during the period between the two rounds of NFHS – 2005-06 and 2015-16, other states seem to have made much greater progress than Bihar. This is evident well from figure 3.2.

Table 3.6: Incidence of stunting among children and low BMI among women in major states

State	Stunted		Women with low BMI	
	NFHS 3	NFHS 4	NFHS 3	NFHS 4
Andhra Pradesh	42.7	31.4	33.5	17.6
Assam	46.5	36.4	36.5	25.7
Bihar	55.6	48.3	45.1	30.4
Haryana	45.7	34	31.3	15.8
Karnataka	43.7	36.2	35.5	20.7
Madhya Pradesh	50	42	41.7	28.3
Maharashtra	46.3	34.4	36.2	23.5
Tamil Nadu	30.9	27.1	28.4	14.6
Uttarakhand	44.4	33.5	30	18.4
West Bengal	44.6	32.5	39.1	21.3

Source: NFHS 4 (2015-16)

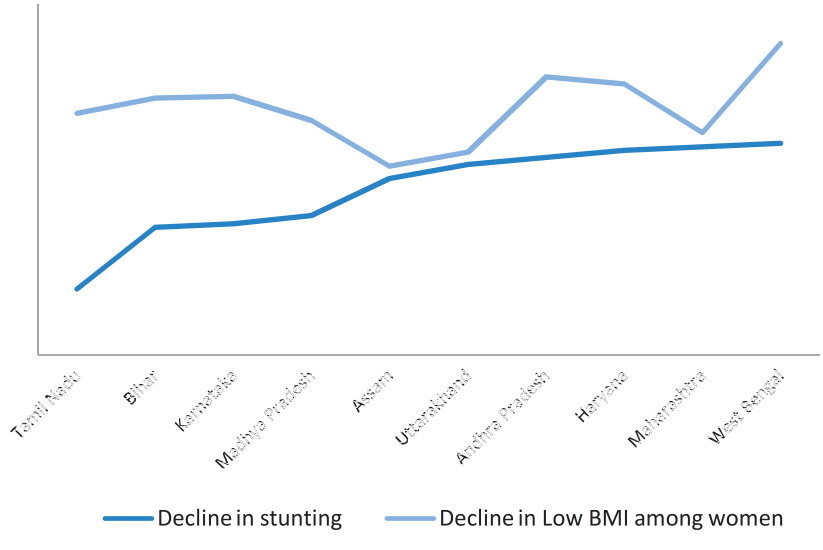


Figure 3.2: State wise decline (in %) in child stunting and low BMI among women between NFHS 3 and NFHS 4
Source: Based on NFHS 3 and NFHS 4

Figure 3.2 gives decline in the percentage incidence of stunting among children and of low BMI among women of 15-49 years age. Evidently, Bihar has witnessed second lowest decline (of 7.3%) in incidence of child stunting, after Tamil Nadu which saw a decline of 3.8%. However, Tamil Nadu already had relatively much lower level of stunting (30.9%) during NFHS 3 and therefore, even a decline of 3.8% brings its stunting level 27.1% during NFHS 4 - the lowest among the listed states. In comparison with other states which had high levels of child stunting during NFHS 3 - such as Madhya Pradesh, Assam, Haryana and Maharashtra – Bihar has lagged significantly behind in addressing the issue. Firstly, the NFHS 3 level of stunting in Bihar at 55.6% was horrendous and secondly the decline has not been drastic, which gives yet unacceptable level of stunting at 48.3%. At the same time, the state has been able to arrest the incidence of low BMI among women almost at comparable levels as other key states. Bihar has witnessed 14.7% decline in incidence of low BMI among women which has come down to 30.4%. This decline is higher than those observed in other states such as Madhya Pradesh, Assam, Uttarakhand and Maharashtra (figure 3.2).

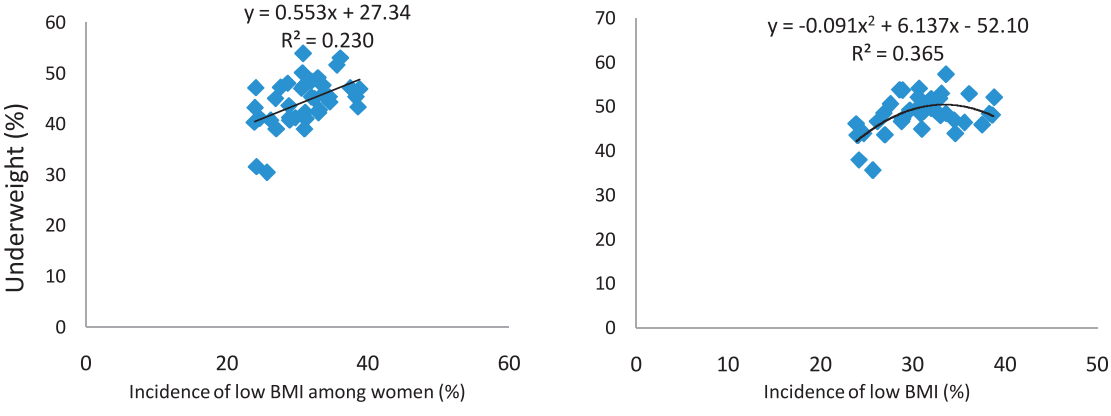


Figure 3.3: Scatter between incidence of stunting and underweight against incidence of low BMI among women across districts

Source: Based on NFHS 4

Figure 3.3 is a depiction of collinearity between incidences of child stunting and underweight on one hand and incidence of low BMI among women on the other. While a direct and linear causality is observable between women's low BMI and children's underweight levels, the relationship between child stunting levels and that of women's low BMI does not appear to be linear. In fact, the level of stunting among children, first increases at increasing rate, as the level of low BMI among women increases and then increases at decreasing rate with respect to the latter. At the same time, the level of underweight among children is more or less increasing linearly with the incidence of low BMI among women across districts. This further strengthens the observation made earlier on the basis of figure 3.2. The relationship between undernutrition among women as measured by low BMI and malnutrition among children as measured by stunting is not invariably strong in Bihar.

Thus, the first interesting observation from the above is that Bihar has been able to arrest the incidence of low BMI among women almost at comparable levels as other key states. However, this is not the trend in context of child stunting. The visibly incongruent trend in the performance of stunting and low BMI indicators in Bihar between third and fourth rounds of NFHS necessarily brings us to the conclusion (subject to further testing) that the decline in malnutrition among women has not been able to translate into a corresponding decline in child stunting. In other words, there are factors other than the mother-child reproductive link that are responsible for high stunting levels in Bihar. Of course this hypothesis is subject to further examination.

3.2 Malnutrition and equity in Bihar: inequalities accumulate through early childhood

If the incidence of child malnutrition is assessed from an equity perspective, it discerns that malnutrition is concentrated among certain social groups (typically various castes) and it is this group specific concentration that is keeping the average malnutrition levels in Bihar rather high. For example, as per the RSOC data the percentage of underweight and wasted children is 27.5 and 11.7 respectively among general (non-backward) caste categories, the same is 46.5 and 14.7 respectively among the Schedule Caste (SC) categories, 38.4 and 14.2 among Schedule Tribes (ST) categories and 35.4 and 12.7 among the Other Backward Class (OBC) categories. As such child malnutrition is indeed a group phenomenon in Bihar. Figure 3.4 brings out inequity in the percentage incidence of stunting and severe stunting among children in Bihar. While the percentage of stunted children is 35.4 within the other caste category, within the SC, ST and OBC groups it is staggering at 57.6, 48.9 and 49.5 respectively. This reflects an extremely dismal picture as far as equity in child stunting is concerned.

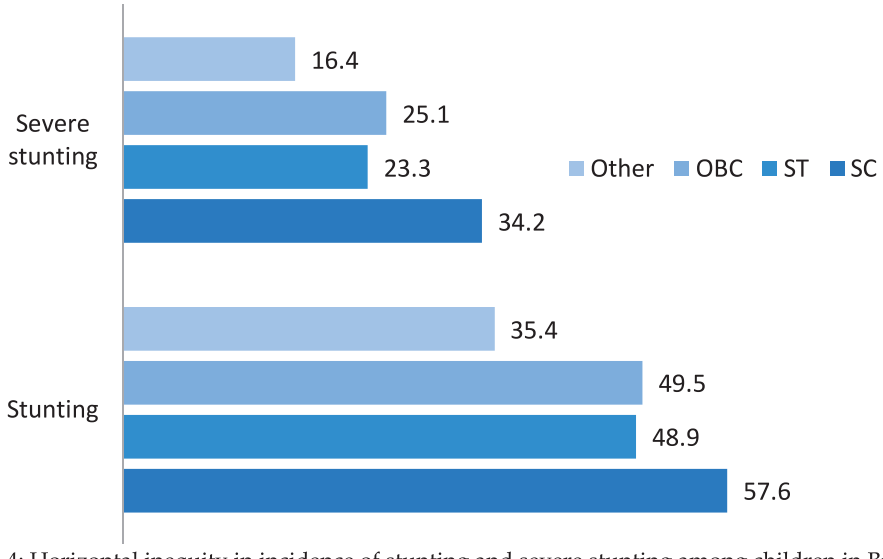


Figure 3.4: Horizontal inequity in incidence of stunting and severe stunting among children in Bihar (%)

Source: Based on Rapid survey on children, 2013-14

Further, there is considerable inter-group variation in incidence of severe stunting as well. Percentage of severely stunted children is 16.4 within 'other' group whereas it is 34.2, 23.3 and 25.1 among the SC, ST and OBC groups respectively. The fact that 25-35% of children in certain social groups is severely stunted i.e. is 3 Standard Deviations below standard height-age z- score is indicative of an alarming state. Further, if relative inequity is observed in terms of the distance between each social group vis.-a-vis. the other (non backward) caste group, figure 3.4 also reveals that the distance is the highest between 'others' and SC - both for stunting as well as for severe stunting. Interestingly, among the three socially backward groups, it is the ST which is located at the least distance from 'other' category. SCs are worse than both STs and OBCs.

Table 3.7: Percentage of Low Birth Weight and low BMI among adolescent girls in Bihar

	SC	ST	OBC	Other
LBW	19.6	21.6	18	17.6
Girls with low BMI	47.4	--	44.7	44.5

Source: Rapid survey on children, 2013-14

Table 3.7 shows that the incidence of low birth weight is 19.6% among the SC categories as compared to 17.6% among the 'other'. It is the highest among the STs at 21.6% whereas among the OBCs it is 18%. Percentage of adolescent girls with low BMI is comparable between OBC and other, but among the SCs it is 47.4. Interestingly, as is observed from figure 3.5, the inter-group disparity in incidences of low birth weight is not so high as in incidence of child stunting noted in figure 3.3. Moreover, the percentage of low birth weight is higher among SCs than others by only 2 % while the percentage of stunted children among them is higher than others by approximately 8%. This is corroborated from figure 3.5, which shows the difference in incidences of stunting, underweight and low birth weight between SC, ST, OBC on one hand and 'other' category on the other. The distance, as is apparent, is the highest in case of child stunting but for both stunting and underweight, it is much higher than the gap in percentage of low birth weight. Although, these incidences of low birth weight and malnutrition pertain to different cohorts, it is clear that nutrition deprivation is relatively greater among children than among new born babies. Thus, second emerging thread vis-a-vis., malnutrition in Bihar is that nutrition deprivation accumulates over the child's early growth year. Perhaps this is one reason due to which the reflection on weak reproductive link between women and child nutrition has been observed earlier after a review of figure 3.2.

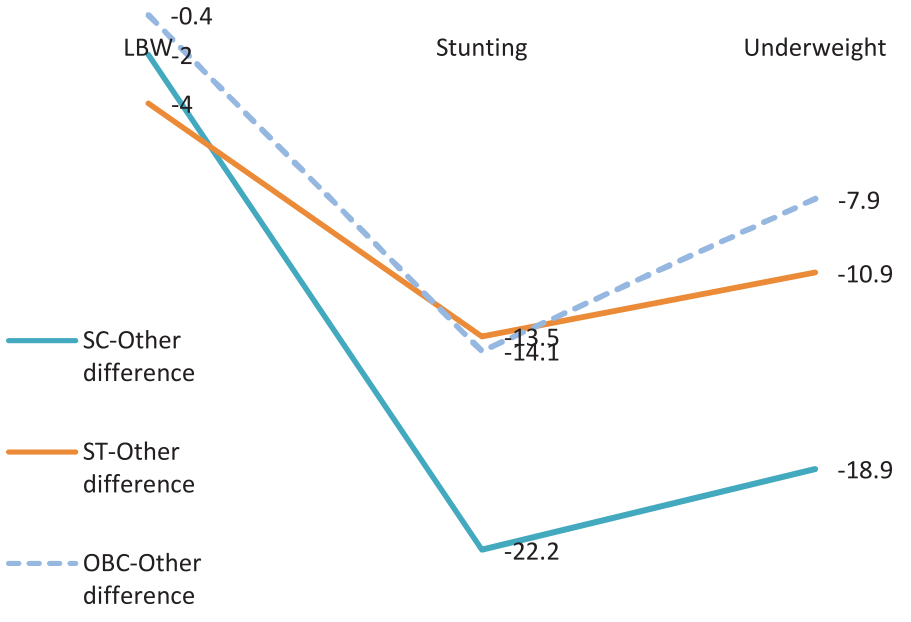


Figure 3.5: Accumulation of inequality from the stage of birth onwards
Source: Rapid survey on children, 2013-14

Table 3.8: Group wise trend of malnutrition among women and children

		NFHS 2	NFHS 3	RSOC
Stunting	SC	57.6	68.7	57.6
	ST	56.4	--	48.9
	OBC	54.7	54.2	49.5
	Other	45.1	47.7	35.4
Underweight	SC	58.5	69.6	46.4
	ST	59.7	--	38.4
	OBC	55.8	55.0	35.4
	Other	43.1	46.1	27.5
Wasting	SC	23.1	33.7	14.7
	ST	33.5	--	14.2
	OBC	19.7	27.3	12.7
	Other	18.3	21.2	11.7
Women's low BMI	SC	46.7	58.3	47.4*
	ST	41.0	--	--
	OBC	38.8	43.2	44.7*
	Other	32.2	39.4	44.4*

Source: Various rounds of NFHS and RSOC 2013-14, *for adolescent girls only

Figure 3.6 gives further light to the level of inequity in decline in child malnutrition across social groups during 1998-99 and 2013-14. As observed, the SC group remains the most disadvantaged as far as progress towards nutrition security is concerned. In fact, it is a sad picture to see that the decline in incidence of stunting is zero among children of SC social group. However, the interpretation must keep in notice that while NFHS 2 gives nutrition status for children below three years of age RSOC (also NFHS 4) gives the data for children below five years of age. Accordingly, it is likely that the under-five children in SC group also may have witnessed some improvement in nutrition. However, in terms of inequity, it still would fare the worst as far as reduction in malnutrition is concerned. The incidence of underweight and wasting however has also declined considerably for SC group children. In case of underweight and wasting, the largest decline is observable among children of ST group while in case of stunting it applies to 'other' group. The OBC group falls somewhere between. Both figure 3.6 and table 3.8 indicate that the overall progress in reducing malnutrition is held back by the lack of progress in SC group, particularly in case of child stunting. In temporal sense, any achievement is discernible only between last two rounds of the NFHS.

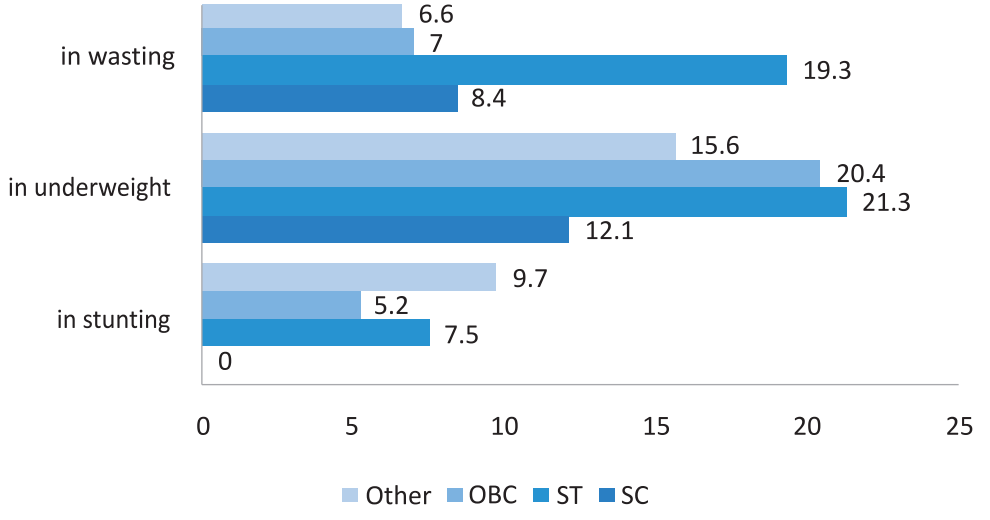


Figure 3.6: Inequity in decline in child malnutrition during 1998-99 and 2013-14
Source: based on NFHS 2 and RSOC (2013-14)

3.3 Extremes in spatial performances

Figure 3.7 depicts the percentage incidence of stunting, underweight and wasting among children below five years of age across the 38 districts of Bihar. Among the districts Sitamarhi has the highest level of child stunting at staggering 57.3%. In fact, nine districts of Bihar viz. Vaishali, Gaya, Jehanabad, Nalanda, Lakhisarai, Kaimur, Madhepura, Purnia and Seohar, have more than 50% of their children as stunted, which is extremely

discouraging scenario. Gopalganj at 35.6% has the lowest proportion of the stunted among children below five years of age. Siwan is the only district after Gopalganj, which has an incidence of child stunting below 40%. Percentage incidence of underweight among children is the highest in Arwal at 54 followed closely by Gaya (53.1), Sheikpura (51.7) and Nalanda (50.2). Gopalganj (30.5) Siwan (31.6), Pashchim Champaran (39.1) and Begusarai (39.1) are the only districts with an incidence of child underweight of below 40%. In terms of wasting Seohar (14.8%) and Siwan (15.4 %) have the lowest levels followed by Gopalganj (16.5%). Arwal, Sheikpura, Jamui and Patna have unacceptably high incidence of wasting among children at or around 30%. Among the districts of Bihar, Gopalganj fares relatively much better on child nutrition indicators and in fact incidence of child stunting at 35.6 % and underweight at 30.5% in the district is comparable to some of the major states listed in table 3.6. Moreover, all the districts of Bihar have an unacceptably high incidence of child stunting except Gopalganj and Siwan where incidence of stunting among under-five children is 35.6% and 37.9% respectively. Although 35-37% of stunting incidence is not low per se, the very high incidence in other districts makes Gopalganj and Siwan – cases worth review. Seen in reference to the other extreme performances of districts with above 50% of child stunting among children, the district of Gopalganj deserves a separate inquiry.

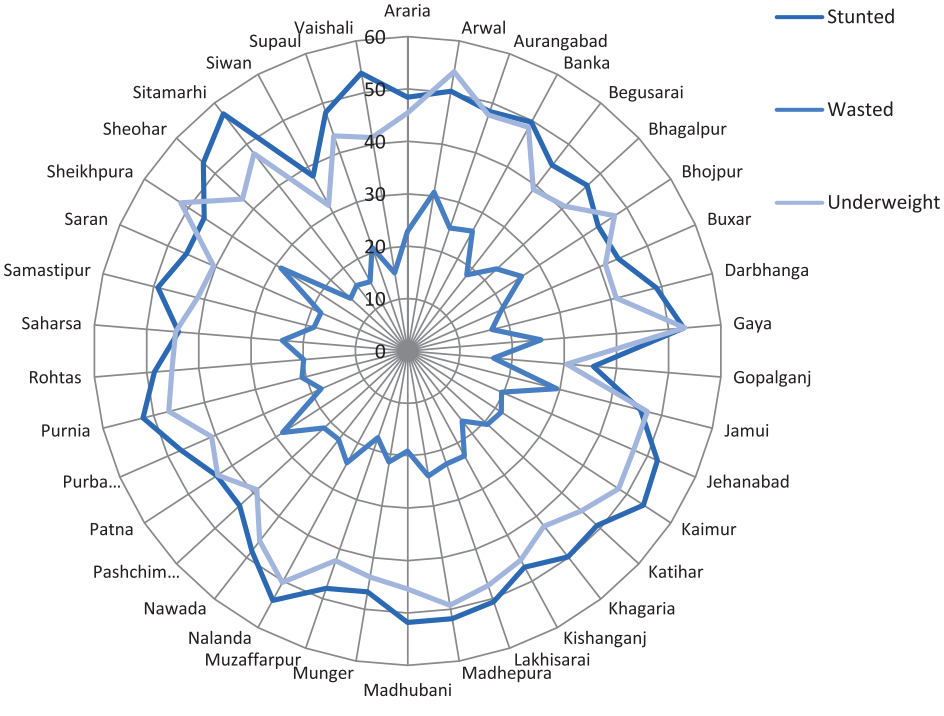


Figure 3.7: Extent of child malnutrition across districts of Bihar
Source: Based on NFHS 4

Figure 3.8 gives district wise incidences of women with low BMI (of less than 18.5 kg/meter square) and of anaemic women. With the percentage of women with low BMI and with anaemia at 38.8 and 72.2 respectively, women's undernutrition is the highest in Purnia district of Bihar. Sitamarhi, Siwan, Gaya, Banka and Paschim (West) Champaran are among the districts where more than 65% of women are anaemic. After Purnia, the percentage of women with low BMI is very high in Gaya, Jamui and Supaul at above 35%. There appears a broad overall correspondence between the incidence of low BMI and of anaemia among women, across districts, which is understandable.

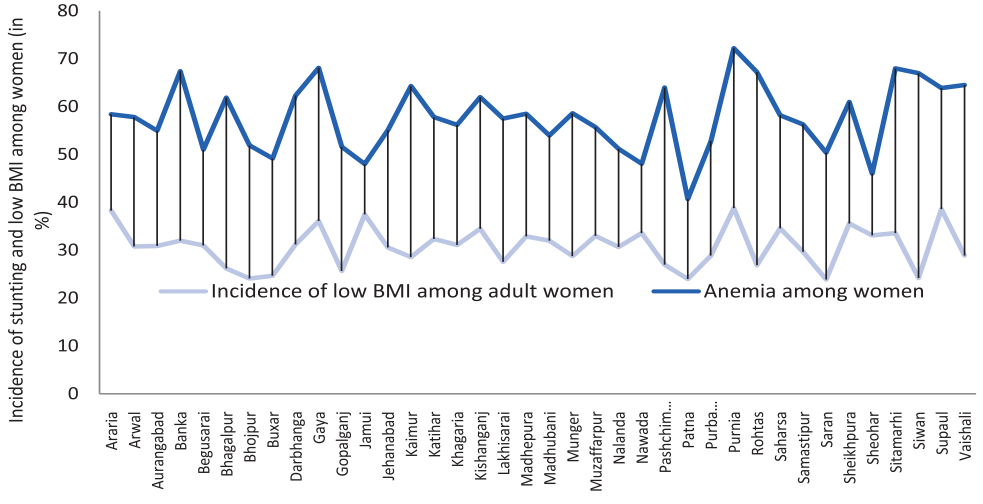


Figure 3.8: District wise incidence of women with low BMI and anaemia in districts of Bihar

Source: Based on NFHS 4

4. Explaining malnutrition: does Bihar repeat the story?

Empirical analysis of malnutrition has been saliently governed by UNICEF's conceptual framework on determinants of child malnutrition[2]. The framework classifies causes of malnutrition as basic, underlying and immediate, which together establish that child malnutrition particularly, incidence of stunting among children, is a multidimensional phenomenon determined by various socioeconomic, cultural and behavioural factors with ramifications for quality of life, child care practices, health seeking attitude, gendered norms and so on (Vir 2016, Pillai and Rodriguez 2015, Mukhopandhyay 2015, UNICEF 2011, Haddad 2015, 1999, Haddad et al 1996; Smith et al. 2003, Ryan and Spencer 2002). This section attempts to estimate predictors of child stunting in Bihar using both NFHS 4 data at district level and NFHS 3 micro data at unit level. This analysis is helpful in explaining some interesting threads that have emerged in earlier sections and establishes as to at which level of UNCIEF's conceptual framework does Bihar fails or lags behind. This exercise ostensibly has significant policy lessons as well.

[2]UNICEF's conceptual framework on determinants of malnutrition
https://www.unicef.org/sowc98/fig5.htm

The analysis of secondary data has been done using detailed descriptive and multivariate techniques. The latter includes district level multiple regression using NFHS 4 data and logistic regression using NFHS 3 micro data for India and Bihar. Although, child malnutrition is assessed in terms of three anthropometric measures viz. stunting, underweight and wasting. The regression analysis is conducted only for stunting among children. This is done deliberately since stunting is an appropriate measure of vulnerability caused through food and nutrition insecurity and it is associated with functional impairment that persists later in life (Nojomi et al, 2004, Milan et al, 2002 and Monabolo et al, 2005). Stunting also indicates long term cumulative consequence of inadequate diet, poor nutrition and feeding practices as well as frequent infection and illness. The stunting status of children is calculated by comparing their actual height-age ratio with the nutritional status of an international reference population recommended by the World Health Organization. The height – age ratio is expressed in standard deviation units (z-scores) from the median for the international reference population. Children who are more than two standard deviations below the reference median on any of the indices are considered to be undernourished.

For district level multiple regression analysis, percentage of under-five children stunted in the district is the dependent variable. The sample for this analysis includes 38 districts of Bihar. For the logistic model, the dependent variable of child stunting is dummy variable of binary nature taking the value of (Y= 1), if the child is stunted and of Y=0, if the child is not stunted. The independent variables in either case include various socio-economic, demographic and woman specific variable, both of continuous and binary nature. The logit model to determine in which category a child is likely to fall, may be constructed as follows:

$$Logit\left(\frac{p(y=k)}{p(y=j)}\right) = \alpha + \sum_{i=1}^{m} \beta_i X_i \quad \text{..... (1)}$$

k=1, 2,……..n-1; j ≠ k= Reference category; n= Number of category of the response variable; X_i s are the predictors and β_i are the logistic regression coefficient associated with the predicators; m is the number of predicators.

L.H.S. of the Model represents the logit or the log of odds of a child falling in the category (k= Stunted) compared to the reference category (the reference category: j= no stunted).

Tables 4.1 and 4.2 give results from multiple regression and logistics regression respectively based on NFHS 4 district level data and NFHS 3 micro level data for Bihar. As seen from table 4.1 on multiple regression estimates for 38 districts of Bihar, care practices and behavioral factors appear as significant determinants of child stunting in Bihar and together they explain approximately 40% variation in the latter. This result is explained well using large scale micro data which is not yet available from NFHS 4. Table 4.2 using estimates

based on NFHS 3 micro data can be considered to explain malnutrition in Bihar, assuming that the dynamics itself has not undergone a transformation over past years.

Table 4.1: Multiple regression estimates for child stunting on underlying determinants [District level, Bihar]

	Co-efficient	Standard error
Coefficient	61.69867	12.32435
% of HH with improved sanitation	-0.09409	0.112254
Mothers with min four antenatal visit	0.017071	0.195905
Exclusive breastfed below 6 months	-0.11142*	0.052607
Mothers who consumed iron folic acid for 100 days or more when they were pregnant (%)	-0.44345**	0.159413
Children age 6-8 months receiving solid or semi-solid food and breastmilk10 (%)	-0.26692**	0.093342
women with more than 10 years schooling	0.369322	0.200055
women aged 15-49 years who are anaemic	0.14748	0.162632
Institutional births (%)	-0.21034**	0.089399
6-23 months' children adequate diet	0.47987*	0.215242
F (9,27) = 3.47, R - Squared = 0.536, Adjusted R - Squared = 0.382 *~significant at 95% significance level, **~significant at 99% significance level		

Table 4.2 gives logistic estimates for child stunting separately on socio-demographic and on behavioural and care variables. The test statistics given in table 4.2A and 4.2B indicate that the models are a good fit, although each of them explains maximum 65% of variation in the dependent variable i.e. the likelihood of a child being stunted. This is obvious since both socio-economic-demographic as well as behavioural and care variables influence child nutrition outcomes. Yet here separate estimation has been done on these two categories of predictors since the behavioural and care variables are invariably mediated by socio-economic variables. Together, these two models effectively predict the incidence of child stunting in the state of Bihar. Maternal education and household's wealth status appear as significant determinants of incidence of stunting among children in Bihar. While religion of household does not seem to make any difference Similarly, child's likelihood of being stunted increases as her/his age increases, child from a Scheduled Caste (SC) household has significantly higher probability of being stunted as compared to those in households from general caste categories. As the number of births in last five years increases, so does the probability of each child being stunted. Sex of the child does not make a difference in stunting outcomes. An interesting finding is the positive impact of mother's access to money for independent use, which implies that the greater the access of mother to money for own use, the lesser is the probability that her child will be stunted. This happens because mother's propensity to spend each additional unit of her income on her children is usually higher than the father.

Table 4.2: Logistic estimates for stunting on socio-demographic variables and behavioral/ care variables [Bihar]

A. Estimates for stunting on socio-demographic variable			B. Estimates for stunting on behavioral and care variable		
	Standard Error	Exp(B)		Standard Error	Exp(B)
Mother's education level: high educated			Access to toilet: yes		
No education	.366	1.913*	No	0.142	1.619**
Primary education	.381	1.482	Access to Vitamin A dose in last 6 months: Yes		
Secondary education	.349	1.398	No	0.265	1.438*
Household wealth status: Richest			Pre natal check with doctor: Yes		
Poorest	.236	3.042**	No	0.140	1.399**
Poorer	.228	3.043**	Had diarrhea recently: No		
Middle	.229	3.073**	Yes	0.174	1.069
Richer	.218	2.035**	Child has health card: Yes		
No. of births in last 5 years	.069	0.886*	No	0.124	1.497**
Child sex: female			Mother is anemic: No		
Male	.094	0.905	Moderate	0.523	0.756
Child's age	.033	1.408**	Severe	0.177	1.396*
Household's religion: Muslim			Mild	0.137	1.128
Hindu	4.018E4	0.000	Constant	0.315	0.330
Christian	4.018E4	0.000	Percentage correctly predicted: 60% Nagelkerke R^2 = 0.060 Hosmer Lemeshow test X^2 (7):8.431; Significance = 0.296 Model Chi Square X^2 (9) = 55.65.29**		
Others	5.683E4	0.000			
Household's caste: general					
SC	0.181	1.831**			
ST	0.578	1.222			
OBC	0.140	1.295			
Mother has money for own use: Yes					
No	0.096	0.846*			
Constant	4.018E4	2.673E8			
Percentage correctly predicted: 65% Nagelkerke R^2 = 0.152 Hosmer Lemeshow test X^2 (8): 11.98; Significance = 0.145, Model Chi Square X^2 (17) = 238.53**					

*significant at 0.05 level; ** significant at 0.01 level

Table 4.2 B establishes the significant role of behavioural and care factors towards the incidence of stunting among children in Bihar. Access to toilet very significantly improves a child's chances of not being stunted. Health and care practices such as pre-natal medical check up and access to Vitamin A dosages also have significantly positive impact on child's height. Having a health card is a proxy for responsible child health practice and does affect child nutrition in a positive manner. Diarrhoea in children is one of the immediate and direct drains on child's nutritional well being and therefore child's exposure to diarrhoea in recent past reflects increased likelihood of a child being stunted.

4.1 The picture on stunting is explained by the behaviour of underlying determinants

Aforementioned findings do explain the downward rigidity in the incidence of child stunting in Bihar. A decline in same would ostensibly emerge from an improvement in the performance of the state in terms of determinants that are statistically significant. Figure 4.1 depicts the percentage points by which the status of given underlying determinants of stunting has improved between the third (2005-06) and the fourth (2015-16) rounds of NFHS. Clearly, all indicators have witnessed some improvement over last 10 years, though there is a variation. For example, percentage of mothers who have had at least four antenatal visits witnessed a significant increase by 37.2 points between the two rounds such that more than 60% of mothers do have minimum four antenatal visits. However, the improvement in other indicators is not as significant so that the current status of them still remains unacceptably low. Thus despite an increase of 10 percentage points, only 25.2% of households have improved access to toilet/sanitation. Percentage of women with 10 or more years of schooling still remains just around 23%. Similar performance is witnessed for other indicators also. In this light, the staggering incidence of child stunting at 48.3% as per the NFHS 4, despite a decline from 55.6% during NFHS 3 is hardly inexplicable.

Figure 4.2 depicts Bihar with its counterparts, on indicators of child stunting and other underlying indicators. It is apparent how Bihar with the highest incidence of stunting among children, fares worse than other states (for which NFHS 4 data is available), that perform bad on child nutrition indicators. While percentage of households with access to improved sanitation is on average far from satisfactory in India, it is the lowest in Bihar with 25.2%. States that have been able to curb their stunting levels have at least 50% of their households an improved access to sanitation. Female literacy a key determinant of child health and nutrition, at less than 50% continues to be very low in Bihar. Percentage of mothers who received at least four ante natal visits is just 14.4% in Bihar as compared to 35.7% and 46.5% in Madhya Pradesh and Assam respectively. In states like Tamil Nadu this percentage is more than 80%. Bihar's performance on other such underlying determinants remains abysmal, as seen in table 3 of the appendix. Percentage of adult women with low BMI is 30.4% in Bihar, which although has improved from its own standard, remains the highest among states.

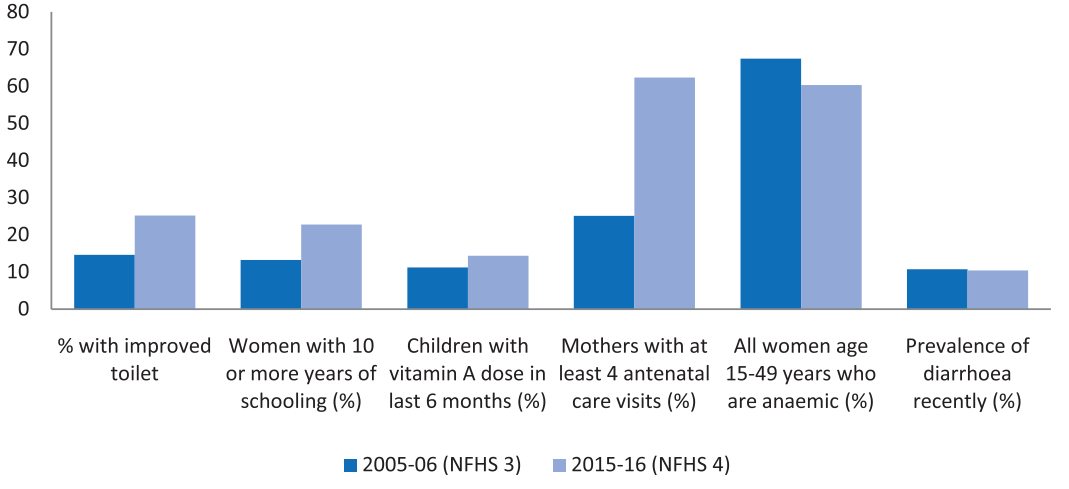


Figure 4.1: Improvement in underlying determinants in Bihar between NFHS 3 and NFHS 4
Source: Based on NFHS 4

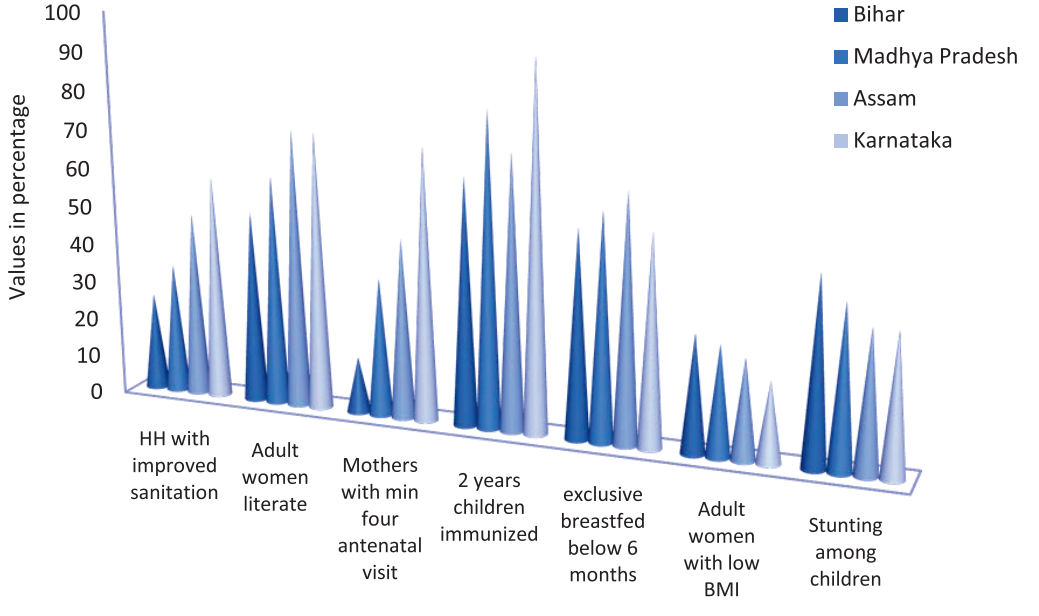
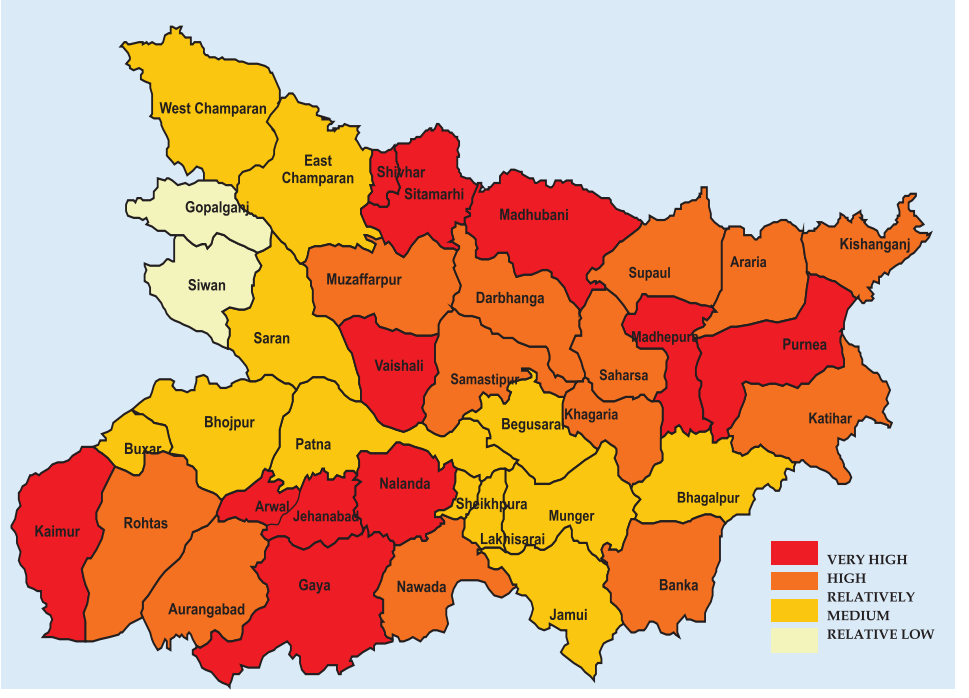


Figure 4.2: Bihar and several states on indicators of stunting and underlying indicators
Source: Based on NFHS 4

A review of underlying determinants at district level can also be enabling to have an insight into differential performance of various districts of Bihar on incidence of stunting among children. A cluster analysis has been run to classify the 38 districts of Bihar on the basis of their levels of child stunting as well as on the basis of their performance on selected

underlying determinants. Map 1 is produced out of the cluster analysis on incidence of stunting, with four broad clusters labeled on the basis of their stunting levels as; very high, high, relatively high and relatively low (see table 4 in appendix for cluster wise districts). Almost all districts of Bihar have a very high incidence of child stunting except Gopalganj and Siwan which have relatively lower (less than 40%) stunting levels. On the other hand, Sitamarhi has the highest level of stunting.



Map 1: Stunting map of Bihar: Districts classification on incidence of stunting

4.2 What singles out Gopalganj and Siwan? Re-asserting gender roles

To begin with, the districts may be classified in terms of two way relationship with the factors that may have influencing role on the incidence of stunting by classifying the districts into four categories (Ramirez et al. 1998 and Ghosh 2006). The factors considered here are Per Capita District Domestic Product (PC DDP), MPCE and percentage access to sanitation facility. In figure 4.3, three panels are given as 1a, 1b, 1c. Average performance of the state as a whole in the concerned indicator is reflected through the horizontal and vertical line dividing the figures into four quadrants. Per Capita DDP, MPCE and access to sanitation are plotted in the X-axis. All these are positive indicators as increasing value reflects better performance. Stunting is plotted on the Y-axis. This is a negative indicator as lower the value of stunting, higher the performance is achieved by the district. South-east quadrant represents the virtuous cycle indicating stunting decreases with the improvement of the positive indicator. North-west portion is vicious cycle as districts are not doing well in

both the positive and negative indicator. While North-east is the lopsided-positive indicator, south-west represents the lopsided-stunting categories

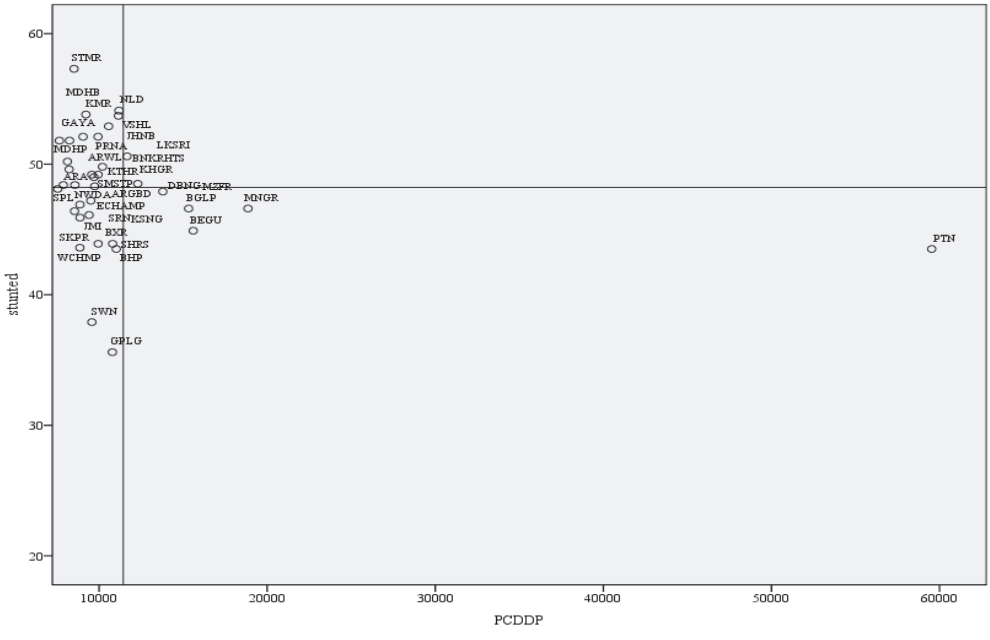


Figure 4.3: Panel 1a: PC DDP

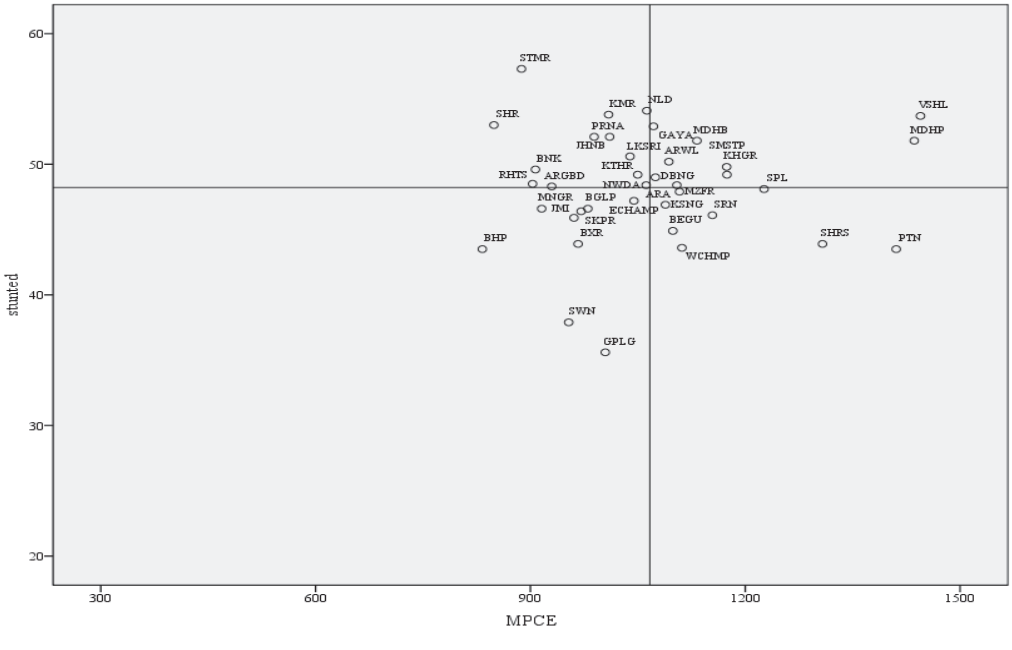


Figure 4.3: Panel 1b: MPCE

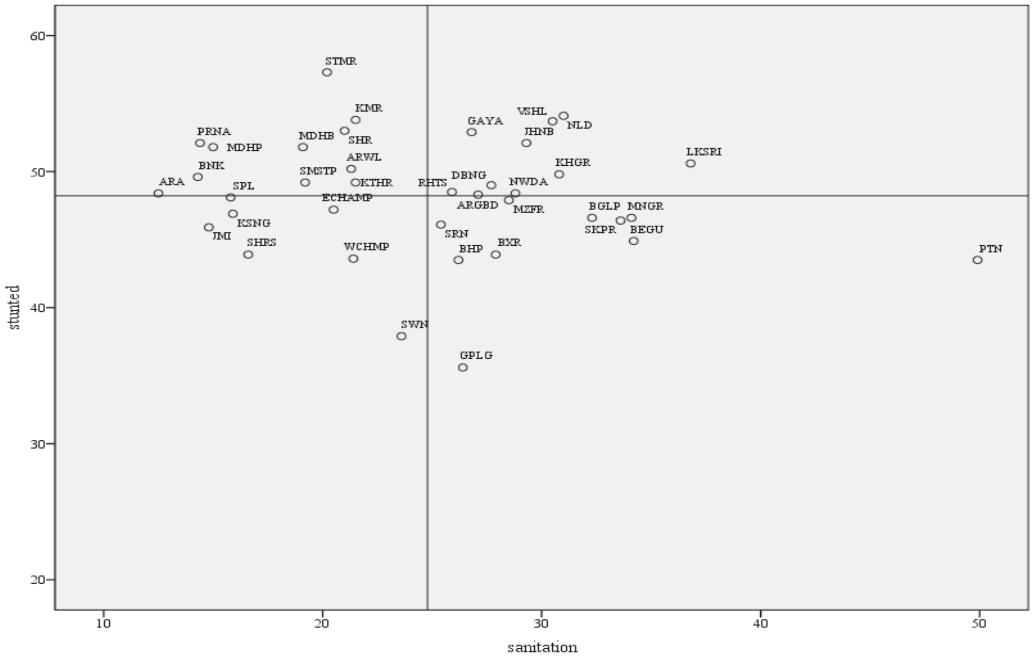


Figure 4.3: Panel 1c: Sanitation

[ARA: Araria, ARWL: Arwal, ARGBD: Aurangabad, BNK: Banka, BEGU: Begusarai, BGLP: Bhagalpur,BHP: Bhojpur, BXR: Buxar, DBNG: Darbhanga, GAYA, GPLG: Gopalganj, JMI: Jamui, JHNB: Jehanabad, KMR: Kaimur, KTHR: Katihar, KHGR: Khagaria, KSNG: Kishangunj, LKSRI: Lakhisarai, MDHP: Madhepura, MDHB: Mdhubani, MNGR: Munger, MZFR: Muzaffarpur, NLD: Nalanda, NWDA: Nawada, WCHMP: West Champaran, PTN: Patna, ECHAMP: East Champaran, PRNA: Purnia, RHTS: Rohtas, SHRS: Saharsa, SMSTP: Samastipur, SRN: Saran, SKPR: Sheikhpura, SHR: Sheohar, STMR: Sitamari, SWN: Siwan, SPL: Supaul, VSHL: Vaishali]

The districts classified thus are listed in table 4.4. As usual, Patna is in the virtuous category in all the three panels and much ahead of other districts. In case of Panel 1a most of the districts are clubbed in the vicious category or around the point where two lines intersect each other. In all the three cases most of the southern districts are placed in the virtuous category (interesting exception Gaya). It is visible that the performance of Sitamarhi district is the worst. An interesting pattern being depicted through panel 1a and panel 1b needs special attention. Though in case of PCDDP, the districts being placed in the lopsided-PCDDP category are almost near to the intersection point of the horizontal and vertical line, same districts are more scattered and clearly visible in this category. This implies that though MPCE is increasing, this does not appear to influence reduction of stunting rate. As noted earlier, Gopalganj is one interesting case where stunting rate is the lowest. But the district is far away from Patna in terms PCDDP and MPCE. At the same time Gopalganj is placed in the virtuous category in case of sanitation, which has positive impact on the reduction of stunting rate

Table 4.4: Classification of Districts based on figure 4.3

Category	PCDDP	MPCE	Sanitation
Virtuous	Patna, Begusarai, Munger, Muzzaffarpur, Bhagalpur	Patna, Begusarai, West Champaran, Saharsa, Saran, Kishangunj, Muzaffarpur, Supoul	Gopalganj, Bhojpur, Saran, Buxar, Muzafarpur, Bhagalpur, Munger, Begusarai, Patna, Sheikhpura
Vicious	Sitamari, Nalanda, Gaya, Purnia, Gaya, Madhubani, Jehnabad, Nawada, Arwal, Aurangabad, Khagaria, Kaimur, Banka, Vaishali, Samastipur, Darbhanga, Araria, Madhepura, Katihar	Sitamari, Nalanda, Gaya, Purnia, Madhubani, Jehnabad, Nawada, Khagaria, Kaimur, Banka, Vaishali, Samastipur, Araria, Madhepura, Katihar, Rohatas, Lakhisarai, Sheohar,	Sitamari, Purnia, Araria, Banka, Madhepura, Madhubani, Sheohar, Katihar, Samastipur
Lopsided-Positive Indicator	Rohatas, Lakhisarai	Gaya, Madhubani, Samastipur, Khagaria, Darbhanga, Arwal, Madhepura, Vaishali, Araria,	Gaya, Rohtas, Darbhanga, Aurangabad, Nawada, Khagaria, Lakhisarai, Nalanda, Vaishali, Jehnabad
Lopsided-Stunting	Gopalganj, Siwan, Bhojpur, Saran, Jamui, East Champaran, West Champaran, Buxar, Saran, Kishangunj	Gopalganj, Siwan, Bhojpur, Jamui, East Champaran, Buxar, Sheikhpura, Bhagalpur, Munger	Siwan, Jamui, East Champaran, Weast Champaran, Supoul, Kishangunj, Saharsa

The aforementioned classification along with figure 4.3, offers interesting insights into the unique position of Gopaganj and Siwan. However, the status of these two districts is not strong enough in terms of sanitation to completely explain the stunting levels. To inquire further into the two districts, several indicators of social structure of the districts are reviewed viz. percentage of Schedule Caste (SC) in total population, sex ratio, female work force participation rate (WPR) and literacy rate among adult women (figure 4.4). This is a simple yet interesting panel inasmuch it clearly segregates Gopalganj and Siwan in terms of the relationship between each of the four variables on one hand and child stunting on the other. In fact, in the entire panel sex ratio followed by adult female literacy rates are the two variables that steer ahead as an explanation for relatively better performance of Gopalganj and Siwan. In terms of female WPR as well, Gopalganj and Siwan are better off than many other districts of Bihar. Alongside, Sitamarhi with more than 57% level of child stunting, performs low on all given parameters. Thus, the whole explanation re-establishes the centrality of gender roles in child nutritional outcomes wherein many of the behavioural factors are found to improve with women's education and their ability to exercise freedom of choice. Sex ratio could be considered as representing an indicator of fundamental social structure, its value in Gopalganj is itself something that needs further investigation.

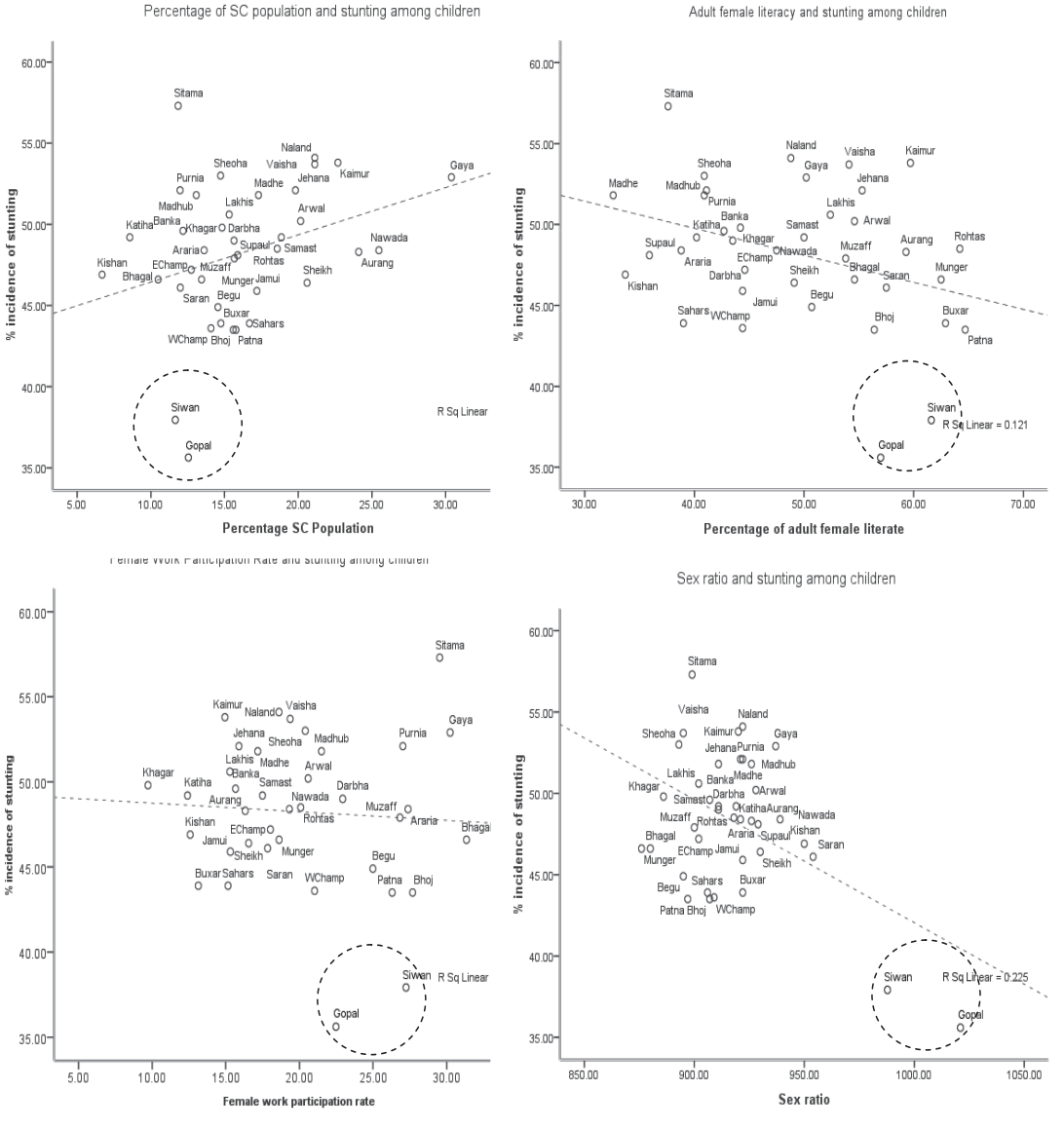


Figure 4.4: What singles out Gopalganj and Siwan? Some social parameters

Table 4.5 further delves in this exercise with a matrix where districts of Bihar are classified on the basis of their performance on selected underlying determinants of stunting. As noticed earlier, Gopalganj followed by Siwan has relatively low level of child stunting in Bihar. The performance of these two districts on listed underlying determinants is consistently average.

Table 4.5: District classification on underlying determinants of stunting

		Incidence of stunting		
		Relatively low 35- 40	**High ~ 40-48**	**Very high >48**
Sanitation	Very low [<26 lower than or equal to Average	Siwan	West Champaran, Saharsa, Jamui, Saran, Kisangunj, E. Champaran	Supaul , Araria, Rohtas, Katihar, Samastipur, Banka, Arwal, Purnea, Madhepura, Madhubani, Sheohar, Kaimur, Sitamarhi
	Better than average [26- 36]	Gopalganj	Bhojpur, Begusarai, Sheikhpura, Bhagalpur, Munger, Muzaffarpur,	Aurangabad, Nawada, Khagaria, Darbhanga, Jehanabad, Gaya, Vaishali, Nalanda
	Relatively high [>36]		Patna, Buxer	Lakhisarai
Female literacy	Very low [<50] lower than or equal to Average		W. Champaran, Saharsa, Sheikhpura, Kishanganj, Jamui, E. Champaran,	Supaul , Araria, Nawada, Khagaria, Darbhanga, Katihar , Banka, Madhepura, Purnea, Sitamarhi, Madhubani, Sheohar, Nalanda
	Better than average [50-60]	Gopalganj	Bhojpur, Bhagalpur, Saran, Muzaffarpur	Aurangabad, Samastipur, Arwal, Lakhisarai,Jehanabad, Gaya, Vaishali, Kaimur
	Relatively high [>60]	Siwan	Patna, Buxer, Begusarai, Munger,	Rohtas
Mothers with min four antenatal visit	Very low [<15] lower than or equal to Average		W. Champaran, Kisanganj, Muzaffarpur, E. champaran,Saharsa, Begusarai, Jamui, Sheikhpura	Supaul, Nawada, Rohtas, Darbhanga, Katihar, Samastipur, Khagaria, Arwal, Madhepura, Madhubani, Jehanabad, Purnea, Gaya, Sheohar, Kaimur, Nalanda,
	Better than average [16-20]		Bhojpur,	Aurangabad, Araria, Banka, Lakhisarai, Vaishali, Sitamarhi
	Relatively high [>20]	Gopalganj, Siwan	Patna, Buxer, Saran, Bhagalpur, Munger	
Exclusive breastfed below 6 months	Very low [<54] lower than or equal to Average		Begusarai, Patna, W. Champaran, Jamui, Sheikhpura, Munger, E. Champaran	Aurangabad, Araria, Rohtas, Nawada, Lakhisarai, Jehanabad, Gaya, Kaimur, Nalanda, Samastipur, Sitamarhi, Khagaria, Arwal ,
	Better than average [54-60]		Bhojpur , Buxer, Saharsa,	Banka, Purnea, Sheohar,
	Relatively high [>60]	Gopalganj, Siwan	Saran, Bhagalpur, Kisanganj, Muzaffarpur	Supaul, Darbhanga, Katihar, Madhepura, Madhubani, Vaishali
Adult women with low BMI	Very low [<31] lower than or equal to Average	Gopalganj, Siwan	Bhojpur, Patna, W. Champaran, Buxer, Saran, Bhagalpur, Munger, E. Champaran	Aurangabad, Rohtas, Samastipur, Arwal, Lakhisarai, Jehanabad, Vaishali, Kaimur, Nalanda,
	More than average [31-40]		Saharsa, Begusarai, Jamui, Sheikhpura, Muzaffarpur, Kishangunj,	Araria, Nawada, Darbhanga , Katihar, Banka, Khagaria, Purnea, Sitamarhi Madhepura, Gaya , Sheohar, Madhubani Supaul,
	Relatively high [>40]			

Source: NFHS 4

With 35.6% and around 38% of their children being stunted Gopalganj and Siwan are also facing serious malnutrition problem. Yet their relatively better position as compared to rest of the Bihar, could be attributed to their not so good but consistent ranking at average level on selected indicators. All other districts with high or very high incidences of child stunting are not necessarily worst on all listed determinants, but their position is not consistent. Moreover, the districts of Bihar, as they perform miserably on child nutrition indicator, they rank inconsistent on background factors crucial for child's nutritional well being. One observation that could be drawn from this is that a convergence is needed in terms of importance of these underlying factors. Figure 4.3 refutes any definite correspondence between income and nutritional outcomes, wherein there are districts with lower Monthly Per Capita Expenditure (MPCE) as well as relatively lower incidence of stunting. Districts of Vaishali and Madhepura are on the higher side in terms of MPCE but so are they in terms of child stunting.

All the districts of Bihar have an unacceptably high incidence of child stunting except Gopalganj and Siwan where incidence of stunting among under-five children is 35.6% and 37.9% respectively. Although 35-37% of stunting incidence is not low per se, the very high incidence in other districts makes Gopalganj and Siwan – cases worth review. As emerging from panels in figure 4.3 and 4.4, these two districts have unique positioning in terms of district performances on social determinants of child stunting. Also these two districts are placed nearly together on all indicators considered in the panel. Gopalganj and Siwan with sex ratio of 1021 and 988 respectively, are unique not only in Bihar but also in India. In terms of adult female literacy and female WPR as well, Gopalganj and Siwan are better off than many other districts of Bihar. Another very interesting reflection emerges from the percentage of cultivators among female main workers, which is 30-32% in rural Gopalganj and rural Siwan as against just around 19% in Bihar on average. Alongside, Sitamarhi with more than 57% level of child stunting, performs low on these parameters.

Does not this whole observation re-assert the centrality of social structure and gender roles in explaining child nutritional outcomes wherein many of behavioural factors are found to improve with women's education and their ability to exercise freedom of choice? This finding is also indicative of the policy imperative to address structural causes of child malnutrition particularly stunting rather than just concentrating on incremental steps such as supplementary nutrition. Sex ratio in particular is a fundamental indicator of skewed gender structure and it tells much more about the gender context than anything else. Its unique level in Gopalganj is itself something that needs further investigation. Another consistent finding this report comes up with is the direct correspondence and causality between population caste group (SC) affiliation and probability of being stunted. Earlier section on status of malnutrition in Bihar as well as the regression estimates has converged in this regard. Both Gopalganj and Siwan are on the lower side as far as the percentage share of SCs in district population is considered.

4.3 Does natural disaster play a role?

Given its vulnerability to natural disaster – both flood and drought, an immediate question that comes up is whether this vulnerability shapes up the vulnerability to malnutrition in the state. This question is particularly appealing in context of flood since 17% of India's flood area is in Bihar, as per Government of Bihar inputs[3]. The state - rich in water bodies is also prone to drought hazards and 33% of the state receives less than 750 mm rainfall annually, making the southern part of Bihar vulnerable to drought[4]. Figure 4.5 gives incidence of child stunting among districts prone to flood and drought as compared to other districts.

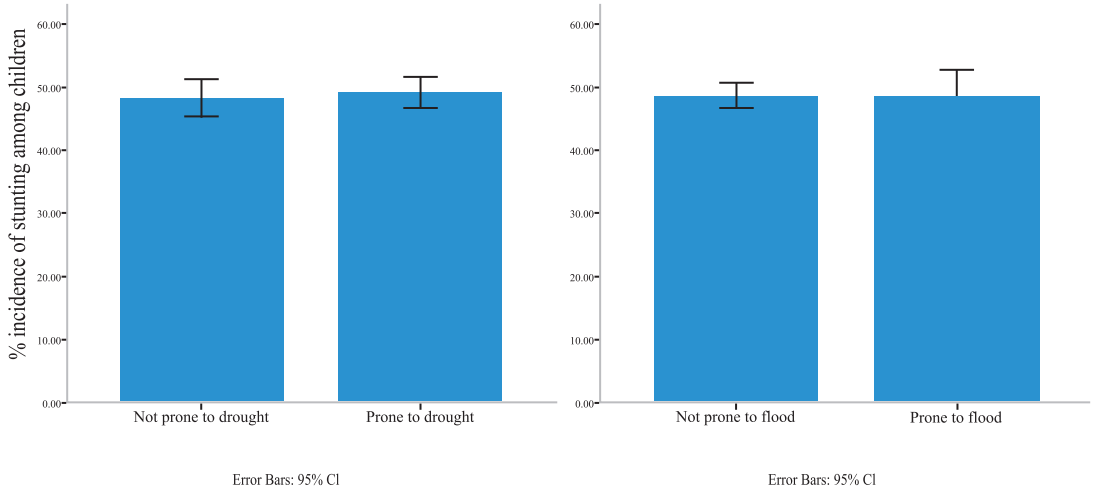


Figure 4.5: Average incidence of stunting among children between districts prone to flood and drought and other districts

Source: NFHS 4 and BSDMA

The district classification on hazards of flood and drought has been borrowed from sources of Bihar State Disaster Management Authority (see maps in appendix for district classification). As observed from figure 4.5, there does not appear any significant difference in the incidence of stunting between disaster prone districts and normal districts. In fact, irrespective of vulnerability to flood or drought, the incidence of stunting on average in classified districts hovers around 49-50%. If the conventional economic indicator is considered, figure 4.6 shows that its performance does not vary either between districts prone to disaster and districts which are safer. Although both the level of per capita District Domestic Product (PCDDP) and MPCE is relatively higher in districts which are not prone to either flood or drought, the difference is not statistically significant as reflected from the overlapping error bars.

[3]Case Studies on Emergency Management, Preparedness and Response by Government of Bihar, accessed from http://www.slideshare.net/cdrnnetwork/government-of-bihar-gagan-cdrn
[4]http://www.ndma.gov.in/en/bihar-sdma-office

The lack of correlation between proneness to disaster and incidence of malnutrition is an interesting observation but may not appear surprising if it is kept in notice that it is the poor who is worst affected during hazards and their situation is no better in terms of nutrition even during normal years. On average, 99% of districts in Bihar perform miserably in this regard.

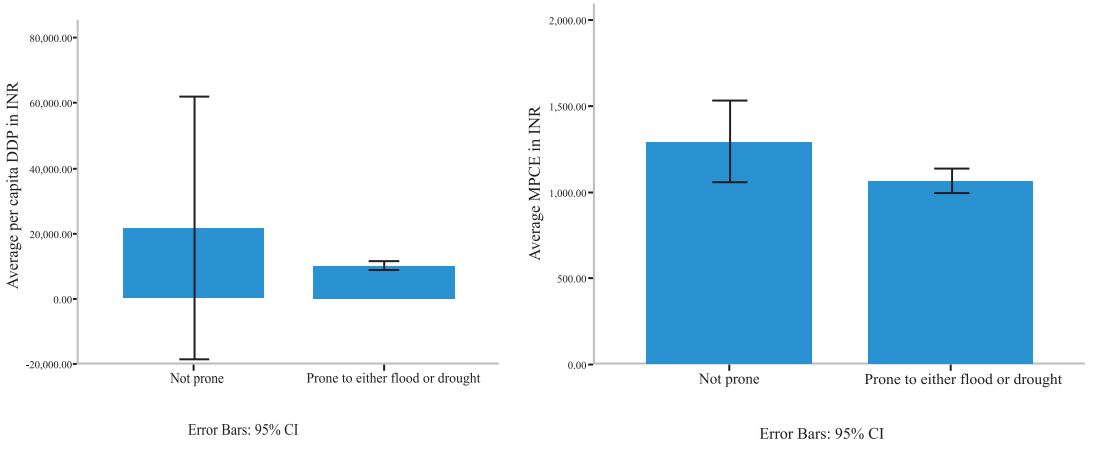


Figure 4.6: Average levels of PCDDP and MPCE between districts prone to flood and drought and other districts

Source: NFHS 4, Directorate of Economics and Statistics, GoB and BSDMA

5. Economic cost of malnutrition: can Bihar afford the burden?

Nutrition is fundamental to human life – metaphor for right to life. But it doesn't end here - nutrition or a lack of it has implications for the 'economy' as well. It indeed costs an economy to have malnourished children. As quantified in the Copenhagen Consensus and reflected in figure 5.1, productivity losses caused by malnutrition are linked to three kinds of losses—viz. direct losses in physical productivity, indirect losses from poor cognitive losses and loss in schooling and losses in resources from increased health care costs.

There is a seminal body of literature that identifies the cost that malnutrition during childhood inflicts upon individuals and through them upon the economy. Height has consistently been found to have human capital implications through productivity linkages (Behrman, Alderman, and Hoddinott 2004, Hunt 2005). Although the nutrition and productivity relationship is strongest for manual labour, it has also been found in the manufacturing sector and among white collar workers (Strauss and Thomas 1998). Growth failure before the age of two, anaemia during the first two years of life, and iodine deficiency in the womb can have profound and irreversible effects on a child's ability to learn (Behrman, Alderman, and Hoddinott 2004). Recent studies have shown that the positive

correlation between nutritional status and both cognitive development and educational attainment also applies to children in normal birth-weight and height ranges (Richards et al 2001; 2002, Matte and others 2001). Malnourished children require more health services and more expensive types of care than other children. Malnourished children have poorer schooling outcomes and may repeat years more often, thus increasing education costs (Behrman, Alderman, and Hoddinott 2004).

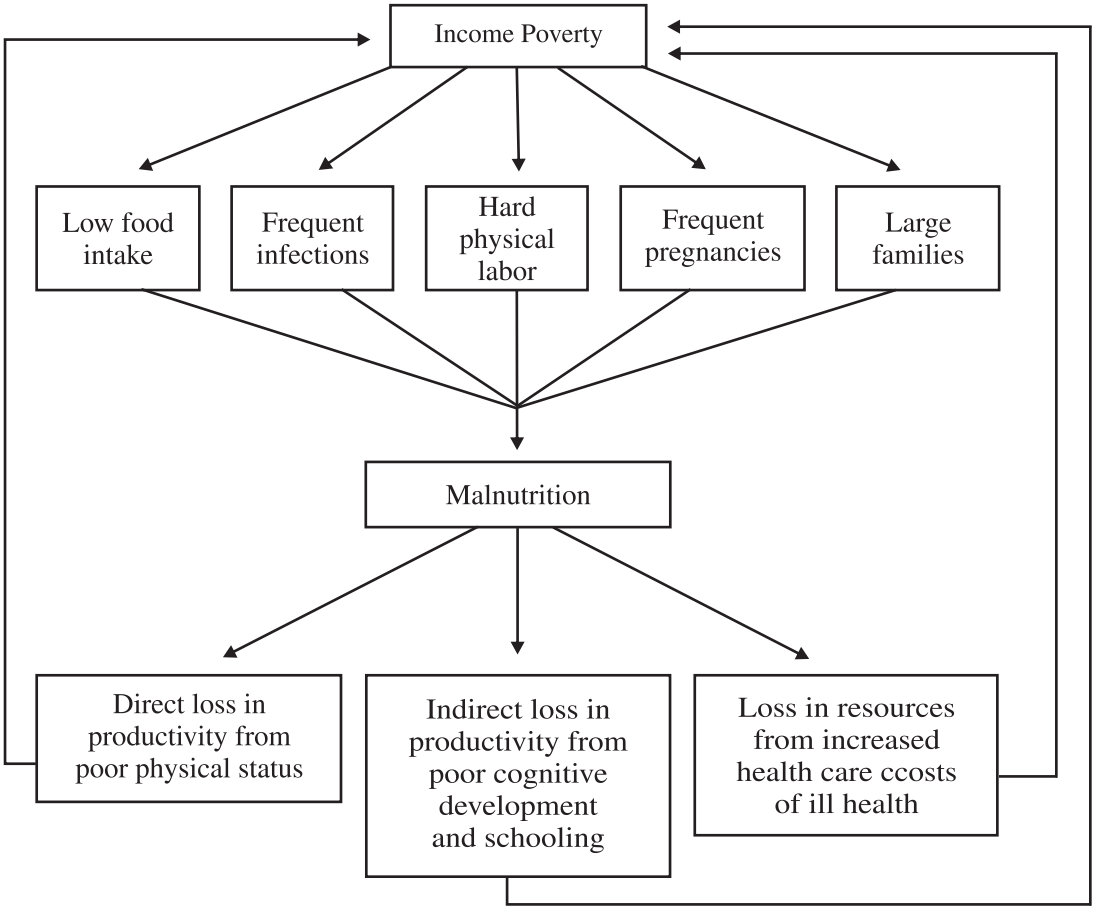


Figure 5.1: The vulnerability trap and cost of malnutrition

Source: World Bank, 2002

Table 5.1 lists salient critical evidences on socioeconomic costs inflicted due to child malnutrition, particularly stunting during childhood. The Global Nutrition Report 2014, explicitly recognizes them. These evidences are based on multi-country estimates including India and are used here to measure approximate cost that the state of Bihar incurs due to the incidence of child stunting. Methodologically, these are longitudinal study, which is

understandable since actual economic implication of childhood malnutrition would manifest only in the long run. Although these estimates have been done in varying contexts, with room for some error, they can yield a fair measure for the cost in Bihar.

Table 5.1: Some evidences on cost of malnutrition

	Evidence	Source
1	45% of under-five mortality is attributable to under-nutrition	Black et al. (2013)
2	Improving linear growth for children under age two by 1 standard deviation adds about half a grade to school attainment	Adair et al. (2013)
3	An additional grade of schooling, controlling for literacy, raises earnings by an addition five percent.	(Hanushek and Woessman 2008)
4	A review of evidence from 79 countries concluded review concluded that stunted children suffer a combined grade attainment and performance deficit of 2.91 years, suggesting "total percentage loss of adult yearly income" of 19.8%.	Grantham- McGregor et al 2007
4	A1% loss in adult height as a result of childhood stunting is associated with a 1.4 percent loss in productivity.	(Victora et al. 2008)
5	Prevention of under-nutrition in early childhood leads to hourly earnings that are 20% higher and wage rates that are 48% higher; individuals who are 33% more likely to escape poverty; and women who are 10% more likely to own their own business	Hoddinott et al. (2013)
6	Asia and Africa lose 11% of GNP every year owing to poor nutrition	Horton and Steckel (2013)
9	Productivity losses associated with forgone wage employment resulting from child malnutrition, estimates the loss at $2.3 billion in India (0.4 percent of annual GDP)	Strauss and Thomas (1998); Horton & Ross (2003).
10	Eliminating anemia results in a 5 to 17 percent increase in adult productivity, which adds up to 2 percent of GDP in the worst affected countries	Hunt (2005)

Based on Adair et al (2013), if stunting among children below two years of age is reduced by 1 Standard Deviation with respect to the WHO standard i.e. if it is reduced by even 50% in a child, she or he can complete at least half a year more of schooling. Thus, if the child is not stunted she or he can complete an additional grade of schooling. The current level of stunting in Bihar among children below two years of age is estimated to be at 48.3%, which based on Census (2011) child population details means that nearly 3500000 children can lose schooling by one year just because their linear growth is retarded[5]. It has been found that at least 45% of under- five mortality (U5MR) is attributed to incidence of underweight (Black et al 2013). Using this estimate for Bihar, if the problem of underweight is addressed among the children, the current rate of U5MR in Bihar could be abated at 31.5.

Several studies establish that the impact of stunting among children on future economic productivity occurs through sub-optimal school achievement and reduced earning in physically demanding work (Grantham- McGregor et al 2007, Behrman 1993, Behrman and

[5]Direct estimate of the incidence of stunting among children below two years of age has been approximated by looking at their share in population of children below five years of age.

Deolalikar 1989, Haddad and Bouis 1991). Grantham- McGregor et al (2007) on the basis of their study on 79 developing countries conclude that stunting in childhood results in 19.8% loss in adult yearly earning. Similarly, severe to moderate stunting in childhood leads to around 6 - 8% loss in adult productivity in manual work (Burkhaltar et al 1998). Following CARD, UNICEF & WFP (2013), this section estimates the annual economic loss incurred due to given incidence of stunting among children in Bihar. Methodologically, this involves estimating the future loss of income to be incurred by currently stunted children through averaging out their participation in labour force in specific economic sectors in the state and by converting these in potential yearly earning, and further calculating net present value of this loss. The economic loss occurs through two channels viz. a.) sub-optimal school performance and b.) productivity loss in physical or manual labour.

Table 5.2: Algorithm for projection of economic loss through underachievement in schooling

Size of stunted child population of 0-4 years @ stunting level of 48.3%	Size of future labour force out of currently stunted children @LFPR of 49.23%	Size of future labour force out of currently stunted children engaged in service sector @ 20.4 % of employment in service sector of	Average yearly income in INR (2014-15)	Average yearly loss in INR with 19.8% deficit in earning	Average yearly income of stunted labour force in services in INR	Average work-life	Calculation of NPV of Annual economic loss for 45 years
6165509	3034047	618946	18560	13474.4	2274550747	45 years	@ 3% discount and 12.5 years delay

Table 5.2 gives projection of economic loss likely to occur through sub-optimal school performance and its consequence of 19.8% deficit in adult earning in future, as estimated by Grantham- McGregor et al (2007). Since educational skills including literacy are primarily needed in tertiary employment, the under-performance in school is likely to have salient implications for the labour force engaged in service sector. The Labour Force Participation Rate (LFPR) in Bihar is 49.23% in 2014-15 and 26.4% of employment in Bihar is derived from the service sector. A very conservative projection is made by applying these rates to future adults who are currently stunted and would be part of the labour force. The consequent size of the adult labour force out of currently stunted children of Bihar as well as the size of this labour force engaged in service section is give in table 5.2. The potential earning of the calculated size of this labour force engaged in service sector is estimated using average per capita income in Bihar i.e. Rs. 18560 per annum, as per the Economic Survey of Bihar (2015-16). The projected annual economic loss being incurred would be equivalent to the Net

Present Value (NPV) of the potential earning. The discount rate applied for calculating the NPV is taken as 3% as recommended by the World Bank for social investments (WDR 1993). The average work-life is assumed to be 45 years, until the person reaches the age of 60. Further, since the future earning shall start only after the currently stunted children reach the age of minimum 15 years, the delay of 12.5 years taking the average current age of those children at 2.5 years, is also accounted for in calculating the Net Present Value of future potential earning. The annual projected economic loss being incurred due to sub-optimal school performance of 48.3% of under - five children in Bihar is more than Rs. 200 crores.

Table 5.3: Algorithm to project economic loss through productivity loss in manual work

Size of stunted child population of 0-4 years @ stunting level of 48.3%	Size of future labour force out of currently stunted children @LFPR of 49.23%	Size of future labour force out of currently stunted children engaged in agriculture sector @ 65 % of employment in agricultural sector	Average yearly income in INR (2014-15)	Average loss in yearly income (in INR) due to deficit in productivity	Average yearly income of stunted labour force in services in INR	Average work-life	NPV of Annual economic loss
706933 @ Moderate level of 23.3%	348518	226537	18560	@6.038% coefficient of deficit = 15786	406218932	45 years	@ 3% discount and 12.5 years delay
791886 @ Severe level of 26.1%	390400	253760		@8.625% coefficient of deficit = 15352	253868945		

Table 5.3 shows the algorithm for similar calculation given that moderate stunting among children results in adult earning deficit of 6.038% and severe stunting among children results in adult earning deficit of 8.625% in case of manual or physically intensive work (Burkhaltar et al 1998). As per RSOC (2013-14) data, 23.3% of under-five children in Bihar are moderately stunted whereas 26.1% are severely stunted. The estimated annual economic loss incurred due to moderate and severe stunting among children in Bihar is approximately Rs. 100 crores and Rs. 300 crores respectively (figure 5.2). If manual labour engaged in industrial sector is also included in the analysis, the projected economic loss will shoot up further.

Ostensibly, the cost of malnutrition is very high and more importantly it is an avoidable cost. Existing studies have also attempted to assess the cost of interventions to abate malnutrition against the cost of having malnourished children (Hunt 2005, Dewey and Begum 2011, Haddad et al 2014) and the latter is found to be more than the former (Hoddinott et al 2013). To sum up, it may be appropriate to mention here that in India, at

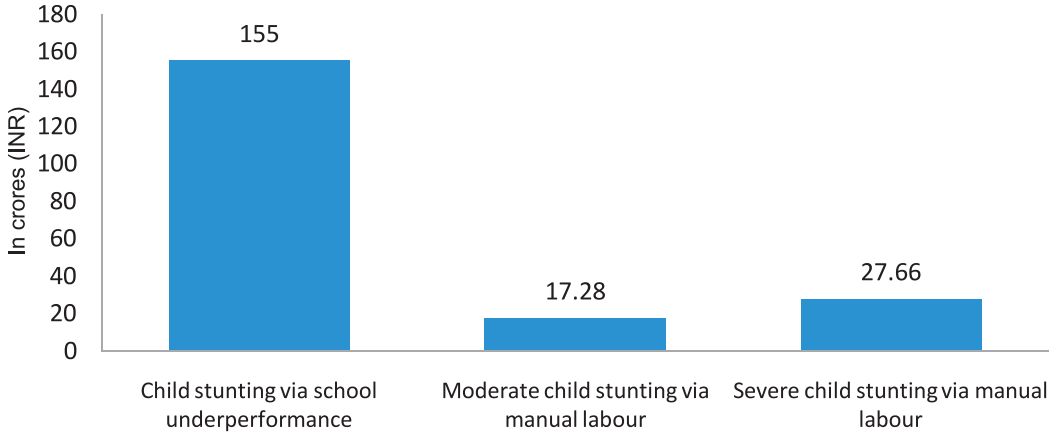


Figure 5.2: Projected annual economic loss due to stunting among children in Bihar

realistic levels of sustained per capita GDP (2.1 percent and 3 percent, respectively) and using an elasticity figure (change in malnutrition rates relative to per capita income growth) of -0.5, economic growth alone would take until 2065 and 2035, respectively, to achieve the nutrition MDG.

6. Policy approach to malnutrition in Bihar : critical reflections

For a substantial period after independence of the country, nutrition was not a visible issue in state's development agenda, neither was it the central concern of public health. What drew much attention from political leadership to begin with and rightly so, was the need to bring the country out of periodic bouts of hunger and starvation. Thus, for a long time ensuring food security was what kept the policy discourse completely engaged and the outcomes were seen in the form of the green revolution and Public Distribution System (PDS). This certainly helped the country which has become self sufficient in food availability and the lack of nutrition to the extent it was driven by food insecurity has largely been reigned in. Subsequently, the problem of access to food was experienced, which the PDS has been supposed to deal with. The performance of PDS in India has not been satisfactory and there has been wide variation in the way different states have performed on the issue. While states like Tamil Nadu and Kerala could ensure considerable utilization of benefits offered through PDS, states like Bihar performed miserably. As far as nutrition is concerned, it got first dedicated consideration with the launch of the Integrated Child Development Scheme (ICDS) in 1975. The performance of ICDS has also varied significantly across states and again Bihar has been among the worst performing states. This necessarily brings the role of state in dealing with food and nutrition security. In recent period, aggressive intervention in Maharashtra is an instance of how state pro-activism can abate the problem of malnutrition. Uttar Pradesh has also begun to give dedicated attention

and resources towards malnutrition issues. Bihar is yet to take striking initiative on this issue.

To begin with, the structure of health finance itself substantiates the unsuccessful story of Bihar in nutritional front. The total expenditure in healthcare is constituted by central and state government share (and also by local body). In 2004-05, per capita expenditure on healthcare in Bihar, both public and private, is much lower and in fact less than half of the national average (National Health Accounts [NHA] 2014-15). The share of the public expenditure in health sector reduced to only 3.61 per cent in 2009-10 from 4.12 per cent in 2004-05 and further reduced to 3.5 per cent in 2012-13. In fact, the share of public health is only 3.7 per cent and more alarmingly, under Family Welfare component, the share of maternity and child health constitute less than 1 per cent.

During 2006-07 to 2009-10, per capita health expenditure has been one of the lowest in Bihar as compared to the major states. The share of Bihar's total per capita health expenditure to that of national average slipped down to 0.21 in 2009-10 from 0.26 in 2006-07. The public health expenditure has been as low as 18.2 per cent while the national average being stood at 41.7 per cent. As a result, out of pocket expenditure to access health services exceeds a certain threshold level resulting in impoverishment of the family (Ghosh 2013). The over-burden of health expenditure drives families to the below poverty level. Due to its resource constraints and poor health outcomes, Government of India (GoI) designated Bihar as focus state category in National Rural Health Mission (NRHM). This has substantially increased the share of central government to per capita health expenditure of Bihar.

Another pattern of public health expenditure in Bihar has been that the share of capital expenditure has remained below 10 percent. Salary component mainly constitutes the revenue expenditure (Choudhury and Nath 2012). Therefore, there has always been resource constraint in expanding health infrastructure. Consequently, demand of trained health personnel particularly doctors could not be supplied. It can be termed as 'vicious cycle' that Bihar needs to break. One silver lining to the problem is arising, as the capital expenditure has increased to 15.11 percent in 2011-12 and further to 23.45 percent in 2012-13 (NHA 2014-15). Overall, the state is continuing with its piecemeal approach associated with various ongoing schemes. The following review of the pattern and structure of resource diverted to various schemes - directly or indirectly related to malnutrition - offers insight into the apathy in policy approach in Bihar.

6.1 Targeted Interventions for nutrition

India has been placed in 'strong' Nutrition Governance category (with the maximum score of 11) by the WHO's Landscape Analysis study (WHO 2009). This ranking may be attributed to the nation's different nutritional intervention (such as ICDS, MDMS etc.)

including effective democratic system. But the issue of implementation has been a matter of concern, particularly in the state of Bihar. As discussed earlier, interventions targeted directly at nutrition, came little late on the agenda of public policy in Bihar, as also has been the case in India. Initial interventions came in the form of programmes targeting food security of the population, which certainly had an impact on the status of hunger induced nutritional deficiencies. The Public Distribution System has been the first and the biggest in this regard.

Public Distribution System (PDS)

After the enactment of the National Food Security Act (NFSA), 2013, around 83 per cent of population in Bihar are entitled to subsidized rice and wheat (at Rs. 2 for 1 kg wheat, Rs. 3 for 1 Kg rice). Therefore, effective functioning of PDS can give a significant relief to hunger and malnutrition. The programme however does not reach its potential since there are major problems, particularly related to leakages in the functioning of PDS. Some evidences observe a decline in leakages in Bihar – for example, (Dreze and Khera 2015).

The central government allocates food grains to the state for 65.23 lakh BPL families; whereas the state government survey has revealed that the total number of BPL families is 1.35 crores. Since there is a shortfall in the supply of food grains from the central government, the state government has decided to provide 25 kgs of food grains to each family, instead of 35 kgs. per family per month. NSSO Report 561 reveals that proportion of households which consume from PDS in terms of rice and wheat, is one of the lowest in Bihar. In 2009-10, it was 12.2 and 12.7 percent respectively for rice and wheat, although, it has substantially increased since 2004-05. National Sample Survey 66th round data indicates that the percentage share of food in consumption expenditure is the highest in Bihar -for rural Bihar-64.7 and urban Bihar 52.9 per cent. Therefore effective functioning of PDS could provide a space to spend some portion to other items that may have implication for improved standard of living including better nutrition.

Under BPL scheme, Muzaffarpur (47.8 percent) tops the list in 2012-13, followed by Nawada (46.5 percent) in terms of lifting of wheat. Under Antyoday, in 2012-13, all districts except Sheohar, Begusarai, Samastipur and Purnea, have lifted more than 80 percent of wheat from PDS. Under Annapurna scheme, Munger, Siwan, Kishanganj, Araria and Katihar have not lifted any amount of wheat. In case of rice, Aurangabad (91.5 percent) has lifted the highest amount under the BPL scheme. For Antyoday scheme, most of the districts have lifted more than 80 percent of their allotment in 2012-13.

Table 6.1: Allotment and offtake under Public Distribution System (2007-08 to 2012-13)
(Figures in '000 tonnes)

Year	Wheat			Rice		
	Allotment	Lifting	Lifting Percentage	Allotment	Lifting	Lifting Percentage
2007-08	479.3	273.8	57.1	1198.2	479.6	40.0
2008-09	447.7	289.9	64.8	1272.1	470.3	37.0
2009-10	447.7	410.3	91.6	1272.1	741.6	58.3
2010-11	610.8	559.6	91.6	1495.1	1217.0	81.3
2011-12	985.9	638.4	64.8	2187.7	1500.2	68.6
2012-13	1348.4	470.5	34.9	2022.6	1065.9	52.7
			Antyoday			
2007-08	408.0	366.6	89.9	612.0	514.0	84.0
2008-09	408.0	322.4	79.0	612.0	461.5	75.4
2009-10	408.0	385.4	94.5	612.0	543.2	88.8
2010-11	417.1	408.6	97.9	625.7	595.2	95.1
2011-12	420.2	395.7	94.2	630.2	573.5	91.0
2012-13	420.2	407.5	97.0	630.3	593.8	94.2
2013-14	385.2	378.9	98.4	577.7	573.0	99.2
2014-15	385.2	377.9	98.0	577.7	572.9	99.0
			Annapurna			
2010-11	106.2	65.1	61.3	70.8	44.2	62.4
2011-12	106.2	62.7	59.0	70.8	39.1	55.2
2012-13	114.2	76.4	66.9	76.1	53.4	70.1

Source: Bihar Economy Survey 2013, 2014, 2015-16

To reiterate, Bihar could be the biggest beneficiary of NFSA if the programme is implemented effectively. The problem lies in the implementation part. The biggest challenge is to ensure the sustainable flow of fund and reduction in leakages.

Mid-Day Meal Scheme (MDMS)

MDMS - a right-based scheme, launched in 1995 is a major intervention in Primary Education. The objective of the scheme was "universalisation of primary education by increasing enrolment, retention and attendance with simultaneous impact on nutrition of students in primary classes". The MDMS has been extended to upper primary classes in 2007 and universalised at the elementary level in 2008.The prominent features of the MDMS are as follows: (i) The central government provides foodgrains (wheat and rice) free of cost through the Food Corporation of India (FCI). (ii) Foodgrains (wheat/rice) are allocated at the rate of 100 grams per child per school day where cooked/processed hot meal is being served and 3 kg per student per month subject to a minimum attendance of 80 per cent by the students where foodgrains are being distributed. (iii) The programme is being implemented through rural and urban local bodies (Panchayat and Nagar Nikay). The scheme provides for serving of cooked meals having a calorie value equivalent to 100 grams

of wheat and rice per student per school. (iv) Foodgrains are to be distributed in the interim period as a prelude to provisions of cooked meals till institutional arrangements are made. The coverage of MDMS at the primary level in Bihar is presented in Table 6.2. This coverage has been decreasing over the years, which could be attributed to enhanced enrolment in primary schools during these years.

Table 6.2: Coverage of MDMS

Year	2008-09	2010-11	2011-12	2012-13	2013-14	2014-15
Class I-V						
Total Enrolment (in lakhs)	138.70	144.77	153.16	147.70	141.62	143.18
No. of Children Availing MDM (per day) (in lakhs)	98.27	80.35	68.55	85.22	94.89	94.36
Coverage Percentage	70.9	55.5	44.0	57.7	67.0	65.9
Class VI-VIII						
Total Enrolment (in lakhs)	38.8	43.37	52.45	52.87	57.57	60.59
No. of Children Availing MDM (per day) (in lakhs)	31.51	21.07	20.55	30.32	38.57	36.99
Coverage Percentage	81.2	48.6	39.2	57.4	67.0	61.0

Source: Bihar Economy Survey 2015-2016

Integrated Child Development Services (ICDS)

Integrated Child Development Services (ICDS) was first launched in 1975 in accordance with the National Policy for Children in India. Over the years it has grown into one of the largest integrated family and community welfare schemes in the world. In fact it has been universalised after several Supreme Court verdicts during 2001-06. Presently, 544 ICDS projects are operational in Bihar, covering all development blocks in 38 districts. 458 Child Development Project Officers (CDPOs) have been in the office in 2014-15 financial year and the number of vacant posts has been increasing over the year. There are many vacant posts lying in similar categories. A total of 91,677 Anganwadi Centres (AWC) are established under those 544 projects. There is around 7 per cent vacancy in the category of Anganwadi Worker and Helpers. As seen from Table 6.3, the budget provision for ICDS has steadily increased from Rs. 880.24 crore in 2010-11 to Rs. 2238.31 crore in 2014-15, implying an annual growth rate of 24.3 percent. Around 94 percent of available resources, has been utilized. Field surveys conducted during this study revealed that ICDS centres in the districts were delivering supplementary nutrition component only to a limited number of beneficiaries.

Table 6.3: Resource Utilization in ICDS

Year	Budget (ICDS) Bihar Rs. Crore	Funds Released by GOI (Rs. Crore)	Expenditure (Rs. Crore)	Fund Released as percentage of Budget	Expenditure as percentage of fund Released
2007-08	483.59	411.02	349.11	84.99	84.94
2008-09	616.21	274.58	482.63	44.56	175.70
2009-10	934.40	696.61	858.71	74.55	123.27
2010-11	880.24	727.17	615.28	82.6	84.6
2011-12	1255.24	767.46	945.09	61.1	123.2
2012-13	1393.30	1094.00	1086.10	78.5	99.3
2013-14	1714.28	1147.43	1234.46	66.9	107.6
2014-15	2238.31	1308.39	1234.92	58.5	94.4

The story from above data can be contextualized through field observations made during the visit to Jalalgarh and Kasba block of Purina district. The problem starts with the lack of vertical coordination among different tier of governance. The flow of fund is very irregular. Therefore ICDS centres almost become dysfunctional for at least three–four months in a year. Even when fund are transferred, this is done at the last moment so that the block administration remains under immense pressure (from the higher authority) to utilize the fund quickly and to send utilization certificate. This leads to administrative preoccupation with fund utilization bypassing quality considerations and thus to under achievement of the programme.

6.2 *Preventive Health Care*

Preventive Healthcare constitutes the access to services that diminishes the possibility of exposure to diseases through safe drinking water and sanitation facilities, good quality nutritional intake, clinical preventive services such as immunisation (Dasgupta 2009). This is important particularly for two reasons. Firstly, it is cost effective, strongly relevant for the state of Bihar. Secondly, there is evidence that poor access to sanitation contributes greatly to the incidence of stunting and underweight (Andres et al 2014).

Immunisation

Bihar has recorded steady improvement in the immunisation coverage of children (Figure 6.1). In 2002-04, 20.7 percent children below two years were fully immunised. Now it is more than three times higher. Rural-urban gap has also been significantly reduced. There are now only 3.7 percent children who have not received any kind of vaccination, a drastic reduction from 51.8 per cent in 2002-04. The improvement is recorded in all the aspects such as BCG, DPT and measles over the year.

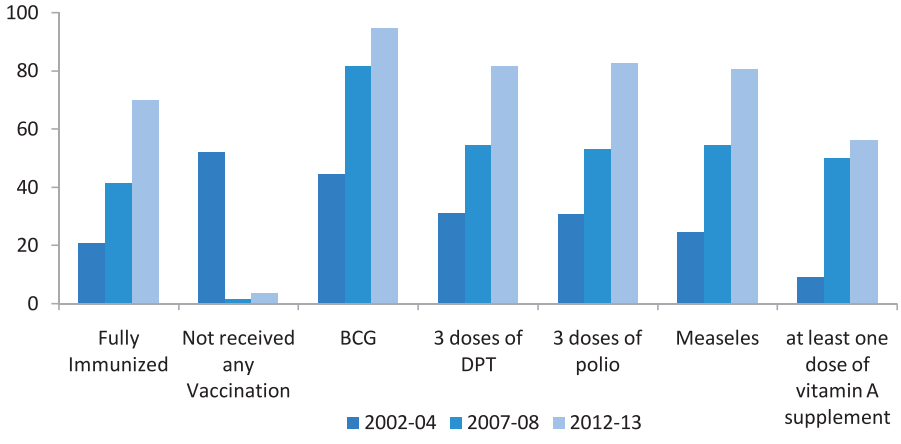


Figure 6.1: Status of Immunization in Bihar
Source: DLHS-2, 3, AHS-3

Table 6.4: Immunization Status of the Districts of Bihar, 2011

Indicator (in %)	Minimum	Maximum	Bihar
Having Immunization Card	71.9 (Jamui)	95.8 (Samastipur)	85.4
BCG	85.9 (East Champaran)	98.0 (Munger)	94.7
3 doses of Polio vaccine	56.5 (Kishanganj)	92.9 (Madhubani)	82.7
3 doses of DPT	57.0 (Kishanganj)	92.7 (Purnia)	81.6
Measles	40.6 (Kishanganj)	91.2 (Samstipur)	80.3
Fully Immunized	32.2 (Kishanganj)	87.8 (Madhubani)	69.9
Polio dose at birth	32.5 (Sheohar)	92.1 (Rohtas)	69
Not received any Vaccination	1.0 (Munger)	9.9 (East Champaran)	3.7
at least one dose of vitamin A supplement last six months (age 6-35 months)	40.7 (Jamui)	69.8 (Saharsa)	56.2
IFA tablets/syrup during last 3 months (aged 6-35 months)	19.3 (Gaya)	61.4 (Madhubani)	33.8
Children whose birth weight was taken	24.5 (Sheohar)	63.9 (Patna)	42.9

Source: AHS-3

Antenatal Care (ANC)

ANC is showing steady improvement in Bihar over the years (Table 6.5), although there are still some shortcomings. Very little progress is recorded in full ANC check-up. The coverage of three or more ANC is only 36.7 per cent in 2011. The rate of consumption of 100 Iron Folic Acid (IFA) tablets is also very low. There is also considerable rural-urban gap in utilising ANC facilities.

Table 6.5: ANC facility availed by year in Bihar

ANC Facility	2002-03			2007-08			2012-13		
	Total	Rural	Urban	Total	Rural	Urban	Total	Rural	Urban
Any ANC Check-up	31.4	31.3	58.9	59.3	58.5	70.8	85.4	84.9	90.5
ANC Check-up in first trimester	18.5	16.3	38.4	24.2	22.9	40.7	49.9	48.6	61.8
Three or more ANC	16	13.8	36.2	26.4	25.4	39.8	36.7	35.1	51.5
At least one TT	30.9	28.3	53.9	58.4	57.5	69.9	84.6	84.1	89.5
BP taken	17.2	15.7	36.2	20.2	17.8	41.5	49.7	48	65.4
Consumed 100 IFA Tablets	6.4	5.3	16	46.5	46.8	42.8	12.7	11.7	21.3
Full ANC Check-up	4.3	3.4	12.4	4.6	4	11.7	7.8	6.8	16.1

Source: DLHS-2, 3, AHS-3

There is also locational gap in availing ANC facility (Table 6.6). The gap is significant in IFA consumption, receiving at least three ANC and in full ANC check-up. However, financial assistance provided for institutional delivery is skewed to rural area. An important gap is noted in percentage of mother who had received antenatal Check-up in First Trimester. The gap between the highest and the lowest performing district is as high as 35.9 percentage points. In fact, in terms of availing ANC facilities, the districts of the southern part of the state are much ahead of the remaining part of the state.

Sanitation and Drinking Water

United Nation Development Programme (UNDP) noted that 'exclusion from clean water and basic sanitation destroys more lives than any war or terrorist act' (UNDP 2006:27). Households (HHs) having basic amenities such as toilet, connection to drain, safe drinking water (SDW) etc. as the components of sanitation and drinking water- diminishes the exposure to diseases that are preventable in nature. UNDP (ibid: 41) notes that accessibility of these two basic facilities can have impact on reducing income poverty, breaking lifecycle disadvantages, holding down wider health costs, improving girls' education, freeing girls' and women's time, ensuring a sense of human dignity. The effectiveness of other services such as immunization is also positively linked with how these services are availed.

Table 6.6: ANC Status in Bihar 2011

ANC Facility	Total	Rural	Urban	Highest among districts	Lowest among districts
Financial assistance for delivery	40.9	41.4	36.1	57.2 (Khagaria)	23.2 (Sheohar)
Financial assistance for Institutional Delivery	69.8	72.8	49.1	86.2 (Samastipur)	52.5 (Patna)
Financial assistance for Govt. Institutional Delivery	91.2	91.7	86.1	97.6 (Araria)	81.5 (Madhubani)
Currently Married Pregnant Women aged 15-49 years registered for ANC	54.4	53	68	90.2 (Jehanabad)	22 (Araria)
Mothers who received any Antenatal Check-up	85.4	84.9	90.5	96 (Aurangabad)	74.1 (Darbhanga)
Mothers who had Antenatal Check-up in First Trimester	49.9	48.6	61.8	64.9 (Patna)	29.1 (Sitamarhi)
Mothers who received 3 or more Antenatal Care	36.7	35.1	51.5	49.2 (Gopalganj)	22.6 (Sheohar)
Mothers who received at least one Tetanus Toxoid (TT) injection	84.6	84.1	89.5	95.6 (Aurangabad)	73.4 (Darbhanga)
Mothers who consumed IFA for 100 days or more	12.7	11.7	21.3	21.4 (Madhubani)	7.1 (Samastipur)
Full Antenatal Check up	7.8	6.8	16.1	15.3 (West Champaran)	2.7 (Samastipur)
ANC from Govt. Source	23.9	23.9	24.3	45.6 (Siwan)	5.1 (Jamui)

Source: AHS-3

Table 6.7: Households having access to basic facilities (%)

Facility	Year	Bihar			India		
		Rural	Urban	Total	Rural	Urban	Total
Bathroom	2001	6.1	43.6	9.6	22.8	70.4	36.1
	2011	33.7	68.6	37.4	45	87	58.4
Latrine	2001	13.9	69.7	19.2	21.9	73.7	36.4
	2011	17.6	69	23.1	30.7	81.4	46.9
Drainage	2001	34.9	68.6	38	34.2	77.9	46.4
	2011	38.9	71.4	42.3	36.8	81.8	51.1
SDW (Tap/Hand pump/Tube well)	2001	86.1	91.2	86.6	73.2	90	77.9
	2011	93.9	94.7	98.34	82.7	91.4	85.5

Source: Census of India 2011

Except safe drinking Water (SDW), Bihar's achievement on other indicator is substantially lower than the national average. During 2001-2011, the availability of these services has increased but still remains very low. More than 70 percent of households have no latrine facility. Further, a considerable portion of those having access to latrine still prefers open defection (Coffey et al 2014). Around 40 percent of HHs has the access to bathroom facility and connection to drain. There is also large rural-urban disparity observed in accessing

these facilities. However, in accessing SDW facility (Tap/Hand pump/Tube well) Bihar's performance is notable, as it is much higher than national average. One of the factors that contribute to this performance is Bihar's location in Gangetic plain, leading to abundance of ground water.

Table 6.8: District performance in terms of accessibility of services in 2011

Facility	Highest among districts	Lowest among districts	Bihar
Bathroom	58.78 (Patna)	20.81 (Jamui)	37.4
Drainage	80.36 (Rohtas)	13.69 (Kishanganj)	42.3
Latrine	53.01 (Patna)	9.36 (Araria)	23.1
Safe Drinking Water	96.7 (Jamui)	99.38 (Sheohar)	98.3

Source: Census of India 2011

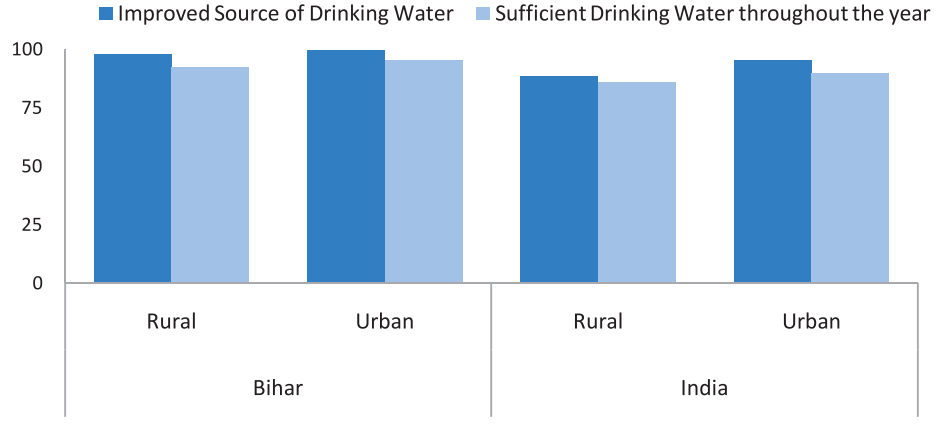


Figure 6.5: Percentage of households having sufficient and improved source of drinking water
Source: Based on NSSO 69th round (July 2012-December 2012)

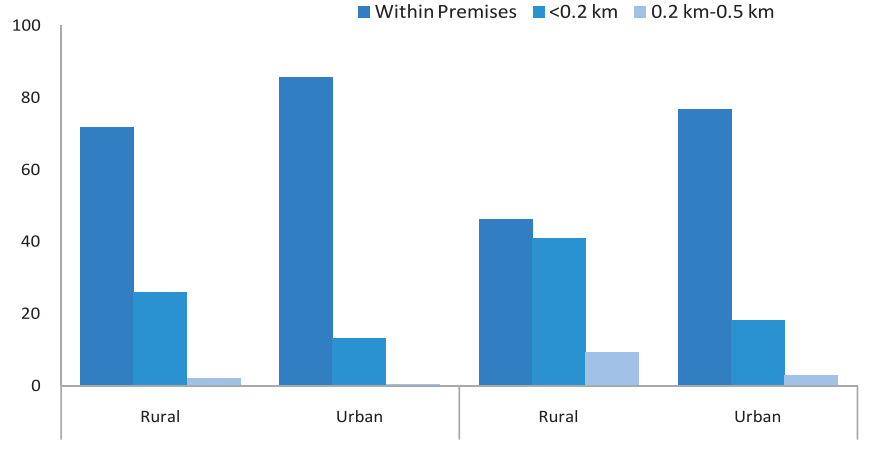


Figure 6.6: Percentage of Households having drinking water within premises and distance covered to reach principal source of Drinking Water
Source: NSSO 69th Round (July 2012-December 2012)

There is also significant variation among districts in accessing these facilities as depicted in the Table 6.8. In Araria, only 9.36 per cent HHs have access to latrine facility. bathroom and drainage. There is huge gap between the highest and the lowest value. However, in SDW, there is very less disparity. Safe hygienic practices are very important aspect of health programmes. Only safe source of DW is not enough, it needs to be free from any kind of contamination such as Arsenik, Flouride, Iron, which have become major problem in Bihar. Availability of SDW throughout the season is also very crucial. Around 90 percent of HHs can access DW through safe sources and throughout the year, both for rural and urban area. It is also noteworthy that Bihar is also much ahead in providing DW covering less distance (Figure 6.5; 6.6). Around 70 percent HHs (85 per cent for urban) in Bihar can access DW within premises. However, in treating DW by any method, in Bihar the proportion is very low in comparison to national average (Figure 6.7). Bihar lags much behind the national average in providing access to improved drainage system and garbage disposal system as well (Figure 6.8). There is also wide rural-urban disparity. The services are almost half in rural areas as compared to urban areas. In fact different dimensions of sanitation (bathroom, drainage, latrine) are closely related (Ghosh 2015) and absence of one facility may affect the accessibility of other components. Therefore, an integrated policy intervention is required to mitigate this severe problem.

Figure 6.7: Percentage of Households treating DW by any method and getting good quality DW and throughout the year

Source: NSSO 69th Round

Moreover, the Total Sanitation Campaign (TSC) - upholding the spirit of 'people oriented' and 'demand driven' approach - transformed the whole sanitation agenda with focus on qualitative change. But, the implementation of TSC in Bihar is poor in comparison with major states of India. Except in terms of number of school toilets and RSM/PC, Bihar could not achieve the project objectives. Bihar lags much behind the national average in providing

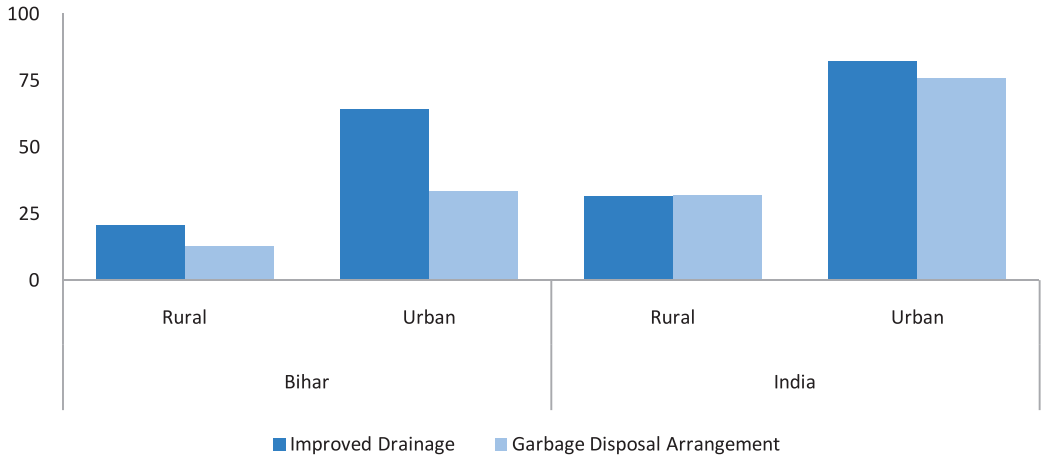


Figure 6.8: Percentage of Households having improved drainage facility and Garbage Disposal Arrangement
Source: NSSO 69th Round

access to improved drainage system and garbage disposal system as well. TSC came as a great opportunity to Bihar as it covers 90 percent of Bihar's rural population. In terms of expenditure, Bihar has been able to spend above the national average but there is significant amount of disparity in spending among the districts. Though, during 2012-13 financial year, Bihar spends less than 45 per cent of allotted sum.

7. Bihar vis. a vis. the conceptual framework: Identifying layers of deficit

India has missed the targets set under the Millennium Development Goals by a wide margin. Although many states in India have been able to curb their levels of child malnutrition, three states viz. Uttar Pradesh, Bihar and Jharkhand remain at an alarming state. Based on Census 2011 and NFHS 4, the contribution of Uttar Pradesh and Bihar to India's stunted children is particularly striking at around 21.5% and 11% as against their share in population at around 16.5% and 8.6% respectively. To reduce stunting in the country, special attention needs to be given to these two states. While with various efforts, the government in Uttar Pradesh has been able to take dedicated initiative towards abatement of child malnutrition, Bihar continues with conventional and business as usual approach on the issue. This is corroborated from the findings outlined in this report on the basis of extensive analysis of latest secondary data supported by intensive field observations. Using empirically established framework on the dynamics underlying child malnutrition, particularly child stunting, this report examines the performance of Bihar as well as of its districts. At the same time, this framework is tested for Bihar using statistical techniques and the findings do conform to existing cross context evidences.

The performance of Bihar on identified determinants of child malnutrition is very poor across the districts. There is no adequately nourished region in Bihar and the whole state is 'stunted'. Although Gopalganj and Siwan have relatively lesser incidence of stunting among under-five children, yet with stunting level at 35% or above, these districts are not in much better situation either. The report also estimates economic cost inflicted due to loss of cognitive ability among children and consequent loss of adult productivity, which is as high as above Rs. 200 crores per annum on average.

7.1 Deficit tilted towards underlying factors

If the performance of Bihar is assessed with reference to UNICEF's conceptual framework on determinants of child malnutrition, it is possible to identify systematically, at which level the largest degree of failure is occurring. The framework classifies causes of malnutrition as basic, underlying and immediate. Access to food and exposure to disease are main immediate causes of malnutrition and while Bihar does not lag much behind in terms of food and calorie intake, exposure to disease is relatively high in the state. If we look at underlying factors such as care for women and children and access to quality health service and living environment, Bihar performs miserably at this stage. Care indicators for women in particular have shown poor performance, whether seen in terms of female literacy or age of marriage or in terms of incidence of anaemia among women or extent of ante-natal care. Access to safe living environment is highly inadequate as shown in preceding analyses, for example in terms of access to toilet. Health services' outreach is low as well. These significant gaps at the level of underlying determinants culminate into under-performance at level of immediate causes. Poor access to quality of life and health services is directly instrumental to incidence of preventable diseases like diarrhoea. Further beneath the underlying determinants lies the level of education, which again is low in Bihar. Literacy rate – the crudest indicator in this regard is still just 61.8% (2011), despite an increase over last decade.

7.2 Deficit at basic level: skewed structure, weak agency

Coming to the basic or fundamental barriers – the structure of resource control and access is among the most skewed in Bihar. Access to resource and control within and outside the household- is quite gendered in nature and is stratified across castes in Bihar. This is found to mediate outcomes of maternal well being and through this the outcomes of child health and nutrition – directly and indirectly. The skewed structure of resource and control is further reflected in group inequality in consumption expenditure and malnutrition, as traced in this paper. This inequality itself is instrumental to the downward rigidity in child stunting in Bihar. At a basic level, the political and ideological environment has been somewhat indifferent or at least less committed towards the issue of nutrition. This is also

reflected in structure of growth that the state has facilitated – urban centric growth along with marginalization of rural workers in a predominately rural state.

The review of programme performance and policy issues reveals considerable inter-district variation. Southern and South-western districts of Bihar are better achievers in terms of accessing various schemes than northern and north-eastern part of the state, which indicates the need for district specific interventions. Although a visit to Kasba block of Purnia did reflect some agility in administrative engagement with nutrition interventions, primarily the ICDS, reflections from focus group discussion and open ended interaction with stakeholders in line departments and field units such as ICDS centres identified following dimensions of the problem:

i. difficulty with respect to norms on beneficiary selection

ii. resource gap

iii. lack of programmatic coordination and

iv. social inertia.

These issues pertain to schematic norms of programmes as well as to resource gap and inter-departmental programmatic coordination. Absence of community participation is also an issue, although projects like UNICEF's Swabhiman – do generate opportunities for involvement of local people in nutrition interventions. But these projects cannot be substitute for state intervention and have limited coverage as well.

Ostensibly, Bihar faces structural barriers as far as functioning of nutrition development and support system is concerned. Unfortunately, the state suffers from weak agency interface as well. The blasphemy of malnutrition finds very negligible space in public discourse. Even media (both print and electronic) coverage is nearly absent (ibid.). The issue finds some place in media only when some kind of carnage (such mid day meal carnage in Bihar) takes place. Thus the scope for building of public opinion on the issue gets narrowed down and consequently, there is no demand or pressure from the bottom to seek more or better nutritional support interventions from the state. Although civil society activism made a dent on policy indifference towards nutrition issue in states like Maharashtra, Bihar is yet to reach such a state.

7.3 Some lessons

The study involved geographically small by intensive field interaction which does leave some message for introspection at policy level.

i. Since nutrition is a multidimensional phenomenon, policy process needs to adopt commensurately dynamic design to address the challenge. As discussed above, in context of Bihar the issue of malnutrition needs to be addressed most

strongly at basic and underlying levels. Policy approach must be sensitive to such an understanding.

ii. Aggressive drive to alter the socially stratified (in terms of caste) and gendered ways of life needs to be mainstreamed in programme structure in contrast to the current situation where the issue of gender is confined to Social Welfare Department of Government. This one drive could have long term implications for several development indicators (most importantly for nutrition) apart from improvement in women's condition which is important in itself. The inter-sectionality between social and gender stratification needs to be considered as well.

iii. Awareness on sanitation needs massive campaign and this is not impossible. The fact that the states have had a successful polio eradication programme based on aggressive and mass scale approach – proves that if the states are willing they can undertake similar approach towards eradication of malnutrition. Good thing and a glimmer of hope is that nowadays we continuously hear the term 'cleanliness [Swachhata]. Sanitation and good nutrition should be incorporated compulsorily in the educational curricula.

iv. Given that due to high population base a few states contribute to majority of the malnourished population of the country, the central government should partner with those states in particular. These relatively poorer states are at a disadvantage as far as their ability to spend on nutrition interventions is concerned. Presently, the ICDS is run with both centre and state contribution and its coverage is not universal. It has been observed earlier that the poorer states receive least coverage and funding (Lokshin et al 2005). The cost sharing formula may be altered at least for these critical states so that there is sustainable flow of fund to the block level.

In addition, at operational level, policy process ought to strategize on following lines.

i. An effective engagement of local people through local bodies may yield far reaching benefits. Strengthening rural and urban local bodies is therefore, indispensable.

ii. There is much scope for involvement of civil society in this regard. Local ownership of programmes can ensure better monitoring, improve service delivery and can also generate demand for more and improved support.

iii. As has been noticed earlier, there is duplication of programmes across various departments which practically have similar consequences for nutritional dynamics. Horizontal and vertical coordination between various government

departments and their line offices is indispensable to avoid wastage of resources and create synergy.

iv. Strong monitoring systems is required to track programme implementation and beneficiaries as well as for an effective and functional grievance redressal System. Information Technology support may be sought to develop relevant system in this regard. Some lessons from Uttar Pradesh are worth a consideration.

The state – at centre or state level- cannot absolve itself on the ground of resource gap as far as its responsibilities towards population nutrition are concerned. The state of Bihar needs to steer out of its passivity on this particular issue and must examine the scope for innovations in terms of context specific interventions. The question that needs to be brought at the forefront of the debate is whether the state of Bihar can afford 48.3% of child stunting levels, associated with annual economic cost of more than Rs. 200 crores. The right to nutrition is an issue of human security and needs to be addressed at a war footing – rather than as a welfare agenda.

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Appendix

Table 1: Trend of Child Health Indicators during 2008-12

Year	Location	IMR		U5MR	
		Bihar	**India**	**Bihar**	**India**
2008	Total	56	53	75	69
	Rural	57	58	77	76
	Urban	42	36	56	43
2009	Total	52	50	70	64
	Rural	53	55	71	71
	Urban	40	34	49	41
2010	Total	48	47	64	59
	Rural	49	51	65	66
	Urban	38	31	47	38
2011	Total	44	44	59	55
	Rural	45	48	61	61
	Urban	34	29	41	35
2012	Total	43	42	57	52
	Rural	44	46	58	58
	Urban	33	28	39	32
2013	Total	42	40	54	49
	Rural	42	44	56	55
	Urban	33	27	37	29
2014	Total	42	39	53	45
	Rural	43	43	54	51
	Urban	37	26	43	28

Source: Sample Registration System – Registrar General, India.

Table 2: District wise Child nutrition status in Bihar

Indicators	Children under 5 years who are stunted (height-for-age) (%)	Children under 5 years who are wasted (%)	Children under 5 years who are severely wasted (%)	Children under 5 years who are underweight (%)	Children age 6-59 months who are anaemic (<11.0 g/dl) (%)
Arariya	48.4	22.8	7.2	45.4	61.8
Arwal	50.2	30.7	16.4	54	66.8
Aurangabad	48.3	24.8	7.2	47.6	53.4
Banka	49.6	26	9.3	48.5	70.4
Begusarai	44.9	18.4	5.8	39.1	62.7
Bhagalpur	46.6	23.1	7.8	40.8	70.1
Bhojpur	43.5	26	12.3	47.2	70.6
Buxar	43.9	19.6	5.7	41.2	59.8
Darbhanga	49	16.6	4.9	41.1	69.9
Gaya	52.9	25.6	7.6	53.1	59
Gopalganj	35.6	16.5	5.4	30.5	63.1
Jamui	45.9	29.4	10.9	47.2	61.3
Jehanabad	52.1	19.6	8.5	47.1	61.4
Kaimur	53.8	21.4	6.9	48.1	63
Katihar	49.2	20.7	6.1	45.1	61.3
Khagaria	49.8	17	6.6	42.4	63.4
Kishanganj	46.9	22.8	9.2	45.4	65.2
Lakhisarai	50.6	22.8	6.4	47.3	66.3
Madhepura	51.8	24.2	9.1	49.2	66.3
Madhubani	51.8	19.1	6.3	45.4	62.9
Munger	46.6	21.5	5.6	43.7	62.5
Muzaffarpur	47.9	17.5	5.6	42.3	58.5
Nalanda	54.1	24.3	6.9	50.2	59
Nawada	48.4	21.4	6.9	45.9	56.4
Pashchim Champaran	43.6	21.7	7.1	39.1	62.3
Patna	43.5	28.5	11.5	43.3	51.6
Purba Champaran	47.2	18	4.8	40.8	65.7
Purnia	52.1	20.8	5.7	47	66.5
Rohtas	48.5	19.9	6.7	45.1	61.3
Saharsa	43.9	24	10.5	44.4	68.4
Samastipur	49.2	18.4	6.1	41.3	65.4
Saran	46.1	18.1	4.6	40.4	61.9
Sheikhpura	46.4	28.9	10.8	51.7	66
Sheohar	53	14.8	4.3	42.8	63.7
Sitamarhi	57.3	15.8	4.6	47.7	69
Siwan	37.9	15	6	31.6	63.1
Supaul	48.1	20.9	7.2	43.4	72.4
Vaishali	53.7	15.1	4.9	41.3	67.4

Source: NFHS 4

Table 3: Underlying determinants on child nutrition across major Indian states

District	HH with improved sanitation (%)	Adult women literate (%)	Mothers with min four antenatal visit (%)	exclusive breastfed below 6 months (%)	Adult women with low BMI (%)
Gopalganj	26.4	57	20.3	61.4	25.7
Siwan	23.6	61.6	21.4	63.3	24.2
Bhojpur	26.2	56.4	16.1	57	24.1
Patna	49.9	64.7	21.7	35.4	24
Pashchim Champaran	21.4	44.4	14.2	48.7	27
Buxar	27.9	62.9	23.3	56.2	24.7
Saharsa	16.6	39	10.1	59.9	34.6
Begusarai	34.2	50.7	7.9	27.3	31
Jamui	14.8	44.4	10.4	40.2	37.5
Saran	25.4	57.5	20.5	73.8	23.9
Sheikhpura	33.6	49.1	13.4	41.2	35.6
Bhagalpur	32.3	54.6	20.1	61.7	26.2
Munger	34.1	62.5	24.4	46.4	28.8
Kishanganj	15.9	33.7	15.5	66.8	34.5
Purba Champaran	20.5	44.6	12.1	51.7	28.9
Muzaffarpur	28.5	53.8	10.9	78.9	33
Supaul	15.8	35.9	11	68.3	38.6
Aurangabad	27.1	59.3	16.2	51.9	30.9
Arariya	12.5	38.8	16.2	51.2	38.3
Nawada	28.8	47.5	13.6	32.8	33.6
Rohtas	25.9	64.2	13.9	42.6	26.9
Darbhanga	27.7	43.5	9.4	61.4	31.2
Katihar	21.5	40.2	8.9	62.4	32.4
Samastipur	19.2	50	11.6	44	29.7
Banka	14.3	42.7	16.8	54.3	32
Khagaria	30.8	44.2	13.2	48.4	31.1
Arwal	21.3	54.6	11.5	43.2	30.8
Lakhisarai	36.8	52.4	17.9	32.7	27.6
Madhepura	15	32.6	9.3	64.4	32.9
Madhubani	19.1	40.9	13.8	63.2	32
Jehanabad	29.3	55.3	17	35.9	30.6
Purnia	14.4	41.1	12.2	60	38.8
Gaya	26.8	50.2	11.8	28.4	36.1
Sheohar	21	40.9	13.4	55	33.1
Vaishali	30.5	54.1	19.3	63.4	28.9
Kaimur	21.5	59.7	10.1	34.1	28.6
Nalanda	31	48.8	9	36.7	30.7
Sitamarhi	20.2	37.6	16.6	38.4	33.6

Source: NFHS 4

Table 4: Results from Cluster Analysis on Stunting in Districts of Bihar

Cluster	Districts	Percentage incidence of stunting	Cluster	Districts	Percentage incidence of stunting
1	Gopalganj	35.6	4	Muzaffarpur	47.9
	Siwan	37.9		Supaul	48.1
Status	**Relatively low**	**36.75**		Rohtas	48.5
2	Jehanabad	52.1		Aurangabad	48.3
	Madhepura	51.8		Nawada	48.4
	Gaya	52.9		Lakhisarai	50.6
	Madhubani	51.8		Arariya	48.4
	Kaimur	53.8		Arwal	50.2
	Sheohar	53		Samastipur	49.2
	Vaishali	53.7		Katihar	49.2
	Nalanda	54.1		Khagaria	49.8
	Sitamarhi	57.3		Banka	49.6
	Purnia	52.1		Darbhanga	49
Status	**Very high**	**53.39**	**Status**	**High**	**49.02**
3	Begusarai	44.9			
	Bhojpur	43.5			
	Patna	43.5			
	Buxar	43.9			
	Saharsa	43.9			
	Jamui	45.9			
	Bhagalpur	46.6			
	Munger	46.6			
	Saran	46.1			
	Sheikhpura	46.4			
	Purba Champaran	47.2			
	Kishanganj	46.9			
	West Champaran	43.6			
Status	**Relatively medium**	**45.31**			

Table 5: District-Wise percentage of households having access to basic facilities, 2011

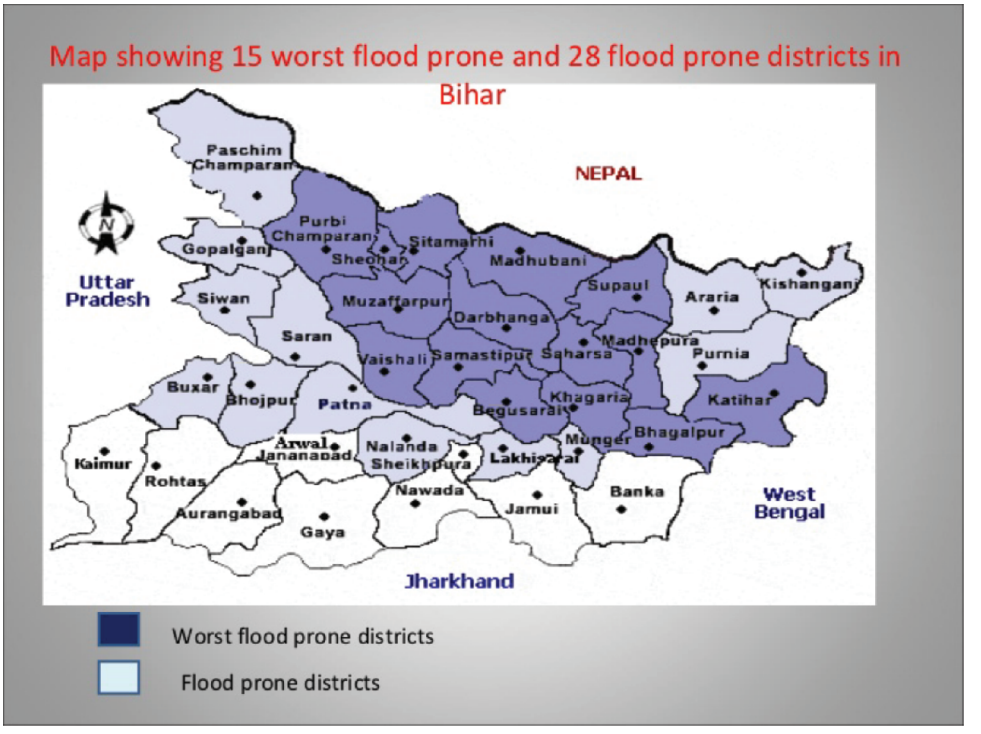
District	Bathroom	Drainage	Latrine	Safe Drinking Water
Araria	40.08	15.20	9.36	98.52
Arwal	43.66	79.27	23.66	98.98
Aurangabad	43.01	73.93	21.78	98.37
Banka	23.27	33.46	12.25	96.92
Begusarai	32.41	35.82	31.31	98.38
Bhagalpur	37.05	42.39	33.72	97.02
Bhojpur	52.08	79.09	27.19	98.69
Buxar	49.84	76.29	24.71	98.47
Darbhanga	30.74	24.93	25.13	98.61
East Champaran	39.73	37.26	18.24	99.22
Gaya	37.79	62.19	24.22	98.21
Gopalganj	49.57	47.93	20.02	99.22
Jamui	20.81	32.72	14.83	96.70
Jehanabad	41.16	76.33	27.77	98.27
Kaimur	40.04	66.58	16.73	98.01
Katihar	32.55	20.23	17.51	97.20
Khagaria	27.09	26.02	23.82	98.80
Kishanganj	32.30	13.69	10.38	97.64
Lakhisarai	36.89	54.24	31.82	97.47
Madhepura	34.67	22.77	13.06	98.27
Madhubani	26.17	17.02	18.52	98.51
Munger	41.54	52.85	38.82	97.62
Muzaffarpur	36.54	40.23	27.06	98.52
Nalanda	37.00	77.57	30.71	97.49
Nawada	38.08	71.08	22.29	97.38
Patna	58.78	77.26	53.01	98.18
Purnea	36.52	21.12	13.70	97.07
Rohtas	54.50	80.36	28.22	98.52
Saharsa	30.80	18.77	16.73	97.83
Samastipur	25.11	30.85	18.75	98.89
Saran	43.11	60.21	21.43	98.90
Sheikhpura	33.75	75.37	28.93	97.53
Sheohar	35.00	26.80	20.42	99.38
Sitamarhi	29.69	24.51	20.79	99.04
Siwan	50.78	55.88	22.88	99.37
Supaul	34.60	17.61	10.83	98.33
Vaishali	33.02	43.52	27.17	98.72
West Champaran	38.26	27.02	15.87	99.04
Bihar	37.44	42.32	23.06	98.34

Source: Census of India 2011

Table 6: District wise status of Immunization and other services by location, 2011

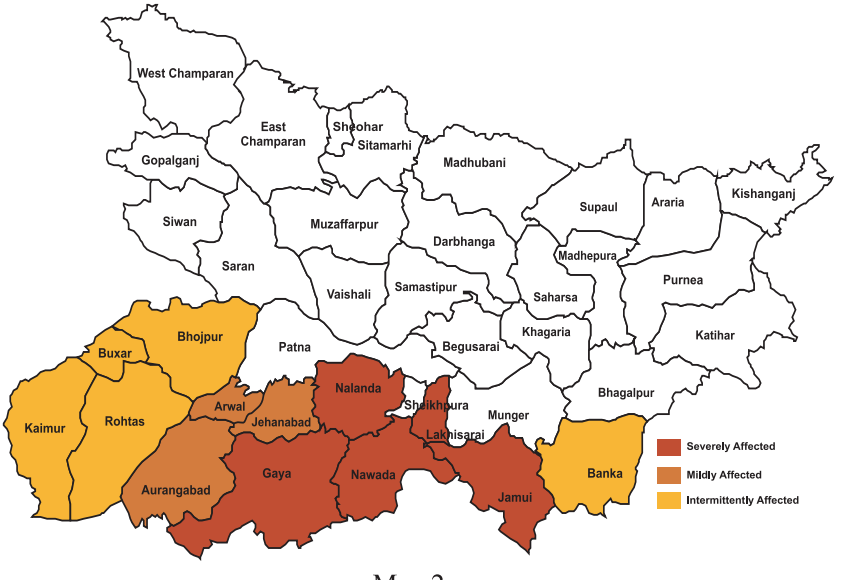
District	Having Immunization Card (%)	Fully Immunized (%)	Not received any Vaccination (%)	At least one dose of vitamin A supplement in last six months (age 6-35 months)	IFA tablets/syrup during last 3 months (aged 6-35 months) (%)	Children whose birth weight was taken (%)	Children with birth weight less than 2.5 Kg. (%)
Araria	78.5	59.9	5.2	65	42.5	37.4	9.8
Aurangabad	83.6	78.6	1.9	57.7	24.3	47.2	20.1
Banka	77.6	65.7	1.7	54.6	24.2	50.2	21
Begusarai	74.9	65.2	1.6	53.5	22.3	50.1	27.5
Bhagalpur	82.7	68	1.8	57.8	28.6	52.9	19
Bhojpur	85.6	67.9	2.7	54.9	22.2	56	18.4
Buxar	82.6	67.8	4.4	41.1	20.9	49	17.8
Darbhanga	94.5	68.9	1.3	56.1	55.4	26.8	23.9
Gaya	77.5	69.3	2	52.9	19.3	41.9	23.4
Gopalganj	91.2	74.8	3.7	50.4	39.8	48.6	15.3
Jamui	71.9	50	4.4	40.7	25.2	43.5	19.7
Jehanabad	89.5	79.1	1.6	60.2	23.9	61.3	18.2
Kaimur	86.5	69.1	1.9	46.6	24.4	45.4	20.5
Katihar	83.6	69.3	4.9	65.5	36	29.5	22.6
Khagaria	91.5	84.8	8.1	61.6	30.4	55.9	19.5
Kishanganj	74.7	32.2	8.9	61.7	34.2	25	28.1
Lakhisarai	76.6	67.3	3.3	52.3	26.7	49	20.9
Madhepura	85.1	80.2	1.2	59.2	31.6	29.5	27.2
Madhubani	95.5	87.8	4.4	69.7	61.4	33	22.3
Munger	82.8	74.4	1	60	25.8	63	19.3
Muzaffarpur	88.7	64.2	2.3	60.5	32.7	46.6	26.8
Nalanda	79.4	74.8	2	57.1	19.7	54.7	23.7
Nawada	78	73.1	1.9	53.1	20	44.2	21.7
West Champaran	90.2	53.9	5.5	54.8	50.3	42.9	21.4
Patna	85.6	76	1.6	55.3	21.5	63.9	20.1
East Champaran	77.9	44	9.9	41.8	38.8	28.6	31
Purnea	85.8	80.9	3.5	68.8	54.2	34.3	39.8
Rohtas	85.3	70.4	2.8	47.6	19.7	49.2	18
Saharsa	86.4	74.8	3.4	69.8	47.8	25.9	17.8
Samastipur	95.8	84.3	3.3	68.9	34.9	53.9	18
Saran	92	79.7	5.2	53.6	31.8	40.8	28
Sheikhpura	79.2	78.2	1.8	54.5	20	55.2	24.2
Sheohar	87.7	69.1	4.6	63.2	47.4	24.5	43.9
Sitamarhi	89.9	69.6	6.2	44.9	41.3	26.7	6.8
Siwan	93.3	76.6	4.4	47	35.3	47.5	28.1
Supaul	85.5	72.6	2.9	60.9	39.6	33.9	12.5
Vaishali	89.7	76.5	3.6	64.1	30	55.8	16.7
Bihar	85.4	69.9	3.7	56.2	33.8	42.9	21.9

Source: AHS 3



Map 1

Source: BSDMA, Government of Bihar
http://www.slideshare.net/cdrnnetwork/government-of-bihar-gagan-cdrn



Map 2

Source: BSDMA, Government of Bihar
http://www.ndma.gov.in/en/bihar-sdma-office

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