

## **Drinking Water and Sanitation Facility in India and Its Linkages with Diarrhoea among Children under Five: Evidences from Recent Data**

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**ABSTRACT :** *Unsafe water, poor sanitation and unhygienic conditions claim around 0.5 million children before the age of 5 from diarrhoea in India annually. This paper aims to provide critical insights into rural-urban differential in basic sanitation and safe drinking water, which calls for an intensive mobilization of resources to reduce the vast coverage gap between urban and rural populations in India. The objectives of this paper is to assess the level, trend, progress rate and State-wise rural-urban differential in accessibility and availability of safe drinking water facility and availability of basic sanitation facility within premises across the country. It also examines the association between diarrhoea among children under five and water, sanitation and various socio-economic and demographic characteristics of Indian households. Data on sources of drinking water and latrine facility from houses, household amenities and assets- Census of India, 1981-2011 and third round of the National Family Health Survey (NFHS-3, 2005–06). Binary Logistic Regression technique was used to explain association between diarrhoea among children under five and water, sanitation and various socio-economic and demographic characteristics of Indian households. India is “on track” to meet the target on access to safe drinking water with sharp reduction in urban-rural disparities. But as per sanitation facility is concern India is lagging far behind. This paper has also found that households with unimproved latrine facility within premises have a higher prevalence of having diarrhea among children U-5 than do those with improved latrine facility.*

**Keywords** -*Safe, drinking water, latrine, diarrhoea, children, states, India.*

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### **I. INTRODUCTION**

Access to safe drinking water and sanitation is not only an important measure of the socio-economic status of the household but is also fundamental to the health of its members. Safe drinking water is essential for child survival. Globally the world is on track to meet the MDG on safe drinking water. India too is on track with 82.7 percent rural and 91.4 percent urban populations having sustainable access to safe drinking water (Census of India, 2011). Between 1990 and 2004, South Asia and India more than doubled their coverage in improved sanitation. Yet in 2004, an estimated 700 million people in India were not using improved sanitation facilities. [9]

India is a country of villages. According to Census 2011 (Provisional Total), 833 million people (69.84%) are still living in the villages. Facts and figures of census of India, 2011 shows that still around 70% of India's rural and slum population (650 million) are exposed to water-borne and vector-borne diseases due to lack of basic sanitation facility, unsafe water and unhygienic conditions. In June 2012 Minister of Rural Development Jairam Ramesh stated India is the world's largest "open air toilet". He also remarked that Pakistan, Bangladesh and Afghanistan have better sanitation records.

Diarrhoea's impact is particularly severe in children. Acute diarrhoea, as occurs with cholera, if left untreated can cause death within a day or less. Diarrhoeal diseases are transmitted through human excreta, and it is therefore critically important to have effective barriers in place to prevent this major transmission route. [11][13] Improved sanitation alone could reduce diarrhoea-related morbidity by more than a third; improved sanitation combined with hygiene awareness and behaviours could reduce it by two thirds. [1] Such behaviours include consistent use of a toilet or latrine by each person in the household, safe disposal of young children's faeces, and hand washing with soap or ash after defecation and before eating. Under nutrition, which is associated with more than half of all under-five deaths [8], is closely linked to diarrhoea. Infectious diseases and diarrhoea in particular, are the main determinants of wasting and stunting of growth in children in developing countries. [6]

It is estimated that unsafe water and a lack of basic sanitation and hygiene every year claim the lives of more than 1.2 million children under five years old from diarrhoea. [5] This tragic statistic underscores the need for the world to meet its Millennium Development Goal (MDG) commitment on water and sanitation: MDG 7, which aims to halve, by 2015, the proportion of people without sustainable access to safe drinking water and basic sanitation. Water and sanitation are vital in themselves, but they are also key prerequisites for reducing child and maternal mortality (MDGs 4 and 5) and combating diseases (MDG 6). [13]

## II. DATA SOURCES AND METHODOLOGIES

Data are from Census of India, 1981-2011, H-Series to assess the level and trend of Drinking Water and Sanitation Facility in India. Census of India is collected data on houses, household amenities and assets data in each censuses in which data was collected regarding main source of drinking water for the household. The source, which was availed during the greater part of the year was to be recorded as the main sources. The main sources of drinking water was categories into – (1) Tap water, (2) Hand pump, (3) Tubewell/Borehole, (4) Well, (5) Tank, Pond, Lake, (6)River, canal, (7) Spring and (8) Any other.

Upto census 2001, tap water, hand pump and tubewell were considered as safe sources of drinking water. Economic survey 2011-12 have published data on “Access to Safe Drinking Water in Households in India” of census 1981-2001. Following the same as **sources of safe drinking water (Tap/Hand-pump/Tubewell)** for census 2011, data on access to safe drinking water in household has been created, collecting data from Provisional, Census of India, 2011, “Houses, Household Amenities and Assets –Drinking water data”.

In every Census, question regarding availability of drinking water source is asked from each household and responses are collected upon the distance at which it was available. Responses are categories into three-

- (1) **Within Premises:** If the source was located within the premises where the household lived.
- (2) **Near the Premises:** If the source was located within a range of 100 meters from the premises in urban areas and within a distance of 500 meters in case of rural areas.
- (3) **Away:** If the source was located beyond 100meters from the premises in urban areas and beyond 500 meters in rural areas.

The Indian census provides information about availability and type of latrine facility within premises. Considering the concepts and definitions about the type of latrine facility within premises two categories e.g. -**improved latrine facility** and **Unimproved latrine facility** within premises for household environments had been defined as following:

### Definitions of ‘improved’ and ‘unimproved’ Latrine facilities within premises in India

Improved Latrine Facility	Unimproved Latrine Facility
<b>Flush/pour flush latrine connected to</b>	<b>Flush/pour flush latrine connected to</b>
Piped sewer system	Other system
Septic tank	<b>Pit Latrine</b>
<b>Pit Latrine</b>	Without slab/open Pit
With slab/ Ventilated Improved Pit	<b>Night soil disposed into open drain</b>
	<b>Service Latrine</b>
	Night soil removed by human
	Night soil serviced by animals

### Methodology of computing the annual actual rate of progress (AARP) and Required Rate of Annual Progress (RRAP) in selected indicators of MDGs, India and states

Indicator	Source	Target	AARP	RRAP
Basic Sanitation Facility	Census	Reduce by half the proportion of people without sustainable access	$\frac{(X_{t_1}-X_{t_0}) * 100}{X_{t_0} * (t_1 - t_0)}$	$\frac{(X_{t_{mdg}}-X_{t_0}) * 100}{X_{t_0} * (t_{mdg} - t_0)}$

Where,

$t_1$  is the most recent year for which data are available, and

$X_{t_1}$  are the values of the most recent year.

$X_{t_{mdg}}$  is the value of indicator which must be achieved in 2015 according to MDG.

$X_{t_0}$  is the value of indicator closest to 1990 for which data are available.

$t_{mdg}$  is the year (2015) by which the target is to be met, and

$t_0$  is the year closest to 1990 for which data are available.

Binary Logistic Regression technique was used to explain association between diarrhoea among children under five and water, sanitation and various socio-economic and demographic characteristics of Indian households using the SPSS 20 statistical software package. The household characteristics data from all the National Family Health Survey 3rd round ( NFHS-III, 2005-06) conducted by the International Institute for Population Sciences, Mumbai under the stewardship of the Ministry of Health and Family Welfare(MoHFW), Government of India has been used. Results are presented in the form of odds ratios (ORs) with 95% confidence intervals (95% CI). The analysis here is based on 52,868 children under-five years of age living in the sample households.

### III. OBJECTIVES

1. To assess the State-wise rural urban differential in drinking water and sanitation facilities in Indian households; and
2. To examine the association between diarrhoea among children under five and drinking water and sanitation facilities in Indian households.

### IV. RESULTS AND DISCUSSION

#### 4.1 Sources of Drinking Water in India

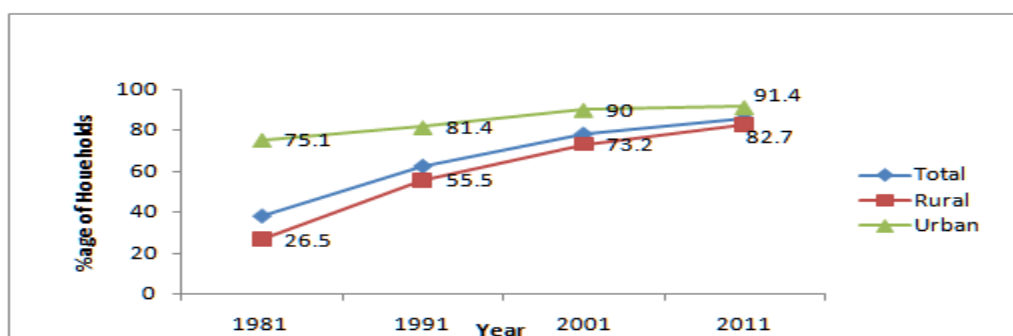
Over large parts of the world, humans have inadequate access to safe or potable water and use sources contaminated with disease vectors, pathogen or unacceptable levels of toxins or suspended solids. Drinking or using such water in food preparation leads to widespread acute and chronic illnesses and is a major cause of death and misery in many countries. Reduction of waterborne diseases is a major public goal in developing countries.

According to census 2011, tap water (treated plus untreated) was the major source of drinking water with access to 43.6 percent household in India followed by hand-pump(33.5%), well (covered plus uncovered)-11% and tube-well/borehole (8.5%). In rural India, hand-pump (43.6%) was the leading source followed by tap water (treated-18% & untreated-13%) and well (covered-1.5% & uncovered-12%) as the main source of drinking water in their household. Whereas in urban India, tap water (treated-62% & untreated-8.6%) was the main source of drinking water in 2011.

#### 4.1.1 Access to Safe Drinking Water in Households in India

India has progressed in access to safe drinking water (Tap/Hand-pump/Tube well) in the household from 38 per cent in 1981 to 85.5 per cent in 2011. In terms of level of rural- urban differential in access to safe drinking water in the households in India, in 1981, 26.5% households in rural India and 75.1% households in urban India, depicting a huge gap of around 49% point in access to safe drinking water. But, over the period of time this gap has also declined to 26% point in 1991 to only 8.7% point (Figure-3) in 2011.

**Figure 1: Trend in access to safe drinking water in households in India (in per cent)**



Though Rural- Urban differential has declined over the period of time, but regional differential (State-wise) in access to safe drinking water in household is still existing. A rural-urban differential of 26 percent point in 1991 in access to safe drinking water has decline to only 8.7 percent point in 2011. But, still Jammu & Kashmir, Jharkhand, Maharashtra, Rajasthan and Madhya pradesh are some major States having large gap in terms of rural-urban differential in access to safe drinking water in census 2011.

The most significant improvement had taken place in the state of Uttar Pradesh and Bihar. After Punjab, Uttar Pradesh and Bihar hold the top ranking states (2<sup>nd</sup> and 3<sup>rd</sup>) in terms of access to safe drinking water (Tap/Handpump/ Tubewell) in households in census 2011. Still 9 States namely Odisha, Assam, Tripura, Mizoram, Jharkhand, Nagaland, Manipur, Meghalaya and Kerala have more than 25 percent households without access to safe drinking water (Table-1).

**Table 1: Access to safe drinking water in households in India (in per cent)**

SI No.	States	Tap/Hand-pump/Tube-well								
		1991			2001			2011		
		Total	Rural	Urban	Total	Rural	Urban	Total	Rural	Urban
1	Jammu & Kashmir	NA	NA	NA	65.2	54.9	95.7	76.7	70.1	96.1
2	Himachal Pradesh	77.3	75.5	91.9	88.6	87.5	97	93.7	93.2	97.8
3	Punjab	92.7	92.1	94.2	97.6	96.9	98.9	97.6	96.7	98.9
4	Uttarakhand	*	*	*	86.7	83	97.8	92.2	89.5	98.6
5	Haryana	74.3	67.1	93.2	86.1	81.1	97.3	93.8	92	96.7
6	Rajasthan	59	50.6	86.5	68.2	60.4	93.5	78.1	72.8	94.3
7	Uttar Pradesh	62.2	56.6	85.8	87.8	85.5	97.2	95.2	94.4	97.8
8	Bihar	58.8	56.5	73.4	86.6	86.1	91.2	94	94	94.7
9	Sikkim	73.1	70.8	92.8	70.7	67	97.1	85.4	82.6	92.2
10	Arunachal Pr.	70	66.9	88.2	77.5	73.7	90.7	78.6	74.3	91.4
11	Nagaland	53.4	55.6	45.5	46.5	47.5	42.3	53.9	54.6	51.8
12	Manipur	38.7	33.7	52.1	37	29.3	59.4	45.4	37.5	60.9
13	Mizoram	16.2	12.9	19.9	36	23.8	47.8	60.4	43.4	75.8
14	Tripura	37.2	30.6	71.1	52.5	45	85.8	67.5	58.2	91.9
15	Meghalaya	36.2	26.8	75.4	39	29.5	73.5	44.7	35.1	79.5
16	Assam	45.9	43.3	64.1	58.8	56.8	70.4	69.9	68.3	78.2
17	West Bengal	82	80.3	86.2	88.5	87	92.3	92.2	91.4	93.9
18	Jharkhand	*	*	*	42.6	35.5	68.2	60.2	54.3	78.5
19	Odisha	39.1	35.5	62.8	64.2	62.9	72.3	74.2	74.4	79.7
20	Chhattisgarh	*	*	*	70.5	66.2	88.8	86.3	84.1	93.9
21	Madhya Pradesh	53.4	45.6	79.4	68.4	61.5	88.6	78	73.1	92.1
22	Gujarat	69.8	60	87.2	84.1	76.9	95.4	90.2	84.9	97
23	Maharashtra	68.5	54	90.5	79.8	68.4	95.4	83.4	73.1	95.7
24	Andhra Pradesh	55.1	49	73.8	80.1	76.9	90.2	90.5	88.6	94.5
25	Karnataka	71.7	67.3	81.4	84.6	80.5	92.1	87.6	84.4	92.2
26	Goa	43.4	30.5	61.7	70.1	58.3	82.1	85.7	78.3	90.4
27	Kerala	18.9	12.2	38.7	23.4	16.9	42.8	33.5	28.4	39.5
28	Tamil Nadu	67.4	64.3	74.2	85.6	85.3	85.9	92.6	92.2	92.9
	<b>India</b>	<b>62.3</b>	<b>55.5</b>	<b>81.4</b>	<b>77.9</b>	<b>73.2</b>	<b>90</b>	<b>85.5</b>	<b>82.7</b>	<b>91.4</b>

Source: Economic Survey 2011-12, A124 & House listing and Housing Census Data Highlights – 2011; Houses, Household Amenities and Assets- Census of India, 2011.

NA- Data not available

\* State not exists

#### 4.1.2 Availability of Drinking Water in India

In 2001, only 39 per cent had availability of drinking water within the premises which has increased to 46.6 per cent in 2011. But, in the same period of time availability of drinking water in India “away” from the household has also increased from 17 per cent in 2001 to 18 per cent in 2011. They have to travel a long distance (beyond 100 meters in urban areas and beyond 500 meters in rural areas) from their households to get drinking water, the most basic need of life.

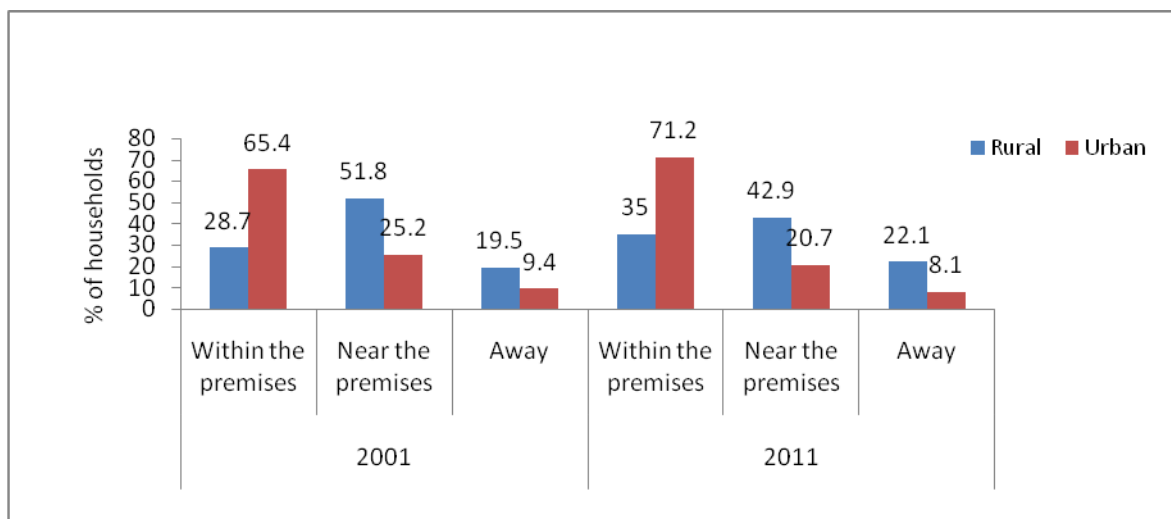
In 2011, around 36 per cent households have to travel within a range of 100 meters from the premises in urban areas and within a distance of 500 meters in case of rural areas for drinking water in India. Figure- 2 shows the rural- urban differential availability of drinking water facility in facility in India. The most significant finding is that in 2001, around twenty per cent households in rural India had to travel a long distance (more than 500 meters from the household) to get drinking water. Now, according to census 2011 more households in rural areas i.e. 22 per cent households have to travel a long distance to achieve the basic need. Whereas an improvement have been seen in urban areas in availability of drinking water, ‘away’ from the household. In 2001, 9.4 per cent households in urban areas had to travel a distance beyond 100 meters from the household to get drinking water and now it has declined to 8.4 per cent households in 2011.

Among major states of India, according to census 2011, in rural parts of Jharkhand, Madhya Pradesh, Rajasthan, West Bengal and Chhattisgarh a range between 30% and 40% households have to travel a long distance for drinking water for their households and it also shows deterioration over the census 2001. The rural

parts of Gujarat and Haryana shows a great improvement over the census 2001 in availability of water ‘away’ from the household in 2011.

According to census 2011, the urban parts of six poor performing states e.g. Odisha, Jharkhand, West Bengal, Madhya Pradesh, Chhattisgarh and Andhra Pradesh have a range between 10% and 20% households ‘away’ from the availability of drinking water source. Urban parts of Punjab, Goa, Uttarakhand, Gujarat and Jammu & Kashmir had only less than 5% households ‘away’ from the source of drinking water.

**Figure2. Rural-Urban differential in availability of drinking water in India, 2001-2011 (in %)**

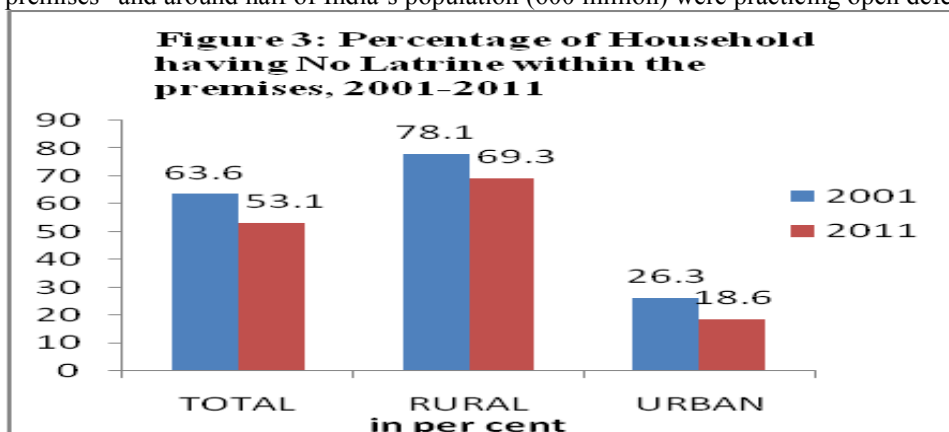


India is dominated by patriarchal society. Girls or women have to perform all the household duties to look after their children and feed the family members. A major proportion of Indian households especially in rural areas women have to travel a long distance (beyond 500 meters) to get water for drinking, cooking and other household chores. During pregnancy, collecting water from a far distance becomes hazardous for the mother as well as their child health. So, responsive administrative bodies would have improved the profile of the availability of drinking water especially at village level considering maternal and child health.

#### 4.2 Availability and type of latrine within the premises in India

Government of India had set a target of universal household sanitation coverage by 2012 when it launched its flagship Total Sanitation Campaign (TSC) in 1991. The scheme is being implemented in 606 districts of 30 States and Union Territories but, evidences from the census of India, 2011 says that 20 states will not be able to meet the 2012 target and MDG 2015 target, as well. In fact, only Eight States – Tripura, Haryana, Himachal Pradesh, Kerala, Goa, Uttarakhand, Sikkim and Mizoram – will be able to meet the 2012 target.

According to census 2001, Sixty four per cent of total households in India had “no latrine facility within premises” and more than 60 per cent population was practiced open defecation. Evidences from new data e.g. census of India, 2011 depict that still 53 per cent households in India had “no latrine facility within premises” and around half of India’s population (600 million) were practicing open defecation- the largest share



in the world. Though, improvement had been observed in percentage of households with “latrine facility within the premises” from 36.4 per cent in 2001 to 47 per cent in 2011.

**Table 2: Type of latrine facility for household, Census of India, 2011**

	INDIA/States/ Union Territories	TOTAL				RURAL				URBAN			
		No facility		Within premises		No facility		Within premises		No facility		Within premises	
		Public Latrine	Open	Improved Facility	Unimproved Facility	Public Latrine	Open	Improved Facility	Unimproved Facility	Public Latrine	Open	Improved Facility	Unimproved Facility
	<b>INDIA</b>	<b>3.2</b>	<b>49.8</b>	<b>41.7</b>	<b>5.1</b>	<b>1.9</b>	<b>67.3</b>	<b>25.1</b>	<b>5.5</b>	<b>6</b>	<b>12.6</b>	<b>77.3</b>	<b>4.1</b>
1	Jammu& Kashmir	2.7	46.1	31	20.3	3.1	58.3	18.8	19.8	1.8	10.7	66.3	21.2
2	Himachal Pradesh	1.2	29.7	66.1	2.9	0.9	32.5	63.5	3	4	6.9	86.7	2.3
3	Punjab	1.2	19.5	72	7.3	1.5	28.1	61	9.4	0.8	5.8	89.4	3.8
4	Uttarakhand	1.1	33.1	63.1	2.6	0.9	45	51.4	2.6	1.7	4.7	91	2.7
5	Haryana	1.5	29.8	61.8	6.8	1.6	42.3	48	8	1.3	8.8	85.4	4.5
6	Rajasthan	0.7	64.3	29.8	5.1	0.5	79.9	14.9	4.7	1.3	16.7	75.5	6.5
7	Uttar Pradesh	1.3	63	31.4	4.2	1.1	77.1	17.9	3.8	2.1	14.8	77.6	5.5
8	Bihar	1.1	75.8	19.5	3.6	1	81.4	14.3	3.4	2.2	28.9	63.2	5.7
9	Sikkim	1.5	11.3	78.1	9	1	14.9	72.8	11.2	2.6	2.2	91.9	3.3
10	Arunachal Pr.	3.2	34.8	32.8	29.2	3	44.3	19.3	33.3	3.8	6.7	72.7	16.8
11	Nagaland	6.9	16.5	48.9	27.5	8.5	22.3	37	32.1	3.2	2.2	78.4	16.4
12	Manipur	1.8	8.9	46.4	43	1.7	12.3	37.7	48.4	1.9	2.3	63.8	32
13	Mizoram	1.5	6.6	69.2	22.9	2.5	12.9	51.1	33.5	0.6	0.9	85.6	12.8
14	Tripura	2.5	11.5	62.5	23.4	3.1	15.4	55.1	26.3	0.8	1.3	81.5	16.5
15	Meghalaya	2.8	34.3	36.4	26.4	3.1	43.1	23.4	30.6	1.9	2.4	84.2	11.6
16	Assam	1.9	33.2	30.6	34.4	2	38.5	21.8	37.7	1.3	5	77	16.7
17	West Bengal	2.5	38.6	48.5	10.2	2	51.3	33.8	12.9	3.7	11.3	80.5	4.6
18	Jharkhand	1	77	20.5	1.6	0.7	79.9	6.3	1.3	1.8	31	64.6	2.6
19	Odisha	1.4	76.6	18.2	3.9	1.2	77.1	10.6	3.4	2	33.2	59.6	5.1
20	Chhattisgarh	1.4	74	21.2	3.4	0.3	81.4	10.7	3.8	5.4	34.4	58.6	1.6
21	Madhya Pradesh	1.2	70	26.5	2.4	0.5	86.4	10.9	2.3	3.3	22.5	71.5	2.7
22	Gujarat	2.2	40.4	56	1.3	1.2	65.8	31.4	1.5	3.6	8.7	86.6	0.9
23	Maharashtra	12.9	34	50.2	2.9	6.2	55.8	34.8	3.3	21	7.7	68.6	2.6
24	Andhra Pradesh	2.5	48	46.9	2.6	2.7	65.1	30.3	1.8	2	11.9	82	4.1
25	Karnataka	3.8	45	48.9	2.3	3.5	68.1	26.5	1.8	4.4	10.7	81.9	2.9
26	Goa	3.9	16.4	74.5	5.1	1.7	27.4	64.5	6.5	5.2	9.5	80.8	4.4
27	Kerala	1	3.8	89.9	5.3	1.2	5.6	87.5	5.7	0.9	1.7	92.4	4.9
28	Tamil Nadu	6	45.7	45.8	2.4	3.5	73.3	21.5	1.7	8.6	16.2	71.9	3.3

Source: House listing and Housing Census Data Highlights – 2011; Houses, Household Amenities and Assets- Census of India, 2011.

Rural India was lagging behind in latrine facility within premises. Figure 3 depicting a huge urban- rural gap in terms of latrine facility within the premises in India. According to census, 2011, every two out of three households of rural India were practice open defecation whereas only 12.6 per cent households in urban India go for open defecation.

In rural India, only one out of four households has improved latrine facility within premises whereas in urban India 77.3 per cent households have improved latrine facility within premises. Though government of India have implemented various sanitation programmes and policies and established thousands of Public toilets across India. But only 3.2 per cent households in India (2% in rural and 6% in urban areas) were using Public

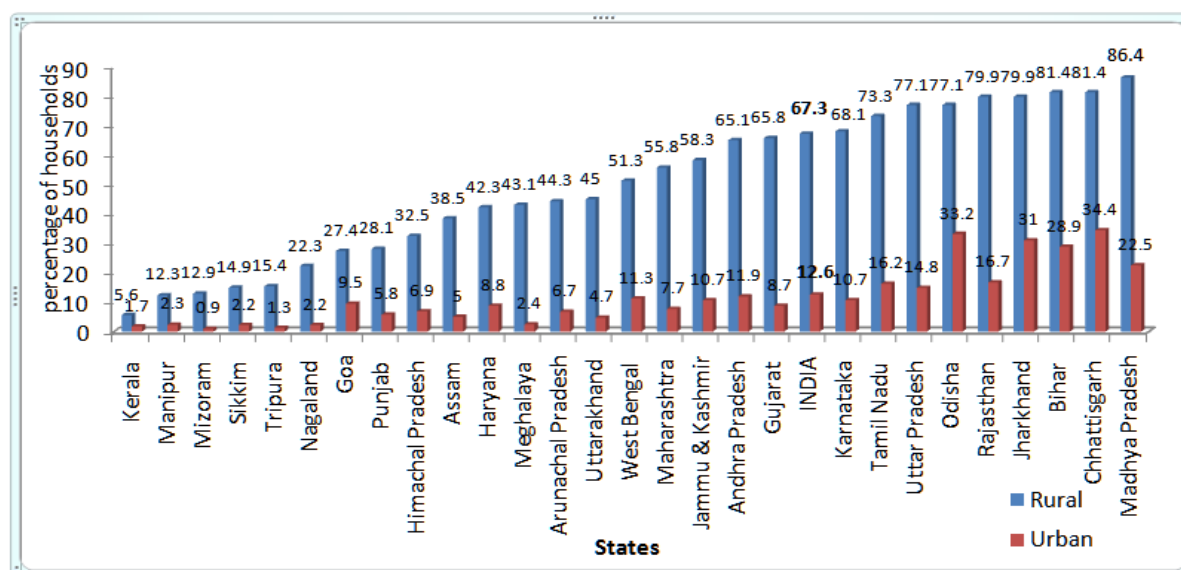
Toilet according to census 2011. In terms of unimproved latrine facility within premises, 5 per cent households in India were using unimproved latrine facility within premises (Table- 2).

The census of India, 2011 household amenity data also depicts the state to state variations in terms of availability and type of latrine facility in India. Jharkhand with 77 per cent households were the worst state in practice of open defecation among Indian states, followed by Odisha, Bihar, Chhattisgarh, and Madhya Pradesh. Kerala was the leading state in practicing least percentage of households (3.8%) open defecation followed by Mizoram, Manipur, Sikkim, Tripura, Goa, Nagaland and Punjab. Kerala (89.9%) was also the leading state in terms of percentage of households with improved latrine facility within premises, followed by Sikkim, Goa, Punjab, Mizoram and Himachal Pradesh. On the other hand, Odisha with 18.2% was the worst state in terms of percentage of households with improved latrine facility within premises among Indian states followed by other EAG states (Table- 2).

Among North-Eastern states of India unimproved/traditional latrine facility within premises is very popular. According to census 2011, Assam with 34.4% has the highest percentage of households using unimproved latrine facility within premises in India. Other North-Eastern states except Sikkim (9%) have a range between 20 per cent and 30 per cent households with unimproved latrine facility within premises. (Table- 2)

Figure- 4 depicts a clear scenario of huge rural urban differential among Indian States in terms of open defecation practice. Rural areas of almost all the states are lagging far behind in basic sanitation facility within their households. The rural Madhya Pradesh with 86.4 per cent households practicing open defecation and corresponding figure for urban Madhya Pradesh 22.5 per cent shows a huge gap of 63.9% point and occupy top position in terms of rural- urban differential in this regard. It is followed by Rajasthan, Uttar Pradesh, Karnataka, Tamil Nadu and Gujarat. In these entire states rural-urban differential was above the national average in this regard (54.7%). Andhra Pradesh and Bihar with a rural- urban gap of 53.2% and 52.5% respectively also shows the huge differential in these states in practice of open defecation.

**Figure-4: Rural-Urban differential in practice of open defecation among Indian States, 2011 (in per cent)**



### 4.3 Progress towards availability of Latrine facility (in percentage) for households among major states in India during 1991-2011

According to Census 1991, around 76 per cent of India’s population had No Latrine facility in their households and practicing Open defecation. To achieve the MDG (7) in this regard India would have to achieve 63 per cent households with latrine facility to reduce by half the proportion of people without sustainable access to basic sanitation facility at the end of year 2015.

Required Rate of Annual Progress (RRAP) to achieve the MDG target regarding this indicator during 1990-2015 is 6.7% per annum. Table 3 shows that India with only 5.6% of annual rate of progress during 1991-



2011 is lagging far behind to achieve the MDG (7) target to reduce by half the proportion of people without sustainable access to basic sanitation facility.

**Table 3: Actual Annual Rate of Progress (AARP) in availability of Latrine facility (in percentage) for Households among major states in India during 1991-2011**

Major States	1991	2001	2011	AARP(1991-2011)	Progress Remark
Kerala	51.28	84.01	96.2	4.38	Achieved
Punjab	33.18	56.84	80.5	7.13	Achieved
Haryana	62.45	44.5	70.2	0.62	Achieved
Maharashtra	29.56	35.09	66	6.16	Achieved
West Bengal	31.51	43.71	61.4	4.74	On Track
Gujarat	30.69	44.6	59.6	4.71	On Track
Karnataka	24.13	37.5	55	6.40	Insufficient
Tamil Nadu	23.13	35.16	54.3	6.74	Insufficient
Andhra Pradesh	18.4	32.99	52	9.13	Insufficient
<b>India</b>	<b>23.7</b>	<b>36.41</b>	<b>50.2</b>	<b>5.59</b>	<b>Insufficient</b>
Uttar Pradesh	18.02	31.43	37	5.27	Insufficient
Rajasthan	19.57	29	35.7	4.12	Insufficient
Madhya Pradesh	15.07	23.99	30	4.95	Insufficient
Bihar	11.75	19.19	24.2	5.30	Insufficient
Orissa	9.81	14.89	23.4	6.93	Insufficient

*Source: Census of India 1991 series 1 Part VII, tables on Houses and household Assets & Amenities, census 2001, and 2011 household amenities and Assets*

*Note: Availability of Latrine facility (in percentage) includes both improved as well as unimproved type of latrine facility within households and households using Public Toilet. North-Eastern states are not taken into consideration in above Table no.3 as these states have very high percentage share of unimproved type of latrine facility within households.*

Odisha and Bihar with less than 7% of annual rate of progress during 1991-2011 and less than 25% households having latrine facility within premises in 2011 occupy the bottom position in this regard. Nevertheless Karnataka and Tamil Nadu the socio-economically well-off states were also lagging behind to achieve the target at the end of 2015 with present insufficient rate of progress.

#### **4.4 Prevalence of Diarrhoea among children under five in India -**

Diarrhoea is one of the single most common causes of death among children under age five worldwide, following acute respiratory infection. Deaths from acute diarrhoea are most often caused by dehydration due to loss of water and electrolytes (IIPS and Macro International, 2007). According to NFHS-3, overall 9% children under five years of age suffer from diarrhea. Table 4 shows the estimated effects of Drinking water, latrine facility and selected demographic and socioeconomic variables on the prevalence of diarrhoea among children less than five years of age in India in alternative models. Model 1 in Table 7 shows that odds ratio of suffering from diarrhoea are higher among the children living in households using unimproved type of latrine within premises than among those living in households using improved type of latrine (OR = 1.082; 95% CI, 1.011-1.158). But there is almost no association between source of drinking water and diarrhoea among children in model 1. The effect of drinking water source and type of latrine use remains virtually unchanged when the three demographic variable e.g. age, sex and birth order is additionally controlled in Model 2. When 6 socioeconomic control variables are included in Model 3, it reduces the effect of unimproved latrine use within the premises on diarrhoea prevalence among children slightly (OR = 1.011; 95% CI, .938-1.089). In all the three models, drinking water source show statistically insignificant association with diarrhoea among children U-5. Sex and age has a positive effect on the prevalence of diarrhoea and female child have a considerably lower prevalence of diarrhoea than do male child (OR = 0.877; 95% CI, 0.822-0.935) and children 1 – 4 years have a considerably half chance of prevalence of having diarrhoea compare to infants (OR = 0.501; 95% CI, 0.466-0.538) in Model 2. As expected, children of 4<sup>th</sup> or higher birth order have significantly higher prevalence of having diarrhoea than do those 1<sup>st</sup> order children (OR=1.085; 95% CI, .994-1.185).



#### 4.4.1 Effects of the control variables on diarrhoea

The discussion of the adjusted effects of the control variables focuses on the full model (Model 3) in Table 7. With other variables controlled, age and sex has a positive effect on the prevalence of diarrhoea and children 1 – 4 years have a considerably half chance of prevalence of having diarrhoea compare to infants (OR = 0.502; 95% CI, 0.467-0.541). Effects of both age and sex are statistically significant.

**Table 4: Results of Logistic Regression analysis (Odds Ratio at 95% C.I.) for determinant of Diarrhoea among children U-5 in India, NFHS- 3 (2005-06)**

Background Characteristics	n=52,868		
	Model 1	Model 2	Model 3
<b>Drinking Water Source</b>			
Improved@			
Unimproved	.987(900-1.086)	.987 (.906-1.076)	.936 (.854-1.026)
<b>Type of Latrine</b>			
Improved @			
Unimproved	1.082**(1.011-1.158)	1.077**(1.008-1.152)	1.011(.938-1.089)
<b>Children U-5</b>			
Infants@			
1 - 4 years		.501***(.466-.538)	.502***(.466-.540)
<b>Sex</b>			
Male @			
Female		.869***(.814 -.927)	.868***(.813-.928)
<b>Place of Residence</b>			
Urban@			
Rural			.936(.861-1.018)
<b>Caste</b>			
General @			
Others			1.021(.943-1.105)
<b>Religion</b>			
Hindus @			
Muslims			1.151***(1.047-1.265)
Others			1.028(.914-1.158)
<b>Season</b>			
Summer @			
Rainy			1.092**(1.007-1.185)
Winter			1.077*(.991-1.171)
<b>Birth Order</b>			
1 <sup>st</sup> @			
2 <sup>nd</sup> /3 <sup>rd</sup>		.983(.910-1.061)	.972(.898-1.051)
4 <sup>th</sup> or Higher		1.085*(.994 -1.185)	1.008(.919-1.106)
<b>Mother's education</b>			
Higher @			
Lower / Illiterate			1.209*** (1.050-1.392)
<b>States</b>			
EAG States <sup>1</sup> @			
Other Major States <sup>2</sup>			.751***(.665-.812)
NE/ Smaller States <sup>3</sup>			.916*(.816-1.029)

\*=  $p < 0.1$ , \*\*=  $p < 0.05$ , \*\*\*=  $p < 0.01$  @ Reference category

EAG states<sup>1</sup>: Bihar, Uttar Pradesh, Madhya Pradesh, Jharkhand, Uttarakhand, Chhattisgarh, Odisha and Rajasthan

Other major states<sup>2</sup>: Punjab, Delhi, Haryana, Jammu & Kashmir, Himachal Pradesh, West Bengal, Maharashtra, Andhra Pradesh, Karnataka, Kerala and Tamil Nadu

NE/Smaller States<sup>3</sup>: Arunachal Pradesh, Nagaland, Manipur, Mizoram, Assam, Tripura, Meghalaya, Sikkim and Goa

Children belongs to Muslim community have significantly higher prevalence of having diarrhoea than so those belonging to Hindu community (OR=1.151; 95% CI, 1.047-1.265). As expected, children living in

households where mothers are illiterate or lower educated (primary or secondary educated) have significantly higher prevalence of having diarrhoea than do those households with higher educated mothers (OR=1.209; 95% CI, 1.050-1.392). According to season, prevalence of diarrhoea among children U-5 is significantly higher in rainy and winter season than do in summer season. Also, as expected, children living in *other major states* have significantly very low prevalence of having diarrhoea than do those living in *EAG states* (OR= 0.736; 95% CI, 0.680-0.797). Children living in North-eastern or smaller states have also significantly lower prevalence of having diarrhoea than do those living in EAG states. Children belongs to ST/SC or OBC categories and children of 4<sup>th</sup> and higher birth order have higher prevalence of having diarrhoea; but result is statistically insignificant for both variables e.g. caste and child birth order.

## **V. SUMMARY AND CONCLUSION**

India is on track to meet the target on reducing the proportion of people without sustainable access to safe drinking water; though it is struggling to keep pace with population growth and ever-accelerating urbanization. A sharp reduction in urban-rural disparities and inequities associated with drinking-water coverage in the country is a great achievement in this regard. But, in relation to availability of drinking water ‘away’ from the household, now more households in rural areas than households in census 2001 have to travel a long distance (beyond 500 meters) to achieve this basic need. It becomes more critical for country dominated by patriarchal society like India; where girls and women have to do the entire household duties, look after their children and collect water for cooking, drinking, washing and other household chores. A major proportion of Indian households especially in rural areas women have to travel a long distance (beyond 500 meters) to get water for drinking, cooking and other household chores. During pregnancy, collecting water from a far distance becomes hazardous for the mother as well as their child health. So, responsive administrative bodies would have improved the profile of the availability of drinking water especially at village level considering maternal and child health.

The target on sanitation will plainly not be met unless progress is greatly accelerated, and if it is not, 600 million people will be without access to basic sanitation in 2015. Two EAG states e.g. Bihar and Uttar Pradesh with around 90% households with availability to improved source of drinking water have already achieved the MDG target in this regard. But, in relation to sanitation, all the EAG states (except Uttarakhand) and two developed states- Tamil Nadu and Karnataka still have a very long road to travel, despite more than doubling its provision between 1990 and 2010. According to census 2011, still around 80% population of rural EAG states are practicing open defecation. In view of very wide rural-urban differential in the provision of sanitation facilities, a particular attention needed in rural India to achieve the MDG target in this regard up to 2020. This paper has also found that households with unimproved latrine facility within premises have a higher prevalence of having diarrhea among children U-5 than do those with improved latrine facility. So, India should raise the profile of sanitation and hygiene in all political and developmental venues to reduce the child mortality. Sanitation is in a state of crisis that needs to be addressed with due urgency.

Water supply and sanitation is a State responsibility under the Indian Constitution. States may give the responsibility to the Panchayati Raj Institutions (PRI) in rural areas or municipalities in urban areas, called Urban Local Bodies (ULB). Ministry of Housing and Urban Poverty Alleviation, Ministry of Urban Development and Ministry of Water and Sanitation at the Federal Level are also responsible administrative bodies for policy setting and their proper implementation.

To eradicate the practice of open defecation, Gram Panchayat in rural areas and Urban Municipal Corporation or Urban Local Bodies (ULB) would need to focus not only on building infrastructure, but also on preventing open defecation through peer pressure and shame approach. There is more need for sensitization at the grass root level about the health hazards of open defecation. The development of the plan would also involve many steps of different sizes including determining leadership and lead departments, mobilizing stakeholders, sanitation mapping, consultations and Good communication, awareness raising through a sanitation campaign, monitoring outcomes, etc.

The relatively slow progress in sanitation when compared with that for water indicates an urgent need to pick up the pace. There is widespread acceptance that sanitation services are critical to improving health and to preserving the gains made in other sectors and a growing recognition that hygiene behavior change is key to saving children’s lives.

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## Abbreviations

AARP:	Actual Annual Rate of Progress
EAG:	Empowered Action Group
MDG:	Millennium Development Goal
NFHS:	National Family Health Survey
NGP:	Nirmal Gram Puraskar.
PRI:	Panchayati Raj Institution.
RARP:	Required Annual Rate of Progress
SRS:	Sample Registration System
TSC:	Total Sanitation Campaign.
UNICEF:	United Nations Children’s Fund
WHO:	World Health Organization.