

# **Problems and Realistic Estimates of Water Related Diseases**

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# **Water-borne Diseases**

**Diseases caused by ingestion of water contaminated by human or animal excrement, which contain pathogenic microorganisms include:**

**Cholera,**

**Typhoid,**

**Hepatitis**

**Amoebic and bacillary dysentery and**

**Other diarrheal diseases**



# Water Pressure







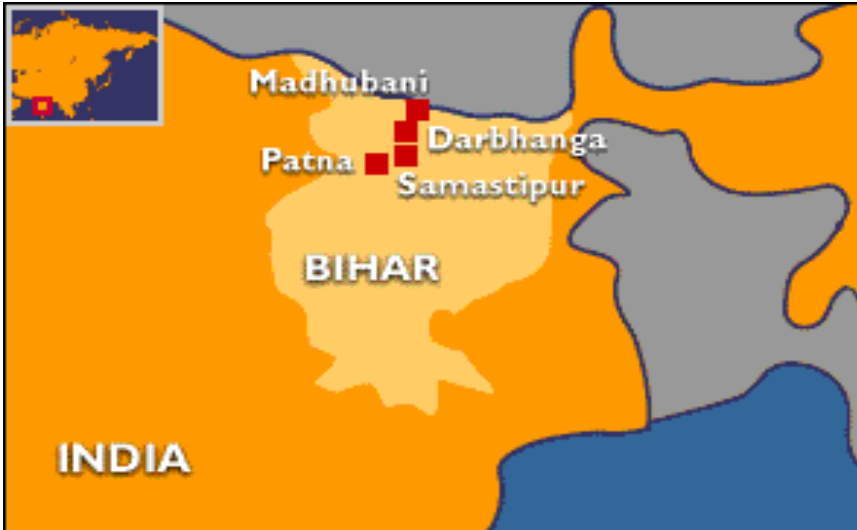




**DROUGHT**

# India Fights Flood Waters

AFP



# WHO-SEARO BUILDING, NEW DELHI





# HIGH SLUM POPULATIONS

(% of population living in slums)

Greater Mumbai

54.1

Faridabad

46.5

Meerut

44.1

Nagpur

35.9

Kolkata

32.5

ALL CITIES

24.1

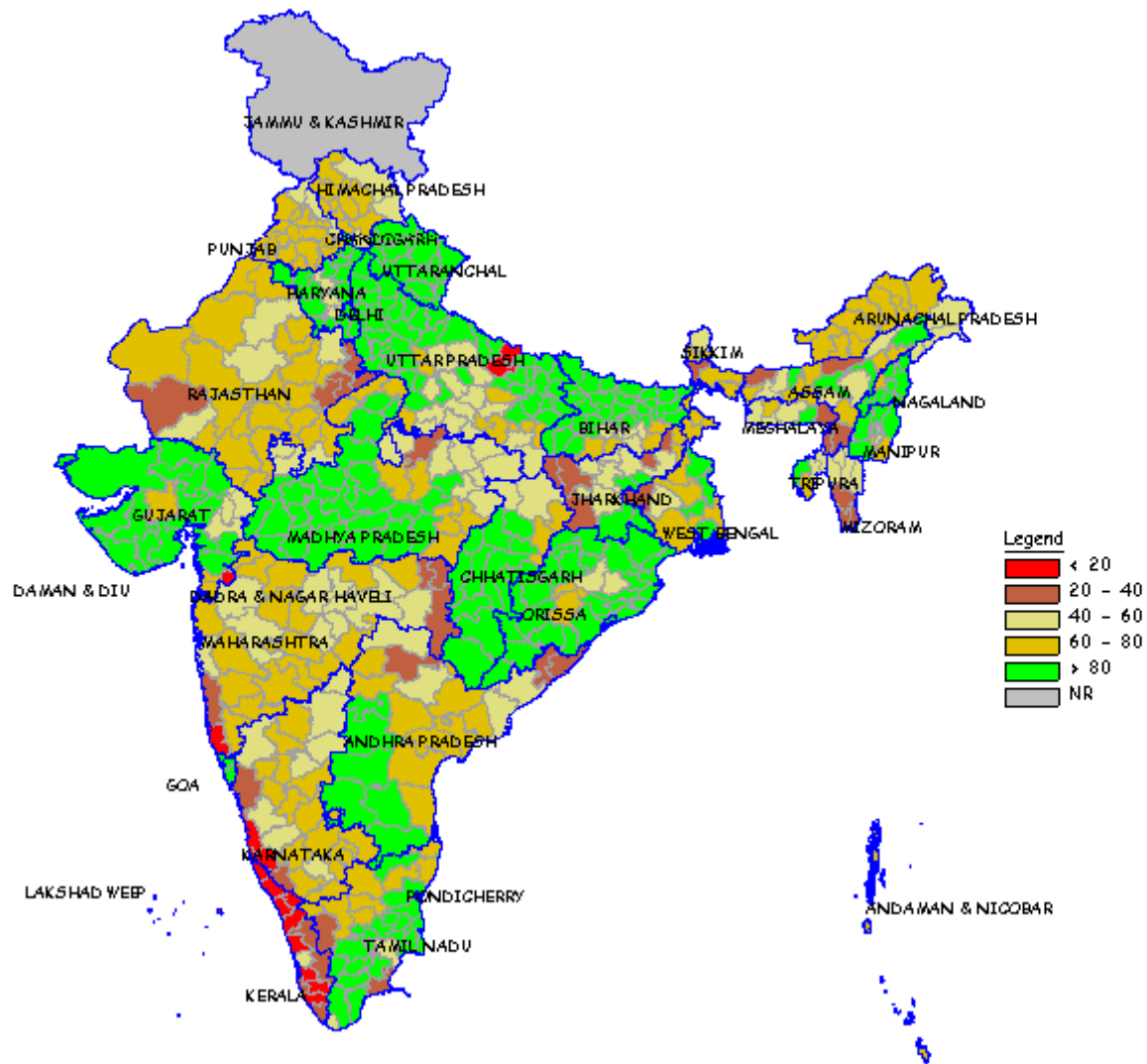
# Some Common Diseases and their Pathogens

<b>Cholera</b>	<b>Vibrio bacteria</b>	<b>Gastro-intestinal</b>	<b>Often waterborne</b>
<b>Typhoid</b>	<b>Salmonella typhi bacteria</b>	<b>Gastro-intestinal</b>	<b>Food/water borne</b>
<b>Hepatitis</b>	<b>Hepatitis A virus</b>	<b>Gastro-intestinal</b>	<b>Food/water borne</b>
<b>Dysentry</b>	<b>Shigella dysenteriae bacteria or Entamoeba histolytica amoeba</b>	<b>Gastro-intestinal</b>	<b>Food/water</b>
<b>Cryptosporidiasis</b>	<b>Cryptosporidium parvum protozoa</b>	<b>Gastro-intestinal</b>	<b>Waterborne, resists chlorine</b>
<b>Polio</b>	<b>Polioviruses</b>	<b>Gastro-intestinal</b>	<b>Exposure to untreated sewage; may also be waterborne</b>
<b>Giardia</b>	<b>Giardia lamblia protozoa</b>	<b>Gastro-intestinal</b>	<b>waterborne</b>

# TYPHOID FEVER

It is a major public health problem in India. The disease is endemic in almost all parts of the country with periodic outbreaks of water borne or food borne diseases. In India in 1992, about 3,52,980 cases with 735 deaths were reported. The number was 3,57,452 cases and 888 deaths in 1993 whereas in 1994, about 2,78,451 cases and 304 deaths due to typhoid fever were reported. Case fatality rate due to typhoid has been varying between 1.1% to 2.5 % in last few years.

## PERCENTAGE OF COVERAGE OF SAFE DRINKING WATER(HABITATIONS)





# Indian Scenario

- **>80% Diseases** in India are water related including typhoid, hepatitis, cholera etc.
- **Over 4 lakh children die** in India every year due to unsafe drinking water
- **Water borne diseases are the largest killer of children**
- **Unsafe water makes one in 5 babies ill every fortnight**
- **It has been estimated by the World Bank that a loss of Rs.19,995 crore annually accrues to India** on account of water pollution alone.
- **Source: GOI 10<sup>th</sup> 5-year plan (2002-07), UNICEF**

Table 12.1.1: Diarrhoea incidence in Andhra Pradesh from 1998 to 2002

C: Cases; D: Deaths

S.No	District	1998		1999		2000		2001		2002	
		C	D	C	D	C	D	C	D	C	D
1	Adilabad	17079	-	21110	-	761	-	1683	3	937	0
2	Anantapur	402	1	109	-	1569	4	520	-	1896	3
3	Chittoor	539	9	138	-	560	-	346	-	337	0
4	Cuddapah	12773	9	19254	6	6267	4	3660	-	1017	0
5	East Godavari	12959	8	260	-	293	-	88	-	265	0
6	Guntur	225	-	235	-	236	-	66	-	73	0
7	Ranga Reddy	41916	-	29938	-	4228	-	494	-	693	0
8	Karimnagar	1786	-	1300	-	677	-	887	-	29	1
9	Khammam	895	-	68	3	595	10	319	2	35	0
10	Krishna	98	10	108	7	287	1	247	-	118	1
11	Kurnool	207	-	173	-	357	-	151	3	588	0
12	Mahabubnagar	529	8	676	-	312	-	346	-	437	0
13	Medak	208	-	1	-	52	-	615	1	89	0
14	Nalgonda	472	-	135	-	2659	-	3576	-	1288	0
15	Nellore	498	-	108	5	165	-	226	-	149	0
16	Nizamabad	-	-	780	-	1681	-	1728	-	1347	0
17	Prakasam	1623	2	1584	-	889	-	701	-	473	0
18	Srikakulam	2810	18	1415	-	1040	-	631	-	717	0
19	Vizianagaram	1505	11	1787	2	1319	1	857	-	314	0
20	Visakhapatnam	618	5	274	2	470	2	338	-	645	0
21	Warangal	251	-	74	-	1898	-	539	-	252	1
22	West Godavari	5238	19	4099	5	1791	-	258	-	1296	0
23	Hyderabad	-	-	-	-	-	-	-	-	613	1
	TOTAL	102631	100	83626	30	28106	22	18276	9	13608	7

Source: Institute of Preventive Medicine, Dept. of Water &amp; Waste Water Analysis, Hyderabad

Table 12.1.2: Gastroenteritis Incidences in Andhra Pradesh from 1998 to 2002

C: Cases; D: Deaths

S.No	District	1998		1999		2000		2001		2002	
		C	D	C	D	C	D	C	D	C	D
1	Adilabad	2292	399	21	1	312	2	75	-	-	-
2	Anantapur	819	28	48	-	282	7	142	1	5	2
3	Chittoor	506	53	291	10	100	10	6	-	-	-
4	Cuddapah	550	8	88	1	41	4	8	-	-	-
5	East Godavari	575	43	59	6	87	3	14	-	11	-
6	Guntur	295	6	91	-	31	2	-	-	-	-
7	Ranga Reddy	327	20	16	2	475	16	49	-	7	-
8	Karimnagar	1704	34	306	-	42	1	-	-	-	-
9	Khammam	85	3	12	-	106	5	-	-	-	-
10	Krishna	106	5	108	7	-	-	-	-	-	-
11	Kurnool	678	23	80	5	762	2	-	-	-	-
12	Mahabubnagar	3872	16	2415	1	370	2	140	-	31	-
13	Medak	208	41	2	-	10	-	10	2	-	-
14	Nalgonda	2182	23	37	-	30	1	-	-	-	-
15	Nellore	184	8	3	-	89	-	-	-	-	-
16	Nizamabad	2773	11	597	1	67	5	2	-	4	-
17	Prakasam	215	16	279	6	90	3	17	1	16	2
18	Srikakulam	914	2	142	1	6	-	24	2	-	-
19	Vizianagaram	429	22	130	1	112	1	4	-	-	-
20	Visakhapatnam	1499	16	1349	8	264	1	-	-	-	-
21	Warangal	714	22	99	-	53	-	-	-	-	-
22	West Godavari	148	18	2	1	67	3	-	-	-	-
23	Hyderabad	13834	105	6355	21	4218	5	925	-	96	-
	TOTAL	34909	922	12530	72	7614	73	1416	6	170	4

Source: Institute of Preventive Medicine, Dept. of Water &amp; Waste Water Analysis, Hyderabad

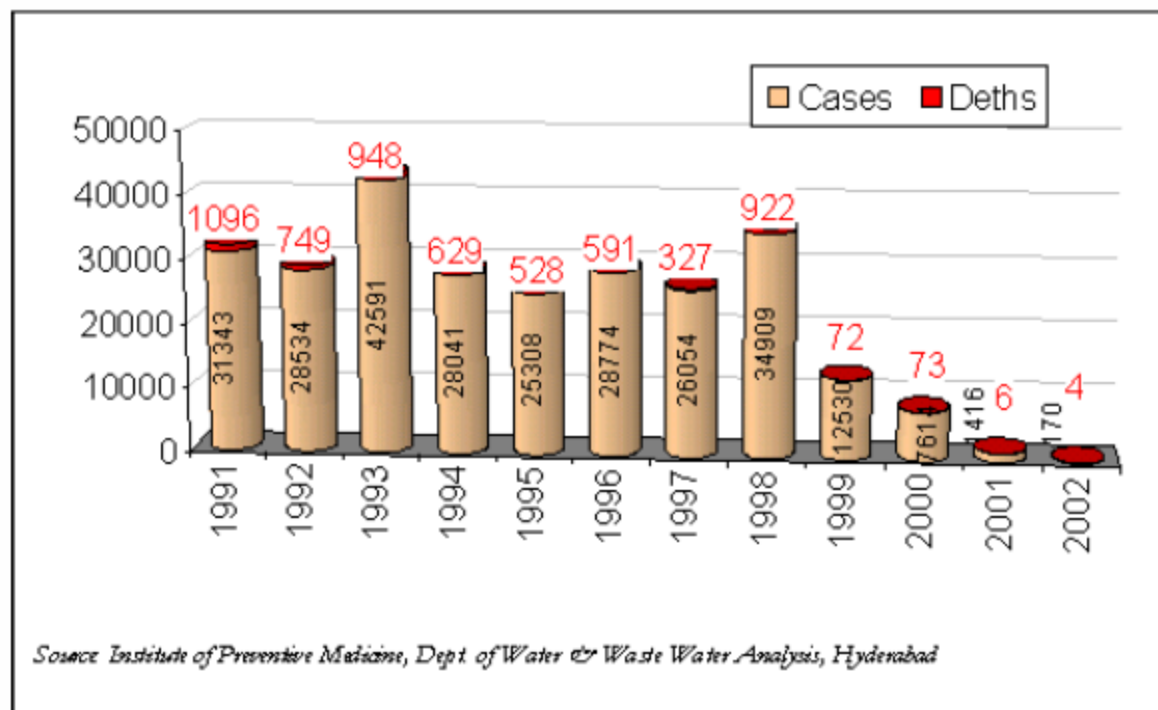
**State-wise Cases and Deaths Due to Acute Diarrhoeal Diseases in India  
(2000 to 2003)**

States/UTs	2000		2001		2002		2003\$	
	Cases	Deaths	Cases	Deaths	Cases	Deaths	Cases	Deaths
Andhra Pradesh	1644219	386	1499437	174	1207976	77	1641127	305
Arunachal Pradesh	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	19561	9
Assam	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.
Bihar	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.
Chhatisgarh	*	*	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.
Goa	9888	1	7473	0	6537	1	8145	0
Gujarat	203942	22	308138	82	268978	34	382274	28
Haryana	167145	27	218061	49	48678	7	237498	48
Himachal Pradesh	492630	35	491124	15	443435	11	456130	29
Jammu & Kashmir	478768	3	447611	21	497387	10	628034	27
Jharkhand	*	*	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.
Karnataka	1154119	416	1016979	434	235148	58	1499082	391



The good news about gastroenteritis is that it has been declining since 1991 (fig 12.2.1). The measures taken leading to this are brought out in table 12.2.1. In the next two tables the effects of communicable diseases in 2001 and 2002 are shown in table 12.2.2, which also shows a decline.

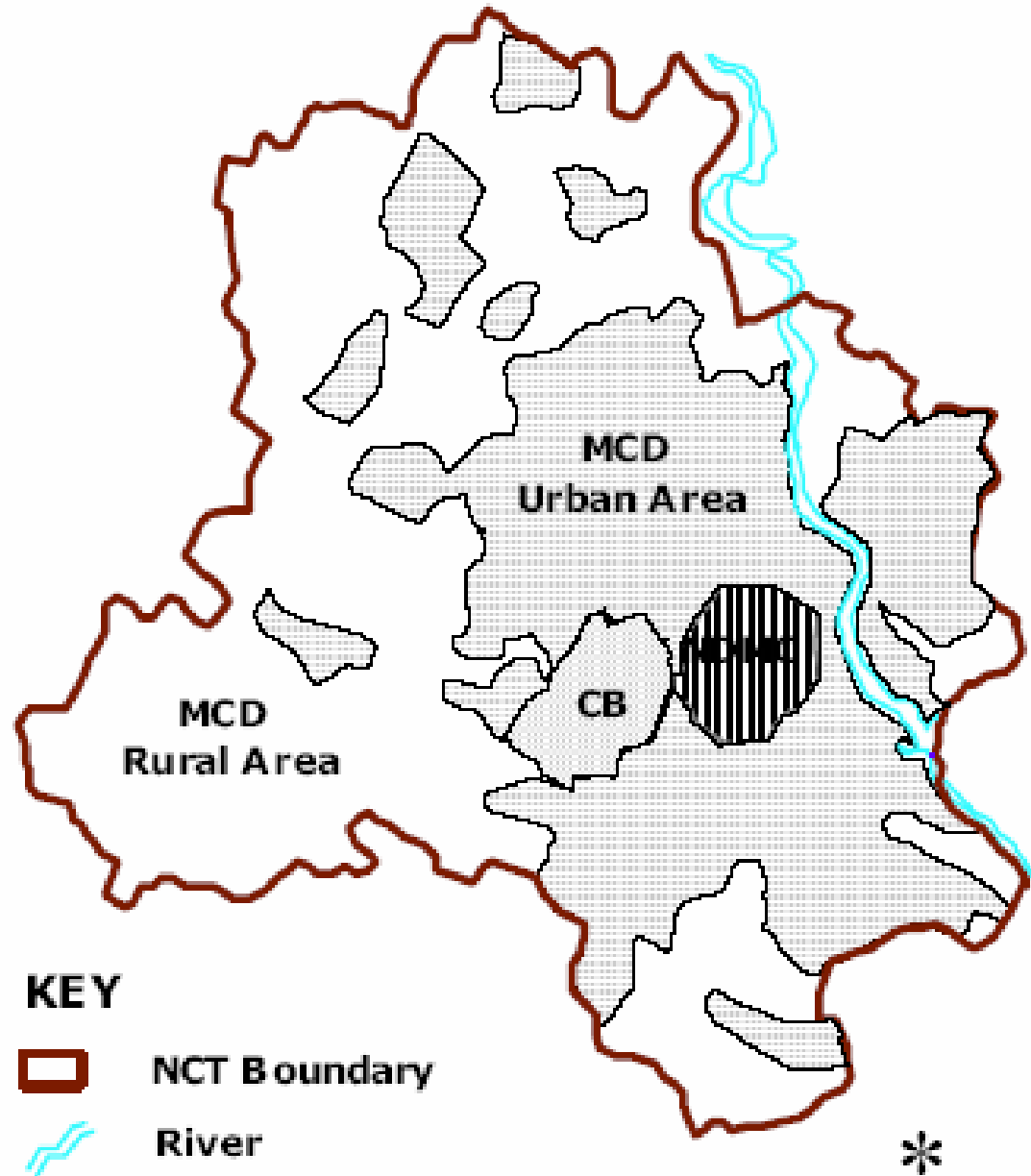
**Fig 12.2.1: Gastroenteritis Cases in Andhra Pradesh from 1991 – 2002**



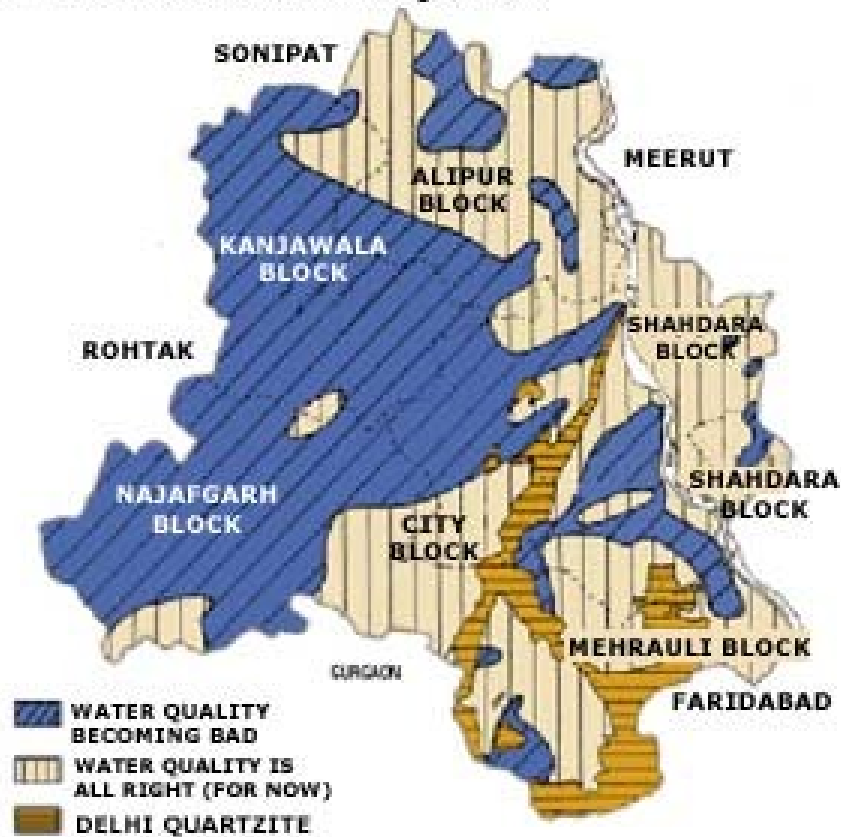
### *12.2.3.1 Prevention and treatment measures for GE/ Diarrhoea cases:*

- i) Instructions were to allot villages to the para-medical staff for periodic water quality testing and chlorination may be implemented accordingly.
- ii) Instructions were issued to train the technical staff of labs of Institute Preventive Medicine/RWS depts.at IPM in two batches in water quality testing, use of chloroscope, chlorination of water who in turn will train 28,200 para-medical staff and 22,000 village secretaries.
- iii) All the Gram panchayats may be instructed to procure chloroscope which costs less than Rs.300 rupees.
- iv) Thereafter, in case of any outbreak of diarrhoea/GE, responsibility may be fixed on the concerned staff/para medical/village secretaries.

# National Capital Territory



## DELHI'S GROUNDWATER QUALITY



SOURCE:  
CENTRAL GROUNDWATER BOARD AND CENTRAL POLLUTION CONTROL BOARD 2002

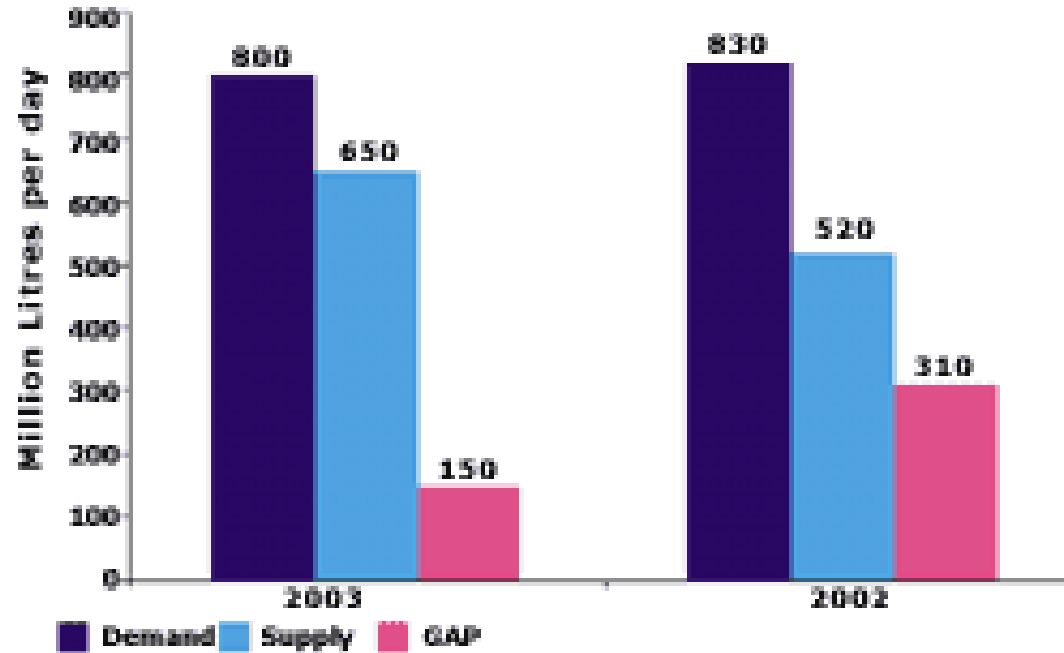
A study conducted by the Central Ground Water Board (CGWB) and Central Pollution Control Board in Delhi revealed that groundwater in most parts of Delhi are contaminated with flouride and nitrate and is unfit for drinking without treatment. Higher rates of groundwater extraction in coastal areas have also led to salinity intrusion in coastal aquifers, especially in Tamil Nadu and Gujarat. Thus unplanned and uncontrolled extraction of groundwater has disturbed the hydrological balance.



## **What is the situation in Delhi?**

**Delhi does not have enough clean water. The city needs 800-mega gallons per day (mgd) of water while it gets only 600 mgd.** The Delhi government has to depend on the neighbouring states for the extra 200 mgd. The problem will become more acute in the near future because fresh water sources will decrease and the city will be surrounded by brackish and saline water. **If the groundwater is exploited without being recharged, then it will also affect the fresh water. Even fresh water tubewells are now yielding brackish water.** This means that the fresh water has been polluted. Moreover, there has been a likely increase of fluoride and nitrate content beyond permissible limits.

### Demand and supply gap in Delhi



source: Delhi Jal Board

**Inequities in water availability are a reflection of unequal development within the country. 13% of Delhi's citizens do not get water supply every day; 40% of households in Madhya Pradesh are not supplied even 40 litres per person per day. Even if we achieve the Millennium Development Goal of halving the population without access to drinking water and sanitation by 2015, 244 million people in rural India and 90 million in urban India will still not have access to safe, sustainable water supply**

**By Darryl D'Monte**

## **Delhi Urban Environment & Infrastructure Improvement Project**

- Water borne and waste related disease outbreaks occur annually.**
- <40% liquid waste is treated**
- Solid waste management is grossly inefficient**
- Solid waste and street sweepings find their way into drains, waterways and sewers**
- Flooding is a regular occurrence in the monsoon season.**



**Table 6. Water supply in Indian cities**

Cities	Coverage (%)	Availability (hours)	Consumption (Ltr/capita)	Demand (million Ltr)
Calcutta	66	10	209	125
Chennai	97	4	80	600
Delhi	86	4	200	3600
Mumbai	100	5	178	3200
Bangalore	70	2.5	105	970

**Table 7. Bacteriological contamination of municipal tap water in Indian cities**

City	Number of samples +ve/number of samples processed			
	Faecal coliforms	E-coli	Entamoeba histolytica	Giardia lamblia
Ahmedabad	26/96	14/96	6/18	5/18
Kolkata	50/88	6/88	3/9	0/9
Chennai	50/89	47/89	3/18	1/18
Cochin	93/104	68/104	5/12	1/12
Delhi	16/86	8/86	4/11	1/11
Hyderabad	39/78	34/78	4/11	1/11
Jaipur	42/91	26/91	1/10	0/10
Kanpur	37/84	20/84	2/10	1/10
Mumbai	59/242	20/242	0/10	0/10
New Mumbai	22/88	15/88	9/24	1/24
Thane	26/84	16/84	-	-
Nagpur	84/84	75/84	7/17	1/17



**This study reveals that 2546.88 MLD of sewage is generated in Delhi and of which, only 885.3 MLD of sewage is collected through sewerage network for treatment and rest 1661.84 MLD of sewage flow in storm water drains, thus, making these open sewers, and in turn causes foul smell and ground water contamination all along the drain and ultimately polluting disposal sink i.e. sacred river Yamuna. The Delhi has 1153.16 MLD of sewage treatment capacity, whereas, only 885.3 MLD is collected through sewerage network and treated in treatment plants.**

**Within this backdrop, it is to estimated that at about 1030 MLD of water is extracted in addition to ground water extraction of 306 MLD by the Delhi Jal Board.**

**Table 1.2.5: Multiplicity of Policy Making Authorities and Implementing Agencies - a Complexity of Governance**

<b>Issue</b>	<b>Concerned Agencies</b>	<b>Result</b>
Provision of serviced plots for housing to accommodate growth	DDA, MoUD, DoLD, GNCTD, MCD, NDMC, DJB, DVB, Private Sector.	Lack of enough houses / plots, growth of unauthorised colonies, growth of JJsCs, spread out colonies with problems in infrastructure provision.
Journey to work and transportation	MoRlys, CPWD, PWD, GNCTD, DoTr, DTC, MCD, NDMC, Private Sector	Lack of adequate mass transportation capacity and routes, resulting in growth of personalised vehicles with resultant problems of traffic congestion, air and noise pollution etc.
Environmental Pollution	CPCB, DPCC, DoEd, GNCTD, DoTr, MCD, NDMC, DJB, Transport Operators	Land, water, air and noise pollution, environmental health problems, etc.
Improving Habitat for Urban Poor	MCD, NDMC, DDA, MoUD, DoUD, GNCTD, other public agencies owning land like Rlys, I & FC	Slum up-gradation or relocation programme cannot pick up momentum.

# RALISTIC ESTIMATES

- Incidence of water borne diseases is the compilation of cases from the government hospitals. Reported cases are fraction of the true incidence of various diseases.
- Government of India is now working on the integrated disease surveillance programme to improve the reporting from the health infrastructure.

# Estimated Burden of Disease in Disability Adjusted Life Years (DALYs) (WHO Report 2001)

<b>Region</b>	<b>Total DALYs</b>	<b>%</b>
<b>World</b>	<b>40,213,000</b>	<b>-</b>
<b>Africa</b>	<b>35,748,000</b>	<b>88.89</b>
<b>The Americas</b>	<b>111,000</b>	<b>2.76</b>
<b>Eastern Mediterranean</b>	<b>1,945,000</b>	<b>4.83</b>
<b>Europe</b>	<b>21,000</b>	<b>0.052</b>
<b>Western Pacific</b>	<b>5,16,000</b>	<b>1.28</b>
<b>South East Asia</b>	<b>1,874,000</b>	<b>4.66</b>
<b>India</b>	<b>1,311,800</b>	<b>(70% of SEAR DALYs)</b>

# Gap Between Actual Disease Burden and Reported Information of Malaria in India

■ Reported Malaria Cases = 1.9 to 2.5 million

■ Estimated Cases = 15 million

(By Dr V.P Sharma, Ex- Director, MRC)

= Around 80 million (By Dr Korensump,  
WHO HQ)

■ Reported Malaria Deaths = About 1000 per annum

■ Estimated Deaths = 83,099 (based on publication entitled  
“Medical Certification of Cause of Deaths, 1998”, Ministry of Home  
Affairs, Government of India)

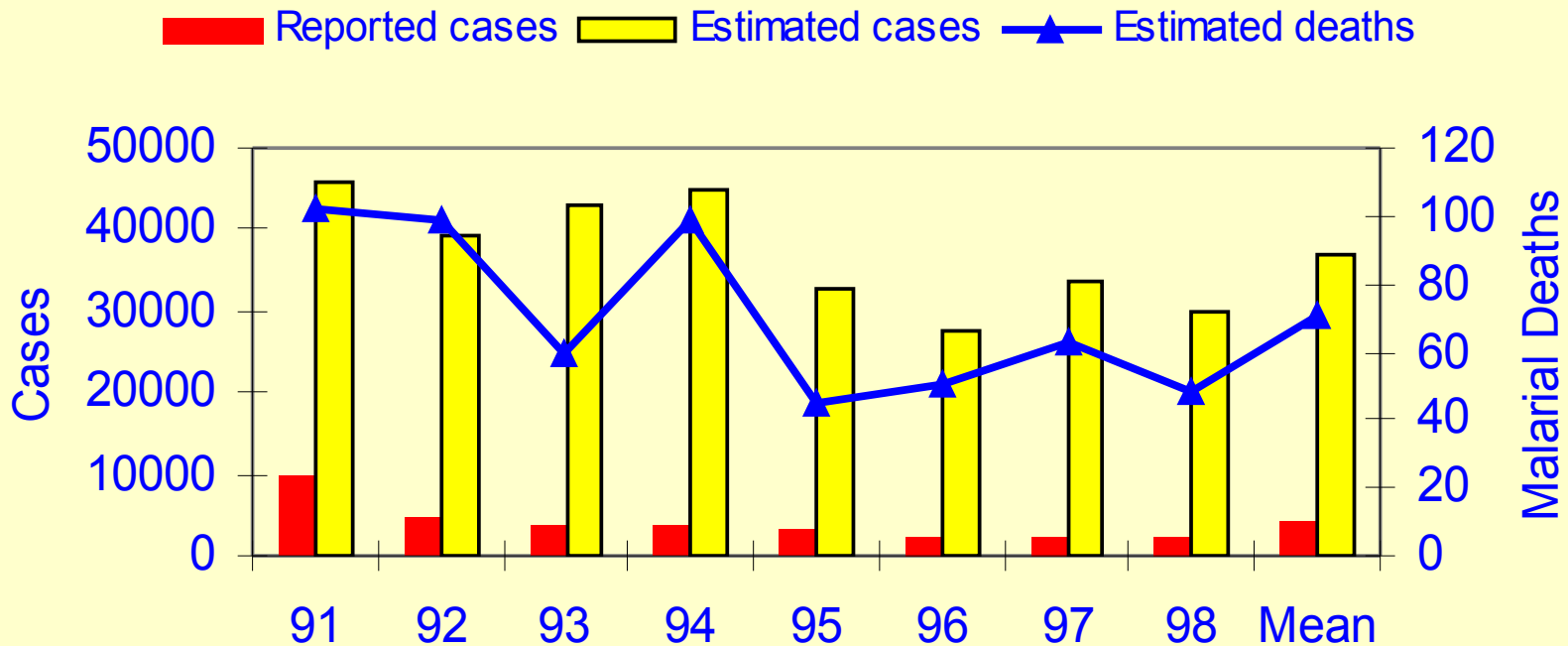
- Highest malaria deaths are being reported from state of Orissa followed by West Bengal, Maharashtra and Assam.
- North- Eastern states are contributing around 15,000 -16,000 malaria deaths annually.



## Estimation of Malaria Morbidity and Mortality

- **Until 1995, malaria incidence in the city was based only on the cases reported through house to house active surveillance in 1.2 out of 3.4 million population**
- **Routine reporting of cases & deaths by Passive Case Detection agencies (hospitals) declined and became zero by 1995. Reporting of malaria deaths was rare.**
- **A retrospective analysis of reported cases and deaths due to malaria during 1991-1998 was made taking records from 99 main health facilities in the city (see table later)**

## Burden of Malaria in Ahmedabad City



**Average ratio of reported to estimated malaria cases =  $36,766/4119$  i.e. 9 times  
71 malarial deaths/3.1 million population (average 2 deaths/100,000 population/yr)**



THANK YOU