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SANITATION IN INDIA
Progress, Differentials, Correlates, and Challenges

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Asian Development Bank

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Foreword

I am pleased to present to you the second issue of the *South Asia Occasional Paper Series*, which is designed to share research on development issues in the region with a wide audience, including policy makers, academics, and the general public. The first issue—Capacity Development in South Asia—was well received, and we hope to produce regular research papers under this series to cater to the knowledge and information needs of the region.

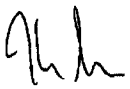
In this issue, we look at Sanitation in India: Progress, Differentials, Correlates, and Challenges. Goal 7, target 3 of the Millennium Development Goals (MDGs) stipulates decreasing the proportion of population without sustainable access to basic sanitation by 50% in the year 2015. To put the spotlight on the large sanitation deficit, the United Nations General Assembly declared 2008 as the International Year of Sanitation. Improved sanitation is essential to reduce ill health, child mortality, lost income associated with morbidity, and to improve environment, human dignity, and quality of life.

The Long-Term Strategic Framework of the Asian Development Bank: Strategy 2020 highlights the poor access to basic sanitation in the region and commits to supporting investments in sanitation that particularly benefit the poor and women. The Asian Development Bank (ADB) is also committed to "livable cities" and reducing the carbon footprint of Asia's cities. ADB will assist cities address a range of environmental problems resulting from rapid urbanization, including water pollution through better wastewater management.

To achieve time-bound results committed under the MDGs, public resources need to be deployed effectively in tandem with private resources. To be effective, public policy needs to be evidence-based, while empirically driven research can support more effective public policy making and more efficient public expenditure. This empirical research, based on large-scale data sets, highlights several key findings that can help fine-tune efforts to improve sanitation in India. I sincerely hope the findings of the study will help key stakeholders address significant challenges in enabling universal access to sanitation in India. The key findings and recommendations of the study are as follows:

- Though progress has been made in access to sanitation in the last decade, the unmet need for sanitation is huge.
- A number of social, cultural, geographical, and economic differentials hinder access to universal sanitation in India.
- An effective strategy to bridge the gap in access to sanitation will have to focus on the disadvantaged, which include households from the poorest quintile, scheduled tribes, and the states that have consistently underperformed—Orissa, Bihar, and Madhya Pradesh.
- The financing requirements are huge; hence, the paper suggests progressive improvement in the types of sanitation solutions.
- Sewerage systems tend to benefit richer households; hence, some form of capital cost recovery could be considered to finance sewerage-related infrastructure.

I would like to thank the South Asia Department staff for conducting the research and producing the paper. The research was conducted under the supervision of Hun Kim, Director, Urban Development Division, and coauthored by Sekhar Bonu and Hun Kim. The study benefited from the feedback and peer review of Kyeongae Choe, Keiichi Tamaki, K.E. Seetharam, Amy Leung, Saugata Dasgupta, and the other members of the Water Community of Practice. I thank Bruno Carrasco, Director, Country Coordination and Regional Cooperation Division and Shunshuke Bando for coordinating the research and publication. Ma. Solita Mabaquiao and Aileen Pangilinan provided administrative support. The Water Team, particularly Ellen Pascua, was very helpful in the research and publication. Eric Van Zant edited and designed the report.



Kunio Senga
Director General

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Abbreviations

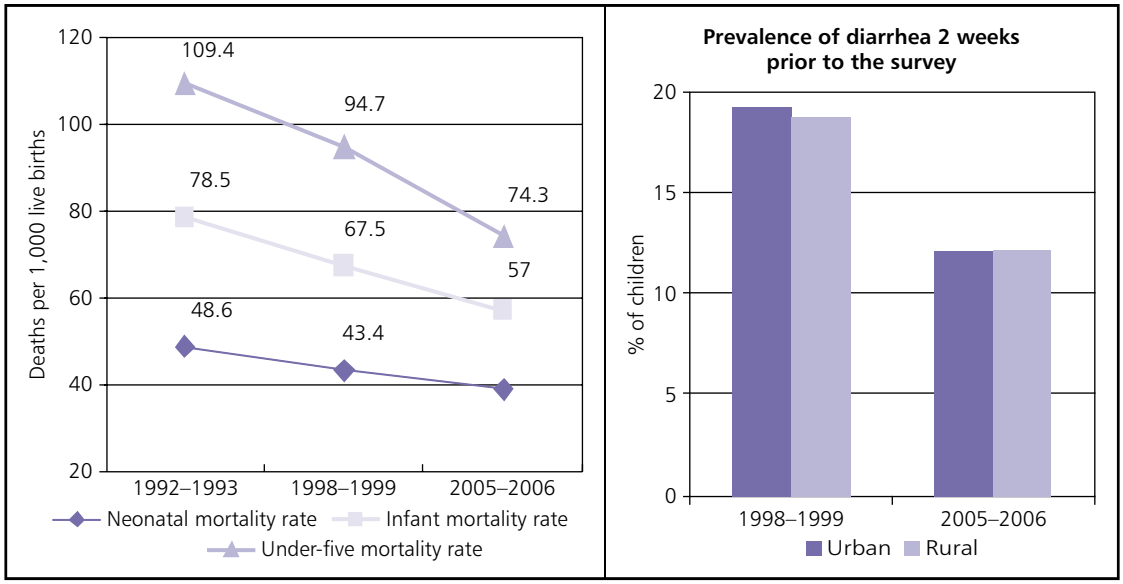
ADB	Asian Development Bank
GDP	gross domestic product
IHHL	individual household sanitary latrines
MDG	Millennium Development Goal
MOUD	Ministry of Urban Development
NCMH	National Commission on Macroeconomics and Health
NFHS	National Family Health Surveys
NSS	national sample surveys
SC	scheduled caste
TSC	Total Sanitation Campaign
UNDP	United Nations Development Programme
UNESCAP	United Nations Economic and Social Commission for Asia and the Pacific
UNICEF	United Nations Children's Fund
WHO	World Health Organization

Introduction

Communicable diseases constitute a significant portion of the overall disease burden in India (Planning Commission of India 2002, National Commission on Macroeconomics and Health [NCMH] 2004). Child mortality and the prevalence of diseases due to poor sanitation (for example, diarrheal diseases) remain high, despite gains in the last two decades (Figure 1). A large proportion of this burden is related to water, soil, and food-borne disease (for example, diarrhea, typhoid, worm infestation, and others). The developed world has controlled communicable diseases through universal access to safe drinking water and hygienic disposal of human excreta and other hazardous wastes, among other things (WHO 2000; UNICEF 2006; UNDP 2006; World Bank 2006a, 2006b; WHO and UNICEF 2008). Improving access to sanitation in India will, similarly, reduce the communicable disease burden and child mortality.

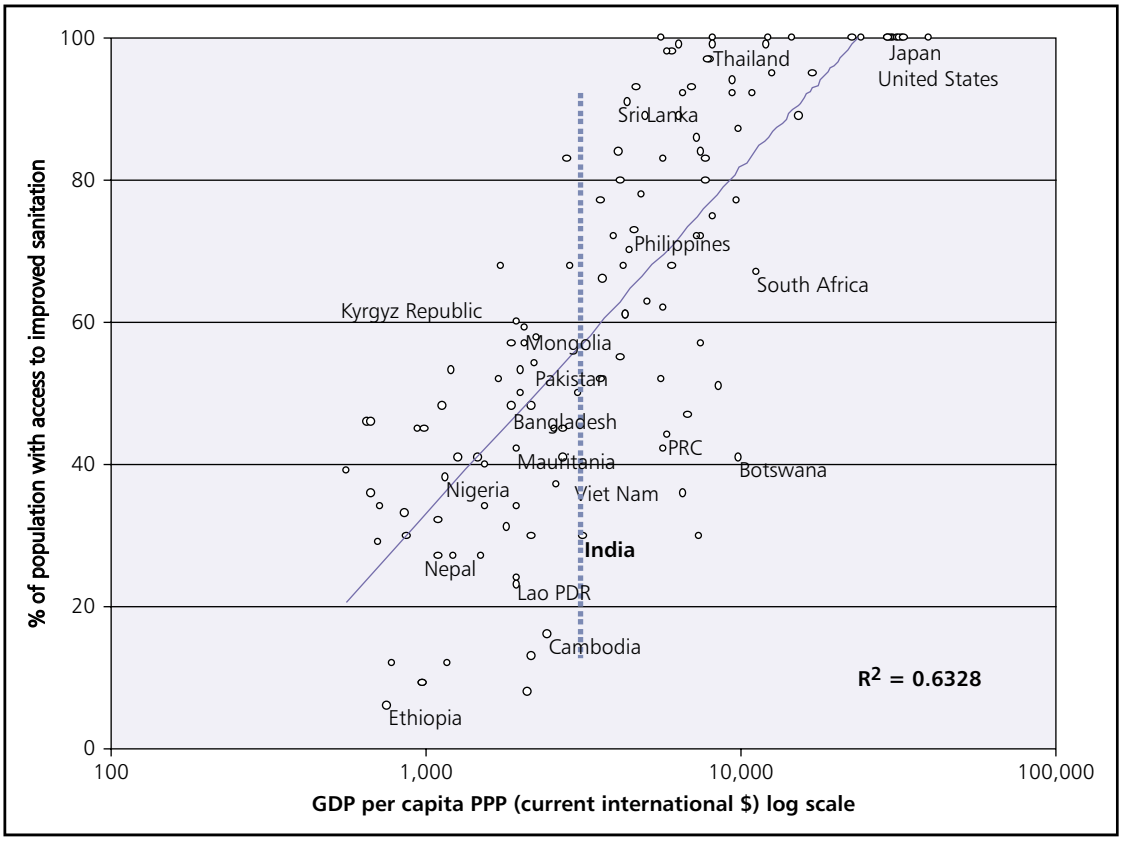
Goal 7, target 3 of the Millennium Development Goals (MDGs) calls for a reduction of 50% in the proportion of population without sustainable access to basic sanitation by 2015 (UNICEF 2006; NCMH 2005). A joint United Nations Children's Fund (UNICEF) and World Health Organization (WHO) report in 2006 categorized India as "not on track" toward the MDG sanitation target (WHO and UNICEF 2008). The report showed improved sanitation coverage, from 14% of households in 1990 to 28% in 2006, but also noted that of the 1.2 billion people worldwide who use "open defecation," 665 million live in India. By contrast, a joint report by the Asian Development Bank (ADB), United Nations Development Programme (UNDP), United Nations Economic and Social Commission for Asia and the Pacific (UNESCAP), and WHO categorized progress as "on track" (ADB, UNDP, UNESCAP, and WHO 2006): urban sanitation coverage, which was 43% in 1990 and 58% in 2002, as per this report is expected to reach 80% by 2015. Rural sanitation, about 1% in 1990 and 18% in 2002, is expected to reach 48% (ADB et al. 2006; ADB 2007). Either

Figure 1: Changes in Child Mortality and Diarrhea Prevalence in India



Source: National Family Health Survey, India 1992–1993, 1998–1999, and 2005–2006.

Figure 2: Access to Improved Sanitation[a] and GDP Per Capita PPP (current $)



PRC = People's Republic of China, GDP = gross domestic product, Lao PDR = Lao People's Democratic Republic, PPP = purchasing power parity.

[a] "Improved" sanitation, according to the Joint Monitoring Program for water supply and sanitation (WHO/UNICEF), includes connection to a public sewer, connection to a septic system, pour-flush latrine, simple pit latrine, and ventilated improved pit latrine. Sanitation solutions not considered improved include public or shared latrine, open pit latrine, and bucket latrines. This definition is used to measure the achievement of the MDG related to sanitation in developing countries. During a survey, determining the type of toilet used is difficult. For this study, "open defecation" by households without toilets represents a definition of a clear category in all the three surveys. Hence, for the majority of the study, we investigated the trends in open defecation (that is, households lacking access to toilets).

Source: World Development Indicators. 2006.

way, progress has not been commensurate with economic growth, and sanitation coverage in India remains lower than that in other countries with similar per capita gross domestic product (GDP) (Figure 2).[1]

In addition to polluting soil and groundwater and contaminating food and drinking water, unsafe disposal of human excreta raises the transmission of fecal-oral diseases, including diarrhea and a range of intestinal worm infections, including hookworm and roundworm (World Bank 1980; Poverty Environment Partnership 2005). Diarrhea accounts for almost one-fifth of deaths among children under 5 years in India—nearly 535,000 children (Boschi-Pinto et al. 2008). Moreover, widespread worm infestation and repeated episodes of diarrhea contribute to widespread childhood malnutrition: 50% of children under 5 years are stunted and 20% are underweight (International Institute of Population Sciences 2007).

[1] For example, in 2006, countries with per capita GDP comparable to India (Malawi, the Philippines, Tajikistan, Tonga, Uzbekistan, Viet Nam, and Zambia) have achieved higher access to improved sanitation.

Sanitation gained public policy importance only recently (UNICEF 2002). The Seventh Five-Year Plan (1985–1990) launched a rural sanitation program in India that aimed to provide 25% of rural households with individual household sanitary latrines (IHHL) by 1995. Consequently, households with IHHL increased from only 1% in 1981 to 9% in 1991. In 1999, the Central Rural Sanitation Program was restructured into a demand-responsive, community-led Total Sanitation Campaign (TSC). The *Zila Parishads* (district-level, third-tier government) and other district-level project implementation agencies currently implement TSC as a district-level project model (Government of India 2007a, 2007b). In September 2008, the Government of India reported the construction of 47 million IHHL since starting the TSC—39% of its goal (119 million units) to eradicate open defecation by 2012.

The United Nations declared 2008 as the International Year for Sanitation.[2] The Ministry of Urban Development (MOUD) launched the National Urban Sanitation Policy in 2008 (MOUD 2008). This study on the status of sanitation in India is, thus, timely. Based on empirical evidence, the paper attempts to discern key policy conclusions that could assist India in meeting its set goal of "Sanitation for All" by 2012. The paper looks at (i) safe disposal of human excreta, as measured by household ownership of a sanitary latrine; and (ii) household access to drainage facilities. It investigates the trends, socioeconomic differentials, and correlates of household sanitary latrines from 1992 to 2006, and provides rough cost estimates for universal coverage of sanitation (Appendix).

[2] United Nations did this to put the spotlight on sanitation to raise awareness and accelerate progress toward the achievement of MDG 7, as discussed above.

Data and Methods

Data

Data for the study come from the National Family Health Surveys (NFHS) and the 60th round of the National Sample Survey (NSS) of India.

National Family Health Survey

We used data from three rounds of the NFHS conducted under the stewardship of the Government's Ministry of Health and Family Welfare: April 1992–September 1993 (NFHS-1), November 1998–December 1999 (NFHS-2), and November 2005–August 2006 (NFHS-3). The International Institute for Population Sciences (Mumbai), served as the nodal agency for survey implementation, and ORC Macro (Calverton, Maryland, United States) provided technical assistance. Conducted globally as part of the Demographic and Health Surveys assisted by the United States Agency for International Development, the three surveys are comparable, nationally representative, and cross-sectional based on systematic and stratified sampling of households.[3]

Data on household toilet status were collected through personal interviews with heads of households and validated by the surveyors. While the questions included in household questionnaires were exactly the same in NFHS-1 and NFHS-2, they differed slightly in NFHS-3, as shown in the box.

Survey	Questions administered in the household schedule
NFHS-1 (1992–1993) and NFHS-2 (1998–1999)	What kind of toilet facility does your household have? Flush toilet: own, shared, public Pit toilet/latrine: own, shared, public No facility/bush field Others _____
NFHS-3 (2005–2006)	What kind of toilet facility do members of your household usually use? Flush or pour flush toilet: piped sewer, septic tank, pit latrine, flush to somewhere else Pit latrine: ventilated improved pit/biogas; pit latrine with slab; without slab, open pit Twin pit/composting toilet Dry toilet No facility

National Sample Survey

We also used the 25th schedule of the 60th round of the NSS (January–June 2004), which sampled 73,868 households comprising 385,055 individuals.[4] The NSS followed a stratified two-stage design: Stage 1 sampled census villages in rural areas and NSS urban frame survey blocks in urban areas; Stage 2 sampled households (National Sample Survey Organization 2006). During the household schedule, the survey used the following questions to elicit information regarding access to toilet and drainage facilities:

Type of latrine (toilet):
- (i) service,
- (ii) pit,
- (iii) septic tank/flush system,
- (iv) others, and
- (v) no toilet.

Type of drainage:
- (i) open kutcha,[5]
- (ii) open pucca,

[3] Additional information about the demographic and health surveys is available at www.measuredhs.com/ and www.nfhsindia.org

[4] Additional information about the NSS surveys is available at http://mospi.nic.in/nsso_4aug2008/web/nsso/se_nsso.htm

[5] *Pucca* is concrete structure while *kutcha* is made of mud. Although *pucca* is desired, poor households settle for *kutcha* structures.

(iii) covered pucca,
(iv) underground, and
(v) no drainage.

Methods

Bivariate and multivariate analyses investigate differentials in access to toilet and drainage facilities by using selected socioeconomic background, such as residence, caste, educational status, and religion. Such characteristics may influence access to toilets either by facilitating access due to differentials in public policy (for example, state of residence, urban/rural residence) or by shaping the cultural attitudes toward having a toilet facility within the household building. Multivariate probit regression[6] analysis is used to investigate the predicted probability of access to toilet facilities by households. The probit regression models the probability that Y = 1 using the cumulative standard normal distribution function, evaluated at $z = ß_0 + ß_1X$:

$\Pr(Y = 1/X) = ø(ß_0 + ß_1X_1 + ß_2X_2)$

ø is the cumulative normal distribution function.

$Z = (ß_0 + ß_1X)$ is the "z=value" of the probit model.

$ß_1$ is the effect on the z-score of a unit change in X_1, holding constant X_2.

The study used a binary outcome variable that equaled "1" if the household had a toilet (any toilet), and equaled "0" if household members resorted to open defecation. Selection of independent variables was informed by existing literature as well as social, cultural, political, and administrative aspects specific to India (Bonu et al. 2005). The independent variables used in the study can be classified as household and community-level variables. Household variables included social group (as measured by caste), religion, wealth quintile, and education level of the head of household. Social group, wealth status, and religion are important markers of social and economic disparities in India (Agarwal 1997, Dyson and Moore 1983, Galanter 1984, Ghurye 1992). Community-level variables included urban/rural residence and states (or province). To control differentials across various states, we included a dummy variable for state. We used STATA 10 statistical software for data analysis (StatCorp 2007).

The purpose of the multivariate analysis is to investigate the association of independent variables in the model with the dependent variable (access to toilet). The selection of independent variables, though based on previous literature, was constrained by the availability of comparable data in the three waves of survey data used. Likewise, due to data limitations, we could not use multinomial probit/logit models for different sanitation methods.

[6] Probit regression analysis is an alternative to logistic regression analysis. These two analyses are very similar in many respects: logit analysis is based on log odds while probit uses the cumulative normal probability distribution.

FINDINGS

Access to Toilets

Bivariate Analysis

Access trends. The percentage of households with flush toilets increased from 21.6% in 1992–1993 to 39.2% in 2005–2006, while households with pit toilets declined from 8.6% to 4.7% (Table 1). Flush toilets, which increased by just 2% between NFHS-1 and NFHS-2, increased by almost 15% between NFHS-2 and NFHS-3. Overall, the percentage of households with no toilet facility declined from 1992–1993 to 2005–2006 (from 69.7% to 55.4%, respectively), with progress accelerating from 1998 to 2005–2006 (with an annual decline of 1.5%) compared to the period between 1992–1993 and 1998–1999 (with an annual decline of 1%). The increase in the percentage of households with flush toilets resulted partly as households upgraded from pit and other toilet facilities to more sophisticated flush toilet facilities, leading to a slightly lower annual rate of decline for households with no toilets (Figure 3). Tables 2, 3, and 4 show the nationwide trend in different types of toilets at the household level, including shared or owned toilets, for 1992–1993, 1998–1999, and 2005–2006.

Table 1: Change in the Distribution of Types of Toilet by Household Background Characteristics (1992–1993, 1998–1999, and 2005–2006)

	Flush Toilets			Pit Toilets			Others			No Facility (open defecation)		
	1992–1993	1998–1999	2005–2006	1992–1993	1998–1999	2005–2006	1992–1993	1998–1999	2005–2006	1992–1993	1998–1999	2005–2006
All India	**21.6**	**24.0**	**39.2**	**8.6**	**12.1**	**4.7**	**0.1**	**0.1**	**0.8**	**69.7**	**63.7**	**55.4**
Residence												
Urban	60.1	63.9	78.7	15.6	16.9	3.4	0.2	0.0	1.0	24.1	19.2	16.8
Rural	6.9	8.8	20.0	6.0	10.3	5.3	0.0	0.1	0.7	87.1	80.8	74.0
State												
Andhra Pradesh	16.7	18.0	38.5	7.7	9.3	3.3	0.1	0.0	0.7	75.6	72.7	57.6
Assam	15.1	14.5	35.4	34.4	48.4	40.6	0.0	0.2	0.4	50.4	36.9	23.6
Bihar	13.2	13.3	21.8	3.1	3.6	2.7	0.1	0.0	0.2	83.5	83.2	75.4
Delhi	72.5	85.4	91.4	11.2	9.0	0.2	0.4	0.0	0.9	15.9	5.6	7.5
Goa	26.1	38.0	69.9	21.8	20.9	0.4	0.0	0.0	5.7	52.0	41.1	24.0
Gujarat	33.7	31.3	53.2	2.1	13.6	0.3	0.0	0.2	1.1	64.2	54.9	45.4
Haryana	14.2	30.4	48.9	12.7	8.7	3.5	0.0	0.1	0.0	73.1	60.8	47.6
Himachal Pradesh	10.3	24.2	44.6	2.2	2.5	0.8	0.1	0.3	1.0	87.5	73.1	53.5
Jammu and Kashmir	13.7	22.2	33.3	5.4	28.9	25.0	0.0	0.1	3.4	80.9	48.9	38.2
Karnataka	17.7	21.8	39.0	13.4	16.8	7.4	0.0	0.0	0.3	68.9	61.4	53.4
Kerala	62.6	17.9	93.0	8.2	67.3	3.0	0.1	0.0	0.2	29.1	14.8	3.8
Madhya Pradesh	16.4	20.3	23.7	4.9	1.9	1.0	0.0	0.0	0.1	78.7	77.8	75.1
Maharashtra	35.0	41.8	52.4	5.8	4.1	0.5	0.0	0.1	0.2	59.2	54.0	46.9

continued on next page

Table 1 continued

	Flush Toilets			Pit Toilets			Others			No Facility (open defecation)		
	1992–1993	1998–1999	2005–2006	1992–1993	1998–1999	2005–2006	1992–1993	1998–1999	2005–2006	1992–1993	1998–1999	2005–2006
North-East	21.6	21.7	50.3	59.8	58.6	34.7	0.2	0.1	3.3	23.8	19.9	11.7
Orissa	6.6	10.9	13.0	5.5	2.6	6.3	0.1	0.0	0.1	87.8	86.5	80.6
Punjab	22.8	36.2	63.2	13.7	15.2	7.4	0.2	0.0	0.3	63.3	48.6	29.1
Rajasthan	15.8	22.7	28.6	4.0	5.1	1.9	0.0	0.3	0.3	80.2	71.8	69.2
Tamil Nadu	25.5	32.8	42.7	3.8	1.2	0.1	0.0	0.1	0.2	70.7	65.9	57.1
Uttar Pradesh	12.7	10.3	29.5	9.9	16.3	2.0	0.3	0.2	3.0	77.1	73.2	65.6
West Bengal	28.5	33.9	48.6	11.8	11.0	10.8	0.1	0.3	0.2	59.6	54.9	40.4
Wealth quintile												
Poorest quintile	0.1	0.2	1.4	0.8	1.4	2.6	0.0	0.1	0.5	99.2	98.3	95.5
Second quintile	0.4	2.4	7.8	3.8	6.8	6.3	0.0	0.2	1.0	95.7	90.6	84.9
Middle quintile	4.8	8.9	25.4	9.2	13.2	6.8	0.1	0.2	1.3	85.9	77.8	66.5
Fourth quintile	22.1	33.1	67.1	15.5	23.4	5.6	0.2	0.1	1.0	62.3	43.5	26.4
Richest quintile	80.1	77.2	95.2	13.8	17.0	2.4	0.1	0.0	0.2	6.0	5.8	2.3
Education (head of household)												
Illiterate	6.2	8.8	17.5	5.7	8.0	4.0	0.1	0.1	1.1	88.1	83.1	77.4
literate – primary	19.3	19.9	33.4	9.5	14.1	6.0	0.1	0.1	0.7	71.1	66.0	59.9
Middle complete	29.3	29.6	44.5	12.5	15.7	5.1	0.1	0.2	0.7	58.1	54.5	49.8
High school +	54.7	54.2	67.2	11.9	15.3	4.7	0.1	0.1	0.5	33.3	30.4	27.6
Household caste												
Scheduled caste	9.0	13.9	27.6	4.3	7.6	3.9	0.1	0.1	0.5	86.7	78.4	68.0
Scheduled tribe	6.6	7.9	13.1	5.8	8.8	4.0	0.0	0.1	0.7	87.6	83.2	82.2
Others	25.4	28.7	45.3	9.6	13.7	5.0	0.1	0.1	0.9	64.9	57.4	48.9
Household religion												
Hindu	na	22.7	36.9	na	9.5	3.5	na	0.1	0.4	na	67.7	59.2
Muslim	na	27.8	45.6	na	25.7	10.9	na	0.2	3.5	na	46.3	40.1
Christian	na	29.3	59.9	na	30.7	9.1	na	0.0	1.1	na	40.0	29.8
Sikh	na	35.7	63.6	na	17.2	9.7	na	0.0	0.3	na	47.1	26.5
Others	na	41.5	42.9	na	9.3	3.5	na	0.1	1.4	na	49.2	52.2

na = not available.

Source: Authors' analysis of National Family Health Surveys, 1992, 1998, and 2005.

Table 2: Distribution of Household Toilet Types by Background Characteristic of the Household (1992–1993)

	Flush (owned)	Flush (shared)	Flush (public)	Pit (owned)	Pit (shared)	Pit (public)	None	Others
All India	**16.9**	**2.8**	**1.8**	**6.4**	**1.3**	**0.9**	**69.7**	**0.1**
Residence								
Urban	45.3	8.9	5.9	9.9	3.3	2.4	24.1	0.2
Rural	6.1	0.5	0.3	5.0	0.6	0.4	87.1	0.0
State								
Andhra Pradesh	14.4	1.5	0.7	5.0	1.1	1.6	75.6	0.1
Assam	12.4	2.7	0.1	30.2	4.1	0.1	50.4	0.0
Bihar	11.8	1.2	0.2	2.6	0.4	0.2	83.5	0.1
Delhi	51.7	7.7	13.1	6.1	2.4	2.7	15.9	0.4
Goa	24.1	1.6	0.4	16.4	1.9	3.5	52.0	0.0
Gujarat	27.9	3.3	2.5	1.5	0.2	0.5	64.2	0.0
Haryana	13.3	0.6	0.3	9.3	3.2	0.2	73.1	0.0
Himachal Pradesh	9.0	0.8	0.5	1.7	0.3	0.2	87.5	0.1
Jammu and Kashmir	12.7	0.7	0.2	3.8	0.4	1.2	80.9	0.0
Karnataka	14.4	2.4	0.9	9.5	1.9	2.1	68.9	0.0
Kerala	60.9	1.3	0.4	7.8	0.3	0.2	29.1	0.1
Madhya Pradesh	13.3	1.7	1.4	2.9	1.2	0.8	78.7	0.0
Maharashtra	17.9	7.0	10.1	2.1	1.7	2.0	59.2	0.0
North-East	12.2	3.4	0.6	50.2	8.9	0.7	23.8	0.2
Orissa	6.3	0.2	0.1	5.0	0.2	0.3	87.8	0.1
Punjab	22.3	0.4	0.0	13.2	0.3	0.3	63.3	0.2
Rajasthan	14.5	0.7	0.6	2.9	1.0	0.1	80.2	0.0
Tamil Nadu	18.2	5.4	1.9	1.2	1.1	1.4	70.7	0.0
Uttar Pradesh	11.6	0.9	0.2	8.0	1.1	0.9	77.1	0.3
West Bengal	18.4	8.2	1.9	8.5	2.7	0.6	59.6	0.1
Wealth quintile								
Poorest quintile	0.0	0.0	0.1	0.6	0.1	0.1	99.2	0.0
Second quintile	0.1	0.1	0.2	3.1	0.4	0.3	95.7	0.0
Middle quintile	2.2	1.2	1.4	6.8	1.3	1.1	85.9	0.1
Fourth quintile	13.2	4.7	4.2	11.0	2.6	2.0	62.3	0.2
Richest quintile	68.6	8.1	3.5	10.3	2.3	1.1	6.0	0.1
Education (head of household)								
Illiterate	3.8	1.1	1.3	4.0	0.9	0.8	88.1	0.1
Literate – primary	13.6	3.2	2.5	7.0	1.5	1.0	71.1	0.1
Middle complete	21.2	5.3	2.8	9.3	2.0	1.2	58.1	0.1
High school +	48.0	5.0	1.7	9.2	1.8	0.9	33.3	0.1
Caste								
Scheduled caste	6.2	1.4	1.5	2.4	0.9	1.0	86.7	0.1
Scheduled tribe	4.4	1.1	1.1	4.7	0.6	0.5	87.6	0.0
Others	20.1	3.3	2.0	7.2	1.5	1.0	64.9	0.1

Source: Authors' analysis of National Family Health Surveys, 1992–1993.

Table 3: Distribution of Household Toilet Types by Background Characteristic of the Household (1998–1999)

	Flush (owned)	Flush (shared)	Flush (public)	Pit (owned)	Pit (shared)	Pit (public)	None	Others
All India	**18.8**	**2.6**	**2.6**	**10.4**	**1.1**	**0.7**	**63.7**	**0.1**
Residence								
Urban	47.7	7.7	8.6	13.4	2.2	1.3	19.2	0.0
Rural	7.8	0.7	0.4	9.2	0.7	0.4	80.8	0.1
State								
Andhra Pradesh	15.8	2.0	0.3	6.8	1.3	1.2	72.7	0.0
Assam	13.2	1.1	0.3	46.0	1.2	1.2	36.9	0.2
Bihar	11.7	1.3	0.2	3.0	0.2	0.4	83.2	0.0
Delhi	73.1	4.5	7.8	5.0	1.2	2.8	5.6	0.0
Goa	32.6	3.4	2.0	16.6	3.4	0.9	41.1	0.0
Gujarat	27.1	3.1	1.2	12.3	0.9	0.5	54.9	0.2
Haryana	29.1	1.1	0.2	8.1	0.5	0.1	60.8	0.1
Himachal Pradesh	22.2	1.5	0.5	2.4	0.1	0.0	73.1	0.3
Jammu and Kashmir	20.9	1.1	0.2	23.5	3.8	1.6	48.9	0.1
Karnataka	18.1	1.8	1.9	12.8	2.5	1.5	61.4	0.0
Kerala	17.8	0.1	0.0	64.1	2.7	0.5	14.8	0.0
Madhya Pradesh	17.9	1.3	1.0	1.1	0.2	0.7	77.8	0.0
Maharashtra	20.0	3.9	17.8	3.3	0.2	0.6	54.0	0.1
North-East	15.8	5.1	0.5	47.9	10.3	0.5	19.9	0.1
Orissa	9.4	1.3	0.2	2.4	0.2	0.1	86.5	0.0
Punjab	35.5	0.7	0.0	14.1	0.9	0.2	48.6	0.0
Rajasthan	20.1	2.4	0.3	4.1	0.7	0.3	71.8	0.3
Tamil Nadu	21.9	7.1	3.8	0.6	0.3	0.3	65.9	0.1
Uttar Pradesh	8.8	1.2	0.3	14.1	1.3	0.8	73.2	0.2
West Bengal	27.7	5.2	1.0	9.2	1.6	0.3	54.9	0.3
Wealth quintile								
Poorest quintile	0.0	0.0	0.2	1.0	0.1	0.3	98.3	0.1
Second quintile	1.2	0.4	0.8	5.5	0.6	0.7	90.6	0.2
Middle quintile	4.9	1.6	2.4	11.1	1.3	0.8	77.8	0.2
Fourth quintile	20.1	6.0	6.9	19.6	2.6	1.3	43.5	0.1
Richest quintile	68.8	5.3	3.2	15.7	0.9	0.4	5.8	0.0
Education (head of household)								
Illiterate	5.7	1.2	1.9	6.5	0.8	0.7	83.1	0.1
Literate – primary	14.2	2.5	3.2	12.1	1.2	0.8	66.0	0.1
Middle complete	21.9	3.7	4.0	13.6	1.5	0.6	54.5	0.2
High school +	46.6	4.9	2.7	13.7	1.2	0.5	30.4	0.1
Caste								
Scheduled caste	9.4	1.6	3.0	5.9	0.7	1.0	78.4	0.1
Scheduled tribe	5.2	1.0	1.7	7.2	0.9	0.7	83.2	0.1
Others	23.0	3.1	2.7	12.0	1.2	0.6	57.4	0.1
Household religion								
Hindu	17.8	2.5	2.4	8.0	0.8	0.7	67.7	0.1
Muslim	20.6	3.5	3.6	22.5	2.4	0.9	46.3	0.2

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Table 3 continued

	Flush (owned)	Flush (shared)	Flush (public)	Pit (owned)	Pit (shared)	Pit (public)	None	Others
Christian	23.9	3.4	2.1	27.0	3.3	0.4	40.0	0.0
Sikh	34.1	1.0	0.5	15.9	1.1	0.1	47.1	0.0
Others	28.9	3.0	9.6	7.8	1.3	0.1	49.2	0.1

Source: Authors' analysis of National Family Health Surveys, 1998.

Table 4: Distribution of Household Toilet Types by Background Characteristics of the Household (2005–2006)

	Flush - piped sewer system	Flush-to-septic tank	Flush-to-pit latrine	Flush - others	Pit latrine—improved	Pit latrine with slab	Pit latrine—open	Others	No facility
All India	**9.7**	**22.0**	**5.9**	**1.6**	**0.3**	**2.7**	**1.7**	**0.8**	**55.4**
Residence									
Urban	27.9	39.5	7.0	4.4	0.5	2.1	0.7	1.0	16.8
Rural	0.8	13.6	5.4	0.2	0.2	3.0	2.2	0.7	74.0
State									
Andhra Pradesh	6.6	29.0	1.9	1.0	0.2	2.8	0.3	0.7	57.6
Assam	0.5	25.5	9.2	0.1	0.0	11.8	28.8	0.4	23.6
Bihar	1.7	18.2	1.5	0.3	0.2	1.7	0.8	0.2	75.4
Delhi	70.5	12.1	0.7	8.1	0.0	0.0	0.1	0.9	7.5
Goa	2.3	66.1	1.1	0.5	0.2	0.1	0.1	5.7	24.0
Gujarat	28.6	12.9	11.3	0.4	0.1	0.2	0.1	1.1	45.4
Haryana	17.2	22.8	8.5	0.4	0.1	2.7	0.8	0.0	47.6
Himachal Pradesh	4.3	34.5	5.6	0.3	0.5	0.3	0.1	1.0	53.5
Jammu and Kashmir	5.7	21.0	1.7	5.0	0.2	1.6	23.2	3.4	38.2
Karnataka	9.4	7.7	20.3	1.6	1.0	5.1	1.3	0.3	53.4
Kerala	1.6	73.1	18.1	0.2	0.0	2.5	0.5	0.2	3.8
Madhya Pradesh	4.2	16.7	1.9	0.9	0.2	0.6	0.2	0.1	75.1
Maharashtra	29.0	21.8	0.7	0.9	0.1	0.2	0.2	0.2	46.9
North-East	1.1	28.7	18.7	1.7	0.1	0.5	33.1	3.27	11.7
Orissa	1.7	10.4	0.8	0.1	1.2	4.7	0.5	0.1	80.6
Punjab	28.6	23.3	10.7	0.7	0.1	5.5	1.8	0.3	29.1
Rajasthan	5.2	18.5	3.5	1.4	0.1	1.3	0.6	0.3	69.2
Tamil Nadu	4.6	28.2	0.3	9.6	0.0	0.1	0.0	0.2	57.1
Uttar Pradesh	5.7	18.4	4.2	1.3	0.7	0.7	0.5	3.0	65.6
West Bengal	3.4	28.8	16.2	0.2	0.2	8.6	2.0	0.2	40.4
Wealth quintile									
Poorest	0.1	0.4	0.9	0.1	0.0	1.2	1.4	0.5	95.5
Second poorer	0.4	3.3	3.8	0.3	0.2	3.1	3.1	1.0	84.9
Middle	2.6	14.0	7.5	1.3	0.4	3.7	2.6	1.3	66.5
Second richest	12.8	40.8	10.6	2.9	0.6	3.7	1.3	1.0	26.4
Richest	32.4	52.5	7.0	3.3	0.4	1.8	0.2	0.2	2.3

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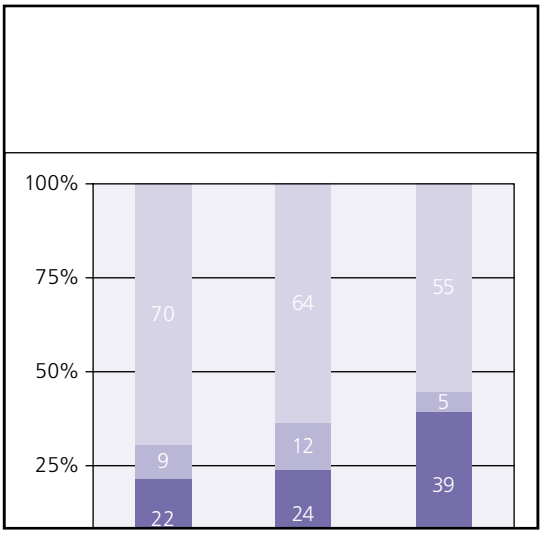
Table 4 continued

	Flush - piped sewer system	Flush-to-septic tank	Flush-to-pit latrine	Flush - others	Pit latrine—improved	Pit latrine with slab	Pit latrine—open	Others	No facility
Education (head of household)									
Illiterate	3.4	9.5	3.8	0.8	0.2	2.1	1.7	1.1	77.4
Primary	6.2	19.0	6.8	1.5	0.3	3.7	2.1	0.7	59.9
Middle	10.3	24.9	7.5	1.7	0.3	2.9	1.9	0.7	49.8
Secondary+	19.2	38.3	7.2	2.5	0.5	2.8	1.4	0.5	27.6
Caste									
Scheduled castes	6.5	14.6	5.1	1.4	0.3	2.5	1.1	0.5	68.0
Scheduled tribes	1.9	7.5	3.3	0.4	0.1	2.3	1.6	0.7	82.2
Others	11.4	25.7	6.4	1.8	0.4	2.8	1.9	0.9	48.9
Religion									
Hindu	9.2	20.8	5.4	1.5	0.4	2.2	0.9	0.4	59.2
Muslim	10.3	25.2	8.1	2.0	0.2	4.5	6.2	3.5	40.1
Christian	9.1	40.5	8.1	2.2	0.2	5.6	3.2	1.1	29.8
Sikh	18.9	30.9	13.3	0.5	0.1	6.8	2.8	0.3	26.5
Others	18.4	21.3	2.6	0.7	0.0	1.8	1.7	1.4	52.2

Source: Authors' analysis of National Family Health Surveys, 2005–2006.

Figure 3: Trends in Access: Different Types of Toilet at Household Level from 1992–1993 to 2005–2006



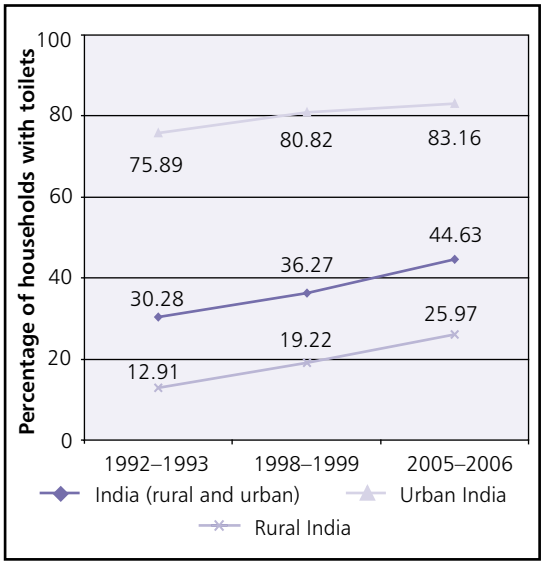
Source: Authors' analysis of National Family Health Surveys, 1992, 1998, and 2005.

Rural–urban differentials. Between 1992–1993 and 2005–2006, household ownership of any sanitary toilet doubled from 12.9% to 25.3% in rural areas, and increased from 75.9% to 83.1% in urban areas (Table 1). The rural–urban gap in household ownership of sanitary toilets declined only marginally from 62% in 1992–1993 to 57.8% in 2005–2006. The percentage of rural households with no toilet declined from 87% in 1992–1993 to about 74% in 2005–2006; in urban areas, this fell from 24% in 1992–1993 to 17% in 2005–2006 (Figure 4).[7]

Caste-based differentials. Significant caste-based differences persist in sanitation coverage. Scheduled tribe (ST) households continue to have the lowest ownership of toilets, increasing from only 12.4% in 1992–1993 to 17.8% in 2005–2006. However, the scheduled caste (SC)

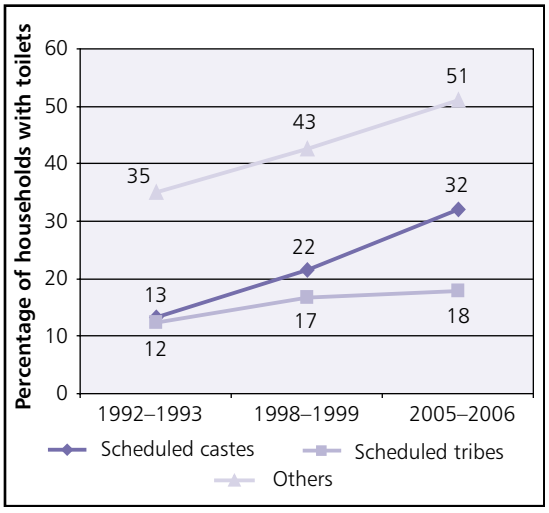
[7] **Progress as per latest official statistics.** The Department of Drinking Water Supply of the Ministry of Rural Development reports significant improvement in the past few years, especially after the last survey results (2004–2005) used for this study. Of the estimated 154.3 million rural households, about 82 million (53%) were provided with toilets under various government schemes. Even if it is assumed that 19% of the households do not use toilets, about 66 million households do, for coverage of 44%. (www.ddws.nic.in/)

Figure 4: Rural/Urban Progress in Household Toilet Ownership (1992–2006)



Source: National Family Health Surveys of India, 1992–1993; 1998–1999; and 2005–2006.

Figure 5: Caste-Based Differentials in Progress of Households with Toilets (%)



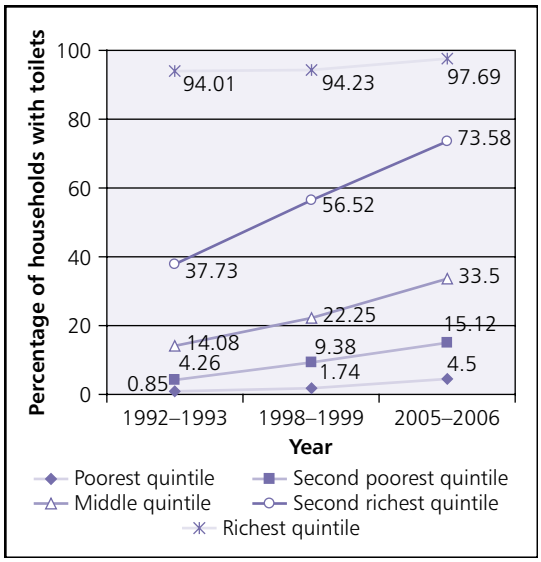
Source: National Family Health Surveys of India, 1992–1993; 1998–1999; and 2005–2006.

and other caste households progressed much more rapidly during the same period (Figure 5). While household sanitation coverage was very similar between SC and ST households in 1992–1993 (13.5% and 12.4%, respectively), the difference widened to 14 percentage points in 2005 (32% for SC households and 17.8% for ST households), mainly due to better SC progress.

Wealth-based differentials. The progress made in the five wealth quintiles of households reveals a range of interesting features. The wealthiest quintile, which had very high coverage of toilets even in 1992–1993 (94%), edged up to 97% by 2005–2006. Conversely, the poorest quintile had very low coverage in 1992–1993 (1%) and improved only modestly to 4.5% by 2005–2006. The second and third wealthiest quintiles achieved the most significant gains (Figure 6).

Education-based differentials. These are large in households lacking toilets and persisted over the last decade (Figure 7). Illiterate households (that is, in which the head is illiterate) have the least access to toilets. In 1992–1993, 88% of illiterate households had no toilet facilities, decreasing to about 77% by 2005–2006. Households that lacked toilets but had heads of household who achieved high school or higher education decreased from 33% in 1992–1993 to 28% in 2005–2006. Unlike wealth- and caste-based differentials, progress in access to toilets by various household education categories appears uniform over the last decade.

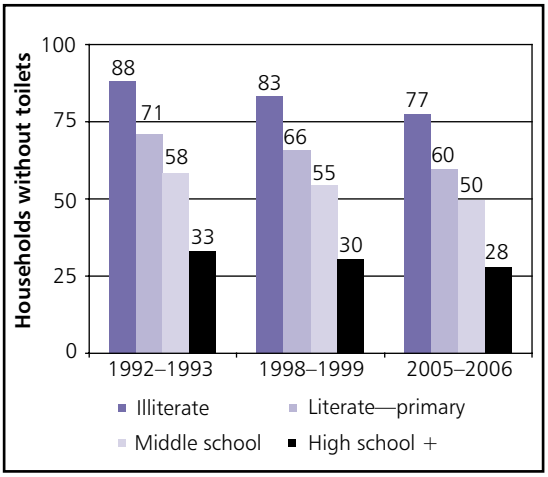
Figure 6: Wealth-Based Differentials in the Progress of Households with Toilets (%)



Source: National Family Health Surveys of India, 1992–1993; 1998–1999; and 2005–2006.

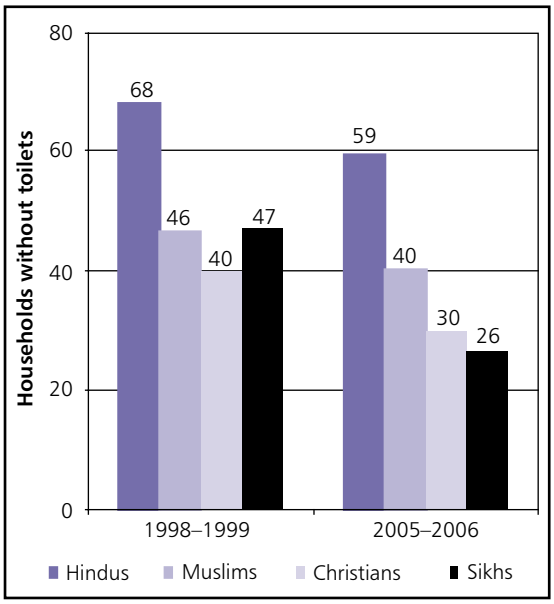
Religion-based differentials. These differences are significant: Hindu households have the lowest sanitation coverage, followed by Muslim

Figure 7: Household Head Education-Based Differentials in Households Without Toilets (%)



Source: National Family Health Surveys of India.

Figure 8: Religion-Based Differentials in the Households Without Toilets (%)



Source: National Family Health Surveys of India (Demographic and Health Surveys), 1992–1993; 1998–1999; and 2005–2006.

households. Between 1998–1999 and 2005–2006 (data on religion is not available in the 1992–1993 survey), Sikh households showed the most significant improvement, with households lacking toilets declining to 26%, from 47%, and sanitation coverage was better than in Christian households in 2005–2006 (Figure 8).

State-level differentials. State-level variations in coverage of toilets are most acute in the latest survey (2005–2006). North-East states, the southern state of Kerala, and New Delhi have the highest coverage of toilets (more than 85% of all households have some type of toilet facility). Conversely, fewer than 35% of households in Orissa, Bihar, Madhya Pradesh, Rajasthan, and Uttar Pradesh have toilets. In all three surveys, Orissa had the lowest coverage and remains the only state where fewer than 20% of households have toilets (Figure 9). During the last decade, Himachal Pradesh showed the greatest improvement, moving from second poorest performer in 1992–1993 to surpass Bihar, Madhya Pradesh, Rajasthan, Uttar Pradesh, Andhra Pradesh, and Tamil Nadu by 2005–2006, which shows that despite constraints few states have managed to accelerate progress compared to others.

Rural–urban differentials in the states. To assess rural–urban differentials in different states, we used arbitrary benchmarks (90% toilet coverage in urban areas and 60% coverage in rural areas) to determine which states encounter different levels of challenges by rural–urban differential progress (Figure 10):

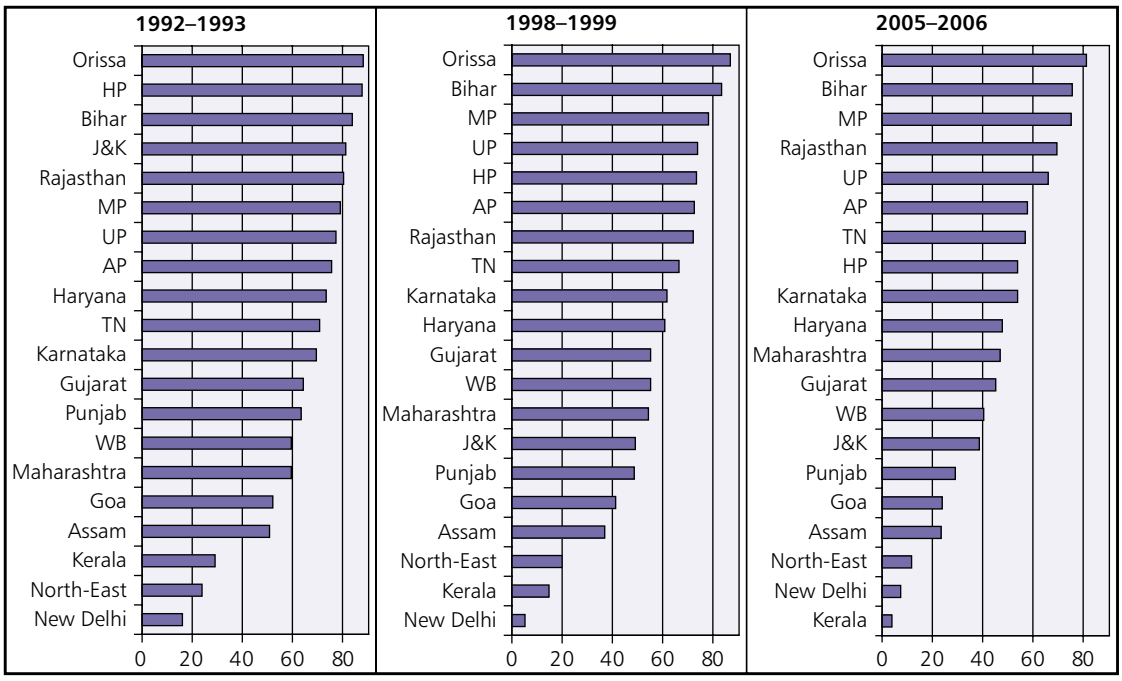
(i) States above benchmark (that is, rural >60% toilet coverage, and urban >90% toilet coverage) are located mainly in the North-East, the capital city of Delhi, and the southern state of Kerala.

(ii) States with urban areas above benchmark and rural areas below benchmark include Punjab, Uttarakhand, Himachal Pradesh, and West Bengal.

(iii) Only Goa, located along the southwestern coast, has rural areas above benchmark and urban areas below benchmark.

(iv) States with both rural and urban areas below benchmark include Jammu and Kashmir, Haryana, Gujarat, Maharashtra, Uttar Pradesh, Rajasthan, Karnataka, Andhra Pradesh, Tamil Nadu, Bihar, Madhya Pradesh, Jharkhand, Chhattisgarh, and Orissa.

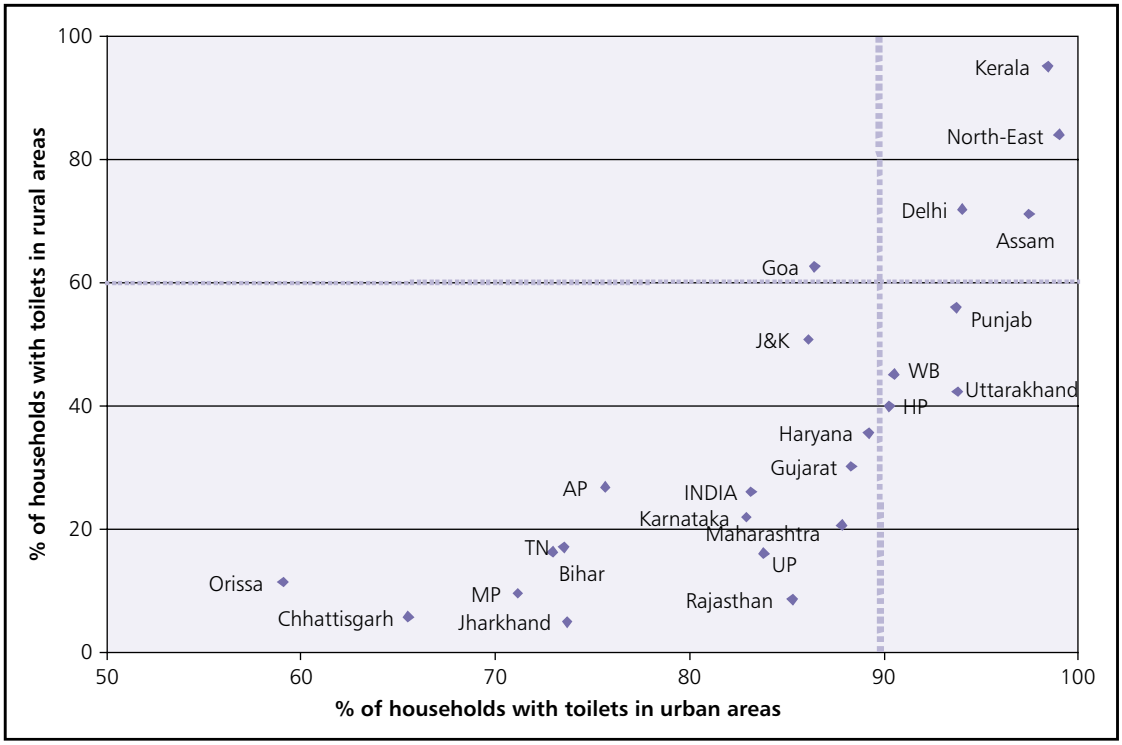
Figure 9: State-Level Changes in Households Without Toilets (%)



AP = Andhra Pradesh, HP = Himachal Pradesh, J&K = Jammu and Kashmir, MP = Madhya Pradesh, TN = Tamil Nadu, UP = Uttar Pradesh, WB = West Bengal.

Source: National Family Health Surveys of India (Demographic and Health Surveys), 1992–1993; 1998–1999; and 2005–2006.

Figure 10: State Rural–Urban Differentials in Household Access to Toilets



AP = Andhra Pradesh, HP = Himachal Pradesh, J&K = Jammu and Kashmir, MP = Madhya Pradesh, TN = Tamil Nadu, UP = Uttar Pradesh, WB = West Bengal.

Source: National Family Health Surveys of India, 2005–2006.

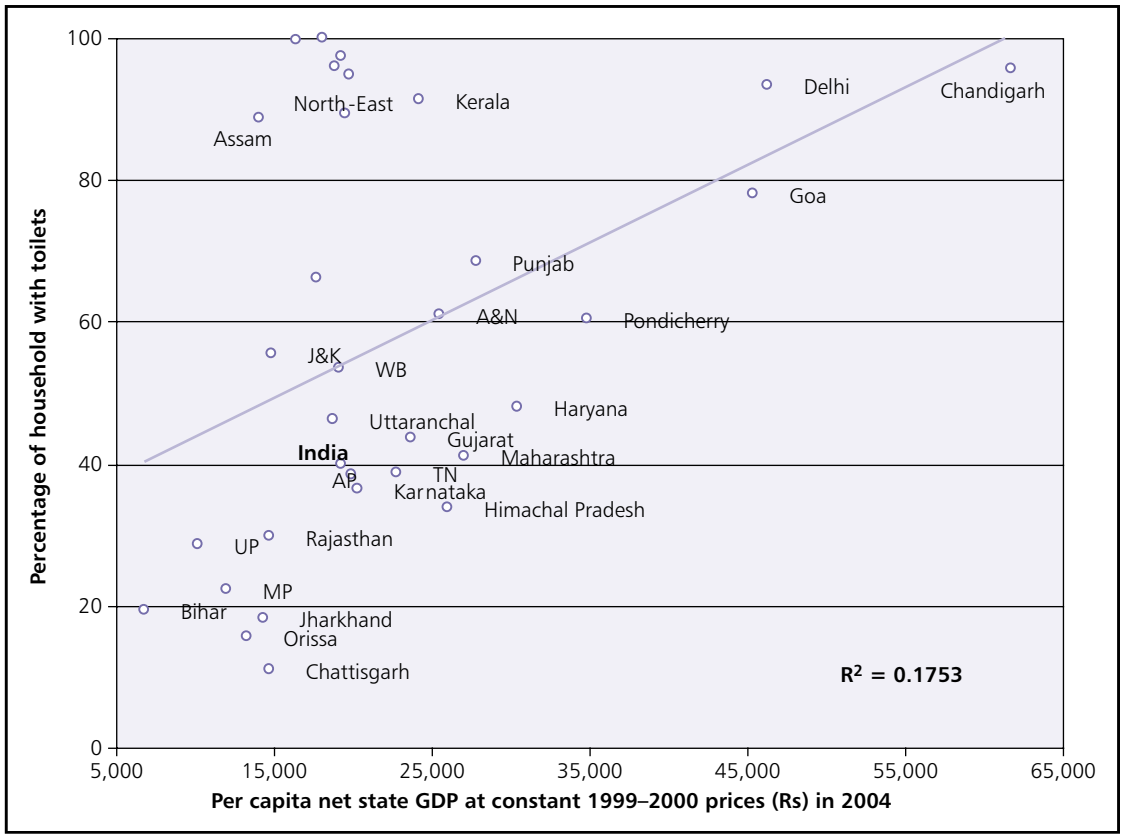
State per capita GDP and access to toilets. Constructing toilets requires capital expenditure for land and building materials, naturally creating some degree of correlation between the availability of household toilets and household wealth. Similarly, positive correlation can be expected between states with high per capita GDP and high access to toilets. We explored this correlation with the help of a scatter plot (Figure 11).

We observed only weak correlation between state per capita GDP and percentage of households with toilets ($R^2 = 0.1753$). While many states are close to the regression line (Figure 10), there are notable exceptions. All the North-East states and Kerala have significantly higher access to toilets than per capita GDP would otherwise predict. Conversely, sanitation coverage in Tamil Nadu, Karnataka, Andhra Pradesh, Maharashtra, Gujarat, Haryana, and Himachal Pradesh is lower than predicted by their per capita GDP. North-East states may share particular social and cultural characteristics that facilitate quicker adoption of toilets.

Relative progress of states. Figure 12 illustrates the relative progress of different states during the study period. For policy and program purposes, we divided the states into the following four categories:

(i) Category 1 (Madhya Pradesh, Orissa, Bihar, Rajasthan, Uttar Pradesh, Tamil Nadu, and Karnataka) includes states that need greater policy attention due to poor toilet coverage (less than 50% households with toilets in NFHS-3) and annual growth in the toilet coverage of less than 1.5% between NFHS-1 and NFHS-3.

Figure 11: Per Capita State GDP (2004) and Percentage of Households with Toilets in Different States



A&N = Andaman and Nicobar, AP = Andhra Pradesh, GDP = gross domestic product, J&K = Jammu and Kashmir, MP = Madhya Pradesh, Rs = Indian rupees, TN = Tamil Nadu, UP = Uttar Pradesh, WB = West Bengal.

Note: The R^2 is the coefficient of determination. It is a statistical measure of how well the regression line approximates the real data points. In this particular case, a R^2 of 0.1753 indicates a poor fit.

Source: National Sample Survey of India, 60th Round (January–June 2004) for data on toilets; and data of per capital net state GDP from Central Statistical Organization, New Delhi.

(ii) Category 2 (Andhra Pradesh and Himachal Pradesh) includes states with low coverage but more than 1.5% annual improvement.

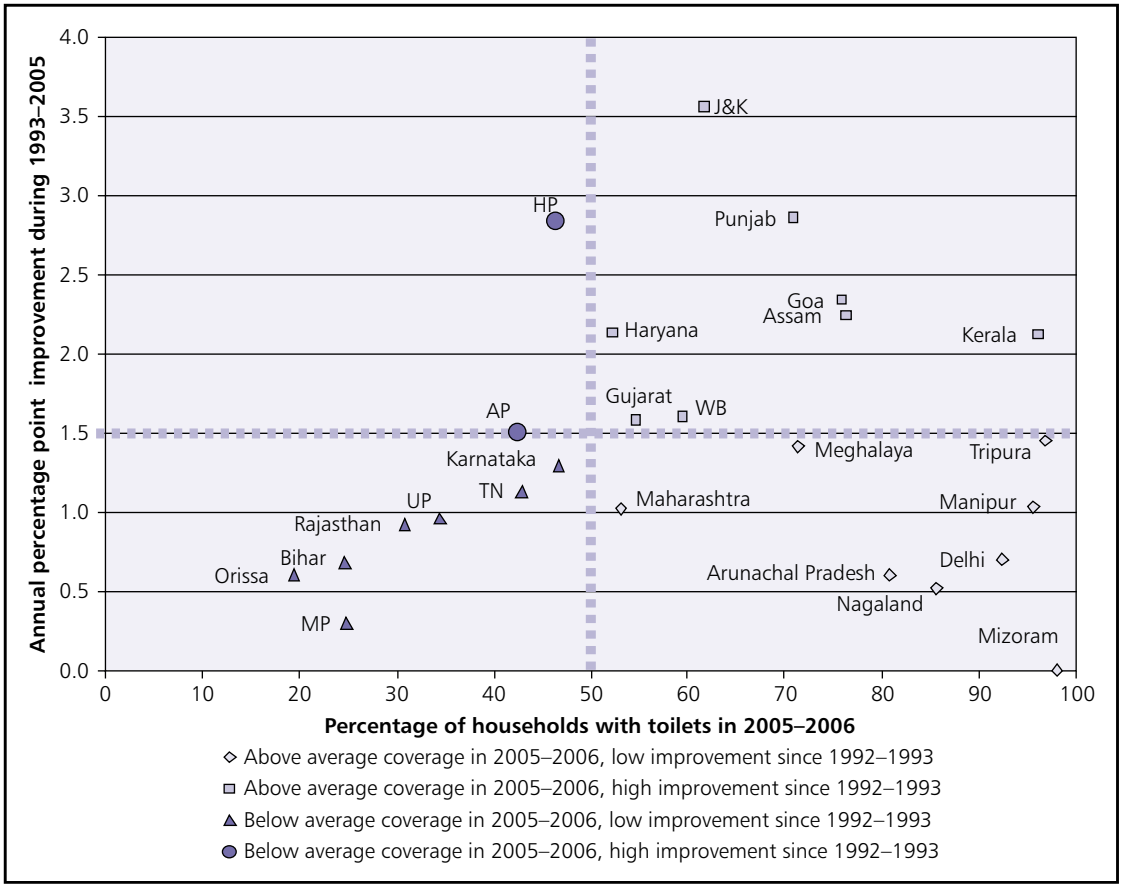
(iii) Category 3 (Maharashtra, Delhi, and North-East) includes states with more than 50% coverage but low annual growth (less than 1.5% per year). Because most of the North-East states had very high coverage in NFHS-1, low annual growth rate may not be of importance here.

(iv) Category 4 (Jammu and Kashmir, Punjab, Kerala, Goa, Assam, Haryana, Gujarat, and West Bengal) includes states with more than 50% coverage and annual growth rates exceeding 1.5%. The highest annual growth rates were clocked by Jammu and Punjab.

Multivariate Analysis

Table 5 shows the results of probit regression for the probability of households with access to toilet facilities in NFHS-1, NFHS-2, and NFHS-3. After controlling other variables in the model, the probability of access to toilets is higher in urban areas than rural areas in all three surveys ($p<0.05$). Compared to households from the poorest quintile, the wealthier quintiles had a higher probability of access to toilets ($p<0.05$). Households headed by the higher educated had a higher probability of access to toilets in 2005–2006 than households with illiterate heads. However, we observed no significant difference between households with illiterate

Figure 12: Relative Progress in Household Toilets by Different States (2005–2006)



AP = Andhra Pradesh, HP = Himachal Pradesh, J&K = Jammu and Kashmir, MP = Madhya Pradesh, TN = Tamil Nadu, UP = Uttar Pradesh, WB = West Bengal.

Note: Above average coverage = >50% households with toilets; below average coverage = <50%. Low improvement if annual increase is <1.5 percentage points between 1992–1993 and 2005–2006; and high improvement if annual increase is >1.5 percentage points between 1992–1993 and 2005–2006. Uttar Pradesh (UP) includes Uttarakhand, Bihar includes Jharkhand, and Madhya Pradesh (MP) includes Chhattisgarh.

Source: National Family Health Surveys of India, 1992–1993 and 2005–2006.

heads and households whose heads had primary-level education in NFHS-1 and NFHS-2. In NFHS-2 and NFHS-3, Muslim, Christian, and Sikh households had higher probability of access to toilets than Hindu households.

Caste- and state-based differentials changed significantly over the three surveys. Compared to scheduled castes, the probability of scheduled tribes having access to toilets decreased in 2005–2006 ($p<0.05$); this was not the case in NFHS-1 and NFHS-2, which showed no significant differences.

While the state-level results of the regression analysis are diverse and difficult to interpret, some trends are clear. After controlling all the other factors in the regression, households in Assam, North-East, Kerala, West Bengal, and New Delhi have higher probability of access to toilets than Uttar Pradesh (control state). In all three surveys, households in Gujarat, Haryana, Himachal Pradesh, Madhya Pradesh, Orissa, Rajasthan, and Tamil Nadu had lower probability of access to toilets than in Uttar Pradesh. Andhra Pradesh, Goa, Jammu and Kashmir, Karnataka, and Punjab showed an improving trend compared to Uttar Pradesh.

Interestingly, bivariate analysis showed that households in Himachal Pradesh had a higher percentage of access to toilets (Table 1) in 2005–2006. But multivariate analysis produced opposite results. Therefore, after controlling other factors in the model, households in Himachal have lower probability compared to households in Uttar Pradesh, likely due to urbanization and education; both are higher in Himachal than in Uttar Pradesh.

Access to Drainage

Wastewater treatment. The amount of untreated wastewater discharged varied from as high as 89% in Class II towns to 59% in metropolitan cities as per one sample survey conducted in 1998–1999 (MOUD 2005). As per this survey, the amount collected to generated varied from 61% in metropolitan cities, to 52% in Class I cities, and 65% in Class II towns.[8] While 66% of the collected was treated in metropolitan cities, only 48% in Class I and 17% in Class II towns was treated as a percentage of the collected (Figure 13). According to a recent report, 20,117 million liters per day is discharged without treatment in Class I cities (3iNetwork 2006, India Infrastructure 2008).

Nationally representative data on household access to drainage facilities are very limited. Two different data sets assessed the current status of household access to drainage facilities: (i) NFHS-3—to investigate household access to flush toilets connected to piped sewer system; and (ii) 60th round of the NSS of India—to investigate household access to different types of drainage (open, closed, underground, and none).

Flush toilets connected to piped sewer system. Only 9.7% of households—28% in urban areas and 1% in rural areas—have flush toilets connected to piped sewer systems. The state differentials are wide, ranging from 71% of households in New Delhi to just 1% in most of the North-East states. In the remaining states, only Punjab, Maharashtra, and Gujarat provide coverage greater than 20% (Figure 14).

Household access to type of drainage facility. Overall, 8% of households had access to underground drainage systems in 2005–2006; 47% had no access to any drainage system; 17% had access to open *kutcha* (mud drainage with no concrete lining); 19% had access to open *pucca* (channels with concrete lining) drainage systems; and 8% had access to covered cement drainage systems. In rural areas, 60% of households had no access to drainage systems compared to 15% in urban areas (Figure 15). Figure 15 also shows religion- and caste-based differentials regarding access to drainage facilities. Figure 16 shows household expenditure decile differentials in access to drainage facilities, and Figure 17 shows state differentials in access to drainage facilities.

Underground drainage facilities. The high-cost solution for drainage—underground drainage—is found most frequently in urban areas (22% of urban households versus only 2% in rural areas). Distribution by household characteristics is also interesting: among STs, only 2% have underground drainage, 14% of other castes have; Hindu and Muslim households 7–8%, and Jains 39%. Among households in the wealthiest decile, 29% have underground drainage, while only 2% of households in the poorest decile do.

[8] Class I cities have population between 1,000,000 and 100,000, while Class II cities have population between 100,000 and 50,000.

Table 5: Results of Probit Regression for Household with Access to Toilet Facilities (1992–1993, 1998–1999, and 2005–2006)

	2005–2006					1998–1999					1992–1993				
	Coefficient		95% CI			Coefficient		95% CI			Coefficient		95% CI		
Rural (Urban)	-1.00	**	-1.03	-	-0.96	-1.09	**	-1.12	-	-1.05	-1.02	**	-1.06	-	-0.98
State (Uttar Pradesh)															
Andhra Pradesh	-0.00		-0.0	-	0.04	-0.21	**	-0.29	-	-0.13	-0.55	**	-0.63	-	-0.46
Assam	1.83	**	1.76	-	1.91	1.77	**	1.70	-	1.85	1.85	**	1.76	-	1.94
Bihar	-0.10	**	-0.20	-	-0.10	0.08	*	0.01	-	0.16	0.05		-0.04	-	0.14
Delhi	0.35	**	0.26	-	0.44	0.27	**	0.16	-	0.39	-0.37	**	-0.46	-	-0.28
Goa	0.03		-0.10	-	0.12	-0.32	**	-0.43	-	-0.21	-0.90	**	-0.99	-	-0.82
Gujarat	-0.20	**	-0.20	-	-0.10	-0.31	**	-0.39	-	-0.24	-0.53	**	-0.61	-	-0.45
Haryana	-0.10	*	-0.20	-	-0.00	-0.61	**	-0.69	-	-0.53	-0.93	**	-1.03	-	-0.84
Himachal Pradesh	-0.40	**	-0.50	-	-0.30	-0.84	**	-0.92	-	-0.76	-1.18	**	-1.28	-	-1.07
Jammu and Kashmir	-0.00		-0.10	-	0.08	0.00		-0.08	-	0.09	-1.39	**	-1.48	-	-1.29
Karnataka	0.00		-0.10	-	0.06	-0.11	**	-0.19	-	-0.04	-0.25	**	-0.32	-	-0.17
Kerala	1.93	**	1.81	-	2.05	1.61	**	1.52	-	1.70	1.11	**	1.04	-	1.18
Madhya Pradesh	-0.20	**	-0.30	-	-0.20	-0.49	**	-0.56	-	-0.41	-0.46	**	-0.55	-	-0.37
Maharashtra	-0.20	**	-0.30	-	-0.10	-0.05		-0.12	-	0.02	-0.30	**	-0.39	-	-0.22
North-East	2.27	**	2.19		2.35	2.07	**	1.99		2.16	2.25	**	2.16	-	2.35
Orissa	-0.30	**	-0.40	-	-0.20	-0.21	**	-0.29	-	-0.12	-0.53	**	-0.63	-	-0.44
Punjab	-0.00		-0.10	-	0.10	-0.67	**	-0.77	-	-0.57	-0.78	**	-0.86	-	-0.69
Rajasthan	-0.50	**	-0.60	-	-0.40	-0.34	**	-0.41	-	-0.27	-0.47	**	-0.57	-	-0.38
Tamil Nadu	-0.30	**	-0.30	-	-0.20	-0.18	**	-0.25	-	-0.11	-0.48	**	-0.56	-	-0.40
West Bengal	1.07	**	1.00	-	1.14	0.90	**	0.82	-	0.97	0.80	**	0.71	-	0.88
Wealth quintile (poorest)															
Second poorest quintile	0.68	**	0.62	-	0.74	0.83	**	0.75	-	0.91	0.73	**	0.62	-	0.84
Middle	1.32	**	1.26	-	1.39	1.43	**	1.35	-	1.52	1.57	**	1.46	-	1.69
Second richest quintile	2.31	**	2.24	-	2.37	2.31	**	2.22	-	2.40	2.36	**	2.24	-	2.48
Richest quintile	3.57	**	3.48	-	3.65	3.65	**	3.55	-	3.75	4.06	**	3.93	-	4.18

* = p<0.1, ** = p<0.05, CI = confidence interval, na = not available, obs. = observations.

continued on next page

Note: In parentheses is the control group of respective categorical independent variable in the regression model.

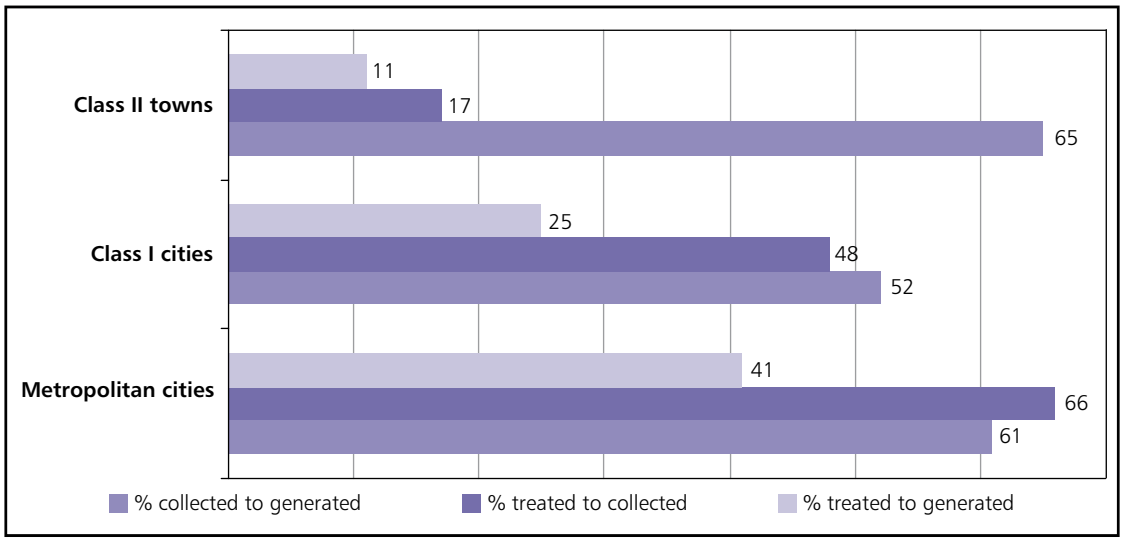
Table 5 continued

	2005–2006					1998–1999					1992–1993				
	Coefficient		95% CI			Coefficient		95% CI			Coefficient		95% CI		
Head of household education (Illiterate)															
Primary	0.13	**	0.09	-	0.17	0.02		-0.02	-	0.06	0.03		-0.02	-	0.07
Middle	0.15	**	0.11	-	0.20	0.08	**	0.03	-	0.13	0.09	**	0.03	-	0.14
Secondary	0.27	**	0.23	-	0.31	0.20	**	0.15	-	0.24	0.21	**	0.16	-	0.26
Caste (Scheduled caste)															
Scheduled tribe	-0.21	**	-0.28	-	-0.13	-0.01		-0.09	-	0.06	0.01		-0.10	-	0.10
Others	0.06	*	0.02	-	0.10	0.16	**	0.11	-	0.20	0.33	**	0.27	-	0.39
Religion (Hindu)															
Muslim	0.63	**	0.59	-	0.68	0.55	**	0.50	-	0.59	na				
Christian	0.31	**	0.21	-	0.41	0.26	**	0.16	-	0.36	na				
Sikh	0.38	**	0.25	-	0.51	0.31	**	0.20	-	0.41	na				
Others	-0.04		-0.19	-	0.10	0.06		-0.07	-	0.18	na				
Constant term	-0.38	**	-0.48	-	-0.29	-0.65	**	-0.77	-	-0.54	-1.21	**	-1.36	-	-1.06
Number of obs.	108,939					92,423					88,531				
Probability > chi^2	0.00					0.00					0.00				
Pseudo R^2	0.58					0.60					0.64				

* = p<0.1, ** = p<0.05, CI = confidence interval, na = not available, obs. = observations.

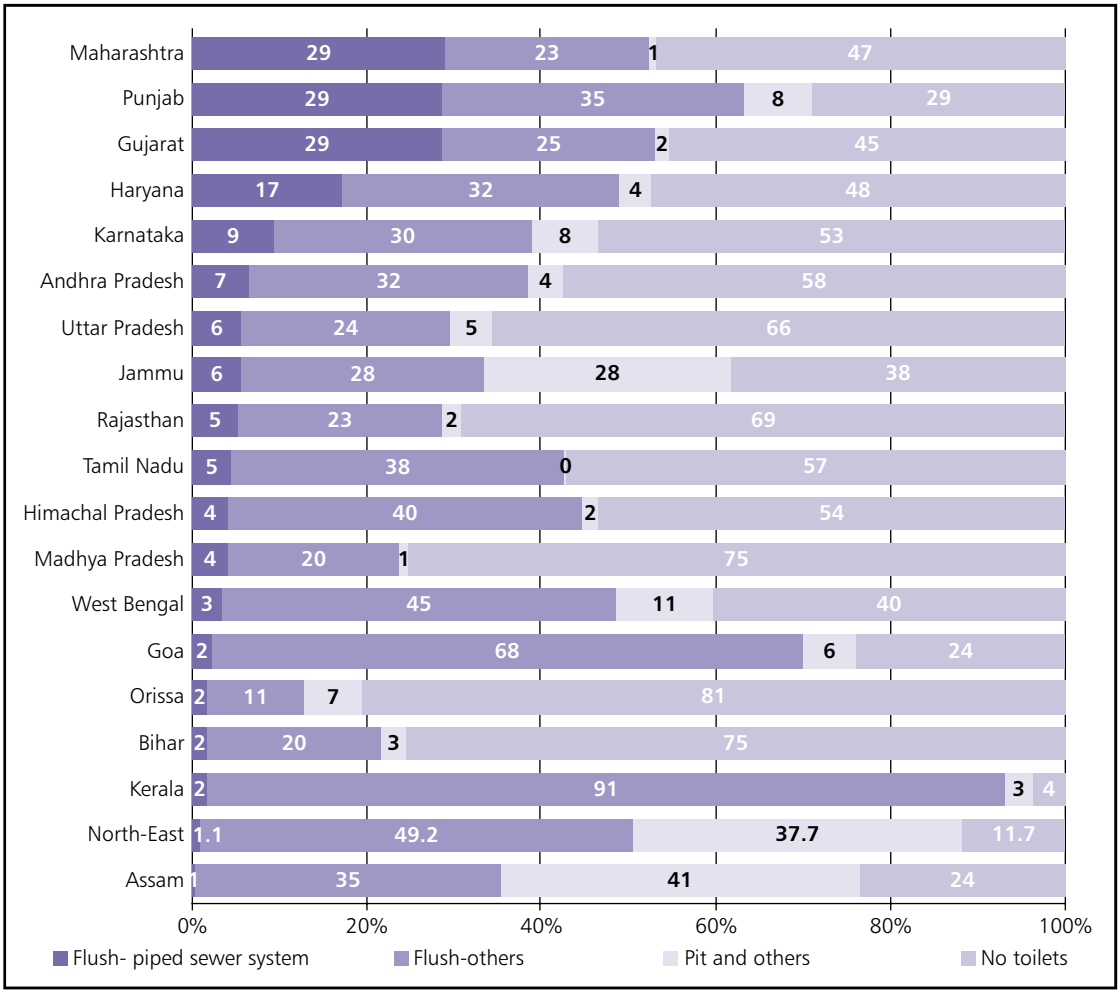
Note: In parentheses is the control group of respective categorical independent variable in the regression model.

Figure 13: Status of Wastewater Treatment in India (%)



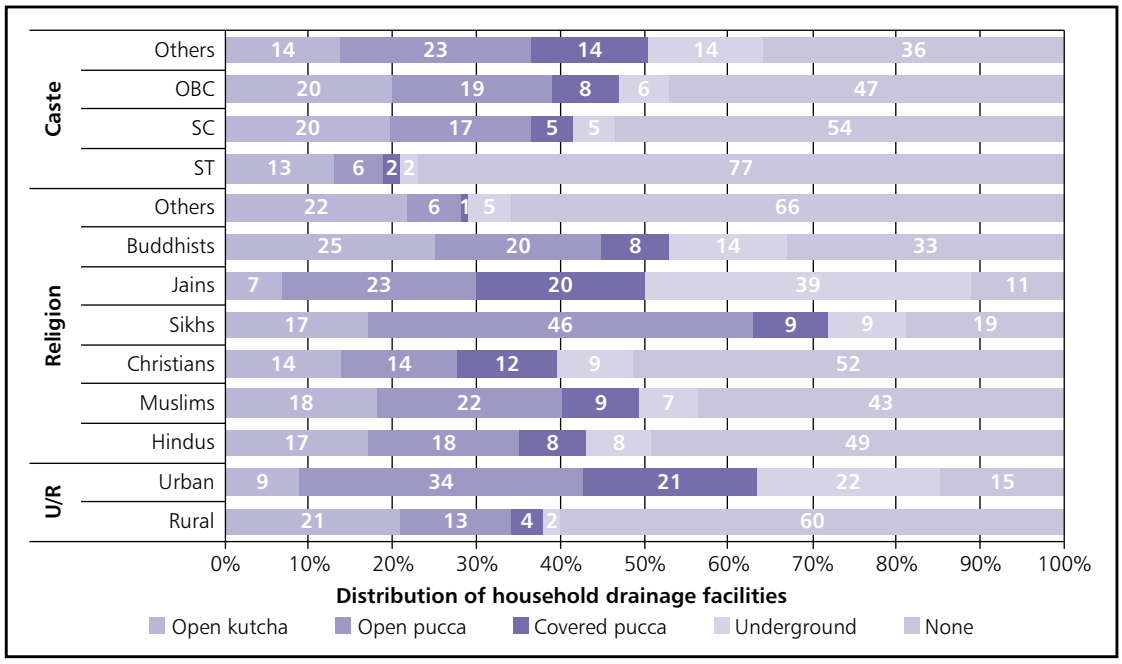
Source: Ministry of Urban Development. 2005. Status of Water Supply, Sanitation, and Solid Waste. Survey conducted by the National Institute of Urban Affairs and Central Public Health and Environmental Engineering Organization in 1998–1999.

Figure 14: Access to Flush Toilets with Piped Sewer Systems in Different States, 2005–2006 (%)



Source: National Family Health Surveys of India, 2005–2006.

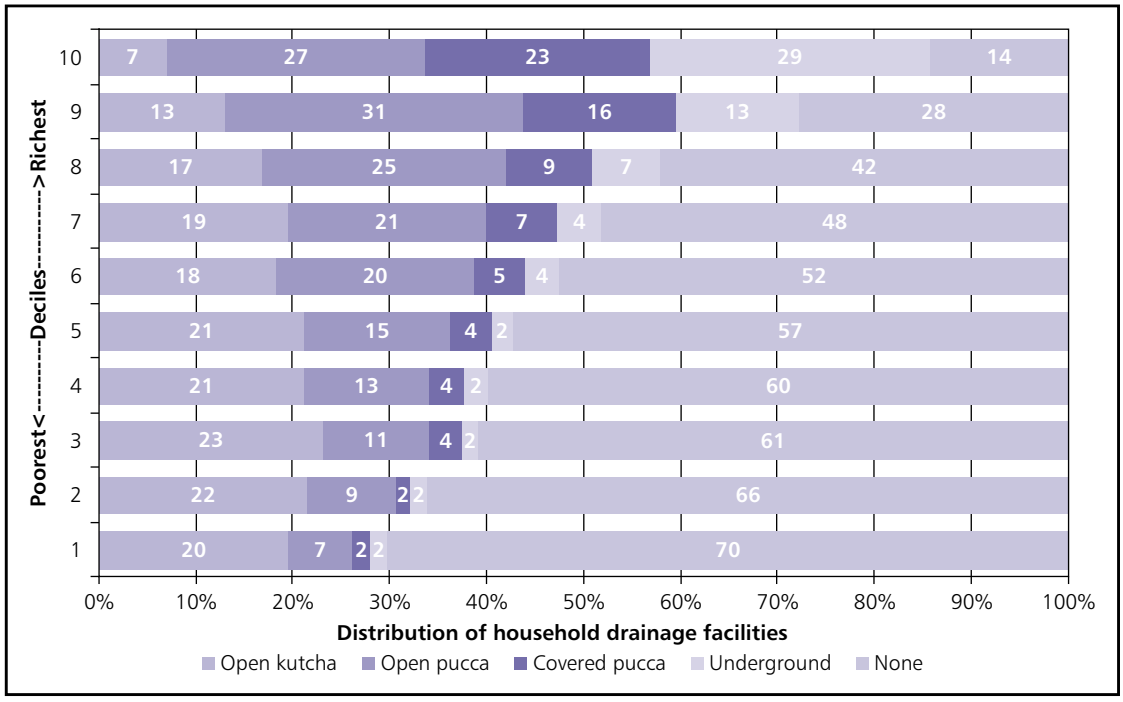
Figure 15: Access to Drainage by Household Background Characteristics (%)



OBC = other backward castes, SC = scheduled caste, ST = scheduled tribe.

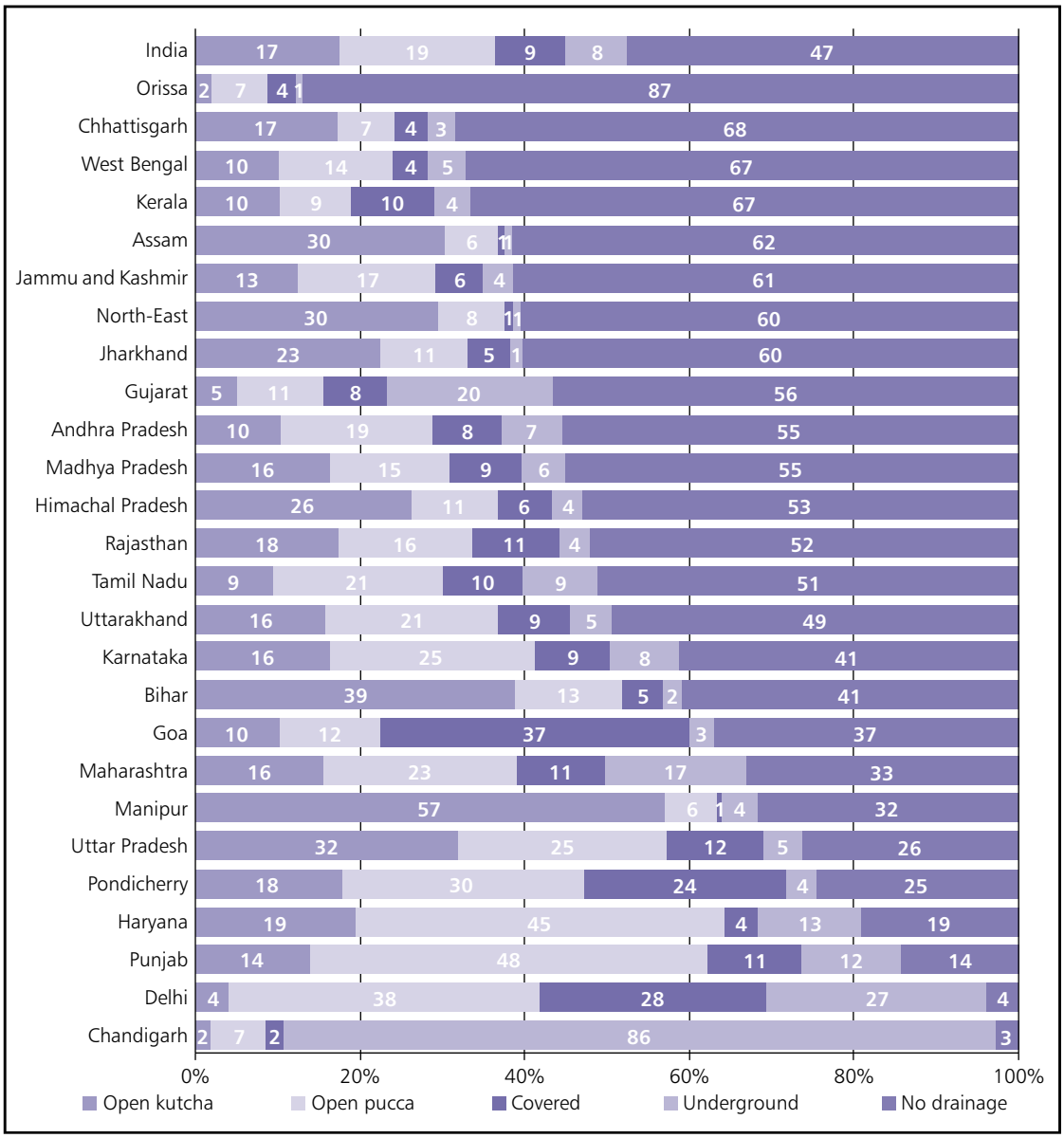
Source: National Sample Survey of India, 60th Round (January–June 2004). National Sample Survey Organization of India.

Figure 16: Household Access to Different Types of Drainage by Expenditure Decile of the Household (%)



Source: National Sample Survey of India, 60th Round (January –June 2004). National Sample Survey Organization of India.

Figure 17: Household Access to Different Types of Drainage by State (%)



Source: National Sample Survey of India, 60th Round (January–June 2004). National Sample Survey Organization of India.

Discussion

Economic growth and sanitation. Our data shows that the relationship between sanitation and economic growth is ambivalent. Figure 2 shows that the variation in sanitation coverage among countries with similar per capita GDP is very high. India underperformed countries with similar per capita GDP. Figure 11 is more telling: Indian states with much lower economic growth can achieve higher levels of sanitation. For example, North-East states have outperformed Maharashtra and Gujarat, despite lower levels of economic development. For policy purposes, the reasons for this dichotomy at the state level could offer important insights.

Cost estimates. The cost estimates for urban infrastructure have varied widely over time.[9] The variation in the cost estimates is understandable given the lack of accurate data and differences in assumptions made. Based on the information on lack of basic sanitation facilities at the household level, the paper estimates costs for universal coverage (Appendix). The cost estimates for providing toilets for all households that lack toilets are $4.8 billion for rural areas and $3.1 billion for urban areas, totaling $7.9 billion (assuming $1 = Rs45). Likewise, the cost estimates for connecting all households lacking underground drainage to sewer systems come to about $7.7 billion for urban areas, and $25 billion for rural areas. The cost estimates are very high and difficult to be met in a short period exclusively through public resources. Hence, innovative solutions, including low-cost solutions, public–private partnerships, and appropriate technology, should be explored further.

Appropriate cost-effecive solutions. Figure 14 compares Assam and Kerala states with Maharashtra and Gujarat. Maharashtra and Gujarat have nearly 50% sanitation coverage consisting mostly of high-end toilets (flush-piped sewerage and flush-others). Conversely, Assam and Kerala use lower-cost solutions, such as pit latrines, to achieve nearly 80%–90% coverage. Thus, by adopting low-cost solutions, Assam and Kerala managed to increase toilet coverage despite economic hurdles, conforming to long-standing recommendations for progressive improvement in the type of toilet coverage (that is, first attempt universal coverage using lower-cost solutions, and slowly improve the quality of toilets with higher-cost implications as and when economic growth permits) (World Bank 1980).

Cost recovery for higher-cost solutions that mostly benefit the wealthy. Similarly, high-cost and high-end drainage solutions, such as underground drainage systems, largely benefit urban areas and wealthy people (Figures 15 and 16). Appropriate cost-effective solutions that cater to a wider range of population require further exploration and scaled-up policy to extend public health benefits to the maximum number of people within the constraints of fiscal realities. For higher-end solutions, such

[9] Zakaria Committee Report (1963); Rakesh Mohan Committee Report (Infrastructure Report 1996); 10th Plan of the Planning Commission of India; and approach to the 11th Plan of the Planning Commission of India (MOUD 2006) are more well known. The others include those made by MOUD from the city development plans under the Jawaharlal Nehru National Urban Renewal Mission (JNNURM); Central Public Health and Environmental Engineering Organization (CPHEEO); and Rail India Technical and Economic Services (RITES) for urban transport in Class I cities. The Zakaria Committee Report estimated a total cost of Rs706 per capita (1998 prices) for provision of water supply, including sourcing, transport, storage, treatment, and distribution. The Rakesh Mohan committee estimated that the cost of urban infrastructure (across the three key services of water, sanitation, and roads) is about Rs280 billion (1996 prices) over a 10-year period up to 2006 (share of water and sanitation was Rs155.23 billion). JNNURM cities' capital investment plans and projects data indicate a requirement of Rs8 trillion for 5,161 cities. The CPHEEO estimated the requirement for 100% coverage of safe water supply and sanitation services by 2021 at Rs1.73 trillion. The RITES estimated Rs2.07 trillion for urban transport in Class I cities over the next 20 years.

as underground drainage—which currently benefits mostly wealthier households—user fees for capital costs, as well as operation and maintenance costs, should be built into the project cost and approval process so that the wealthy pay for services that cannot be provided universally otherwise.

Planning and sequencing. A household may contaminate a shallow aquifer in their neighborhood when converting pit latrine to pour-flush latrine. Neighborhood sewage may pollute the discharge point in the receiving body of water much more intensely than before. Lacking proper coordination, some household investments can become wasteful and/or redundant. Therefore, some regulation is necessary.[10] Concerted investment efforts between households and government are the key. This leads to the need for proper medium-term sequencing strategy (say, for the coming 20 years). (Probably, there will be a need for several model sequencing strategies.) Choice of on-site system versus off-site system vis-à-vis population density is particularly crucial depending, among other things, on investment capacity.

Inadequate progress in meeting goals. The government launched the Total Sanitation Campaign (TSC) in April 1999, close to the period of the NFHS-2 survey. Thus, NFHS-2 can provide baseline data to assess progress made under the TSC. Partly due to the TSC, sanitation coverage accelerated in 1998–2006 compared to 1992–1998, though many other factors (that is, literacy levels and economic growth) may have contributed as well. However, progress following the launch of TSC has not accelerated sufficiently, especially in rural areas, to achieve either the government's goal of "Sanitation for All" by 2012 or the MDG that aims to reduce by 50% the number of people lacking access to sanitation by 2015. Only 26% of rural households owned or used sanitary latrines in 2005–2006; if the rate of progress remains at the same level observed between 1998 and 2005, it may take another 3–4 decades before rural India rids itself of open defecation practices.[11]

Wealth differentials. The TSC, a targeted program for households below the poverty line (BPL), provides an almost 80% subsidy for construction of individual household sanitary latrine (IHHL). As of September 2008, TSC gained higher achievement in BPL households (26 million IHHL, or 45% of the set target) compared to households above the poverty line (APL) (20.8 million IHHL, or 34.3% of the set target). As presented earlier, however, survey data do not validate these reported results with progress in IHHL coverage much lower in the two poorest quintiles between NFHS-2 and NFHS-3 (3 percentage points in the poorest and 6 percentage points in the second poorest quintile) compared to the second wealthiest and middle quintile (17 and 12 percentage points, respectively).

Sociocultural differentials. In addition, our disaggregated analysis shows that certain areas and population groups have greater resistance to adopting household sanitation facilities than others. Thus, cultural attitudes toward the entire concept of defecation within the house may affect progress, affordability aside. Because progress is much slower in the large Hindi-speaking states and the poorest households, the program may require more targeted effort for some population groups,

[10] For example, back in the 1960s in Japan, households were not allowed to convert vault and vacuum toilet systems to the flush system until the sewer network reaches the neighborhood. As soon as the sewer network reaches the neighborhood, everyone was required to connect to the network. Such planning and regulation are a must to improve the overall public hygiene rather than letting affluent households improve their personal hygiene at the expense of their poorer neighbors.

[11] The physical progress under TSC remains low (about 40% against the target set). Between November 1999 and October 2005, the Government gave financial sanction for the construction of 111.1 million IHHLs in rural areas—54 million for BPL households and 57 million for APL households—and reported achievement of almost 43.9 million IHHL during the same period, amounting to almost 25% of all households in India. In addition, the TSC reported higher achievement among BPL households compared to APL households. However, as per NFHS-2 and NFHS-3, the percentage of households with any type of toilets improved by only 7 percentage points in rural areas, from 19.2% (1998–1999) to 26% (2005–2006). TSC has reported accelerated improvement since 2005 onwards, which is likely to be reflected in household surveys conducted in more recent years.

while also addressing sociocultural attitudes toward owning a household toilet. Differential household size may indicate that a much higher percentage of the population might lack access to sanitary facilities than reflected by the percentage of households. Information, communication, and education campaigns with the help of communities and grassroots organizations, including nongovernment organizations, community-based organizations, *panchayati raj* institutions, and others, can accelerate change and hasten the adoption of sanitary practices. All these efforts would need additional money. Research into the effectiveness of various outreach activities, and evidence-based investment in outreach activities that are most effective are important.

Scheduled tribes (STs) need special attention. STs include some of the most disadvantaged groups in India. Regarding access to drainage facilities, STs clearly are at the bottom of the pyramid. For example, 77% of ST households lack any drainage coverage (Figure 15), compared to 70% without drainage coverage in the poorest decile of households (Figure 16). As a group, STs have much lower access to drainage coverage than the poorest 10% of India's population likely due to a high degree of inequality in access to basic drainage facilities associated with dispersed hamlets and generally remote rural and forest areas inhabited by ST population. Without special attention and focused effort, it is unlikely that these differentials will change in the near future.

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Appendix

Estimates of Costs to Increase Coverage of Toilets and Drainage

We attempt here to provide a rough cost estimate of (i) constructing toilets and (ii) sewer connection for all households lacking such facilities. We use the unit costs from a previous Asian Development Bank (ADB) discussion paper (ADB 2006). The estimates are "rough" due to the broad assumptions we used to estimate the unit cost. In addition, the estimates are for hardware components only. The real costs, especially for toilets, will be much higher because overcoming various social, cultural, economic, and regional barriers to the adoption of toilets by households might require additional costs that are not easy to compute. The purpose of this exercise is to give a more detailed basis for working out the costs, which can be used by interested parties to derive estimates based on different costs for toilets and drainage.

Because we lacked more accurate data, we made the following assumptions while calculating rough minimal costs: (i) the cost of constructing a toilet is Rs1,500 per household in rural areas (simple pit latrine) and Rs2,500 per household in urban areas (ventilated improved pit latrine);[1] and (ii) the cost of providing "sewer" connection per household being Rs8,000.

Household-level data for costing is derived from the 60th round of the National Sample Surveys (NSS), conducted in 2004. NSS estimated the total number of households at about 198,503,000, including 143,312,000 rural and 55,792,000 urban households in India (Table A.1). **Table A.1** also presents the distribution of rural and urban household access to different types of drainage facilities.

Table A.2 includes cost estimates for providing toilets for all households that currently lack toilets. The approximate cost estimates are Rs215 billion for rural areas and Rs149 billion for urban areas, totaling Rs364 billion (approximately $7.9 billion assuming $1 = Rs45). This figure exceeds the National Commission on Macroeconomics and Health (2005) estimate for ensuring universal access to safe drinking water and sanitation (NCMH 2005).

Table A.3 includes cost estimates for connecting all households lacking underground drainage to sewer systems. We used a rough estimate of Rs8,000 per household to connect to sewer. For urban areas, the cost comes to about $7.7 billion and for rural areas, about $25 billion.

[1] HUDCO used Rs5,000 per capita for septic tank with soak pit and Rs800 per capita for integrated low-cost sanitation scheme (Ministry of Urban Development, 2005).

Table A.1: Distribution of Households by Type of Drainage Facility

State	Population	Total households ('000)			Rural households ('000)						Urban households ('000)					
		Rural	Urban	Total	Open kutcha	Open pucca	Covered	Underground	No drainage	Total	Open kutcha	Open pucca	Covered	Underground	No drainage	Total
Andaman and Nicobar	330	49	25	74	6	16	2	0	25	49	1	17	3	2	2	25
Andhra Pradesh	72,000	13,000	5,000	18,000	1,500	1,600	430	240	9,000	13,000	320	1,700	1,000	1,100	830	5,000
Assam	24,000	4,000	530	4,600	1,200	66	13	26	2,700	4,000	160	230	28	9	110	530
Bihar	69,000	11,000	1,400	12,000	4,600	1,100	280	160	4,900	11,000	230	480	360	120	190	1,400
Chandigarh	730	23	180	200	0	12	4	6	1	23	4	2	0	170	4	180
Chhattisgarh	20,000	3,500	620	4,100	620	87	52	61	2,700	3,500	91	200	100	78	150	620
Dadra and Nagar Haveli	250	46	6	51	7	5	1	1	32	46	1	2	2	0	2	6
Daman and Diu	140	28	9	38	1	13	2	0	13	28	1	1	4	3	0	9
Delhi	12,000	340	2,300	2,600	20	200	84	1	37	340	93	800	650	710	63	2,300
Goa	1,700	290	130	420	15	34	120	1	120	290	28	18	37	11	39	130
Gujarat	47,000	6,100	3,700	9,800	300	200	250	390	5,000	6,100	190	850	480	1,600	540	3,700
Haryana	19,000	2,600	1,000	3,600	630	1,200	80	78	600	2,600	75	400	68	380	93	1,000
Himachal Pradesh	5,800	1,100	150	1,300	310	95	48	31	650	1,100	28	44	34	17	30	150
Jammu and Kashmir	7,300	1,100	270	1,400	130	110	34	17	800	1,100	39	120	42	35	31	270
Jharkhand	23,000	3,700	760	4,400	900	160	21	44	2,500	3,700	91	310	210	21	130	760
Karnataka	46,000	7,000	3,100	10,000	1,300	1,700	170	110	3,700	7,000	320	850	740	730	420	3,100
Kerala	31,000	5,200	2,000	7,200	610	360	340	130	3,800	5,200	130	280	380	180	990	2,000
Lakshadweep	52	5	5	10	1	0	0	1	2	5	1	0	0	0	3	5
Madhya Pradesh	60,000	8,500	2,800	11,000	1,500	700	310	220	5,700	8,500	320	940	660	410	460	2,800

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Table A.1 continued

State	Population	Total households ('000)			Rural households ('000)						Urban households ('000)					
		Rural	Urban	Total	Open kutcha	Open pucca	Covered	Underground	No drainage	Total	Open kutcha	Open pucca	Covered	Underground	No drainage	Total
Maharashtra	94,000	12,000	9,100	21,000	2,500	2,400	410	170	6,300	12,000	730	2,500	1,800	3,400	600	9,100
North-East	9,840	1,647	447	2,070	446	94	11	16	1,072	1,647	127	160	14	6	132	446
Orissa	34,000	6,400	970	7,400	130	140	72	13	6,100	6,400	29	340	190	41	370	970
Pondicherry	960	84	160	240	21	18	6	0	39	84	21	53	53	9	20	160
Punjab	23,000	2,900	1,800	4,700	490	1,500	210	170	530	2,900	180	740	330	410	140	1,800
Rajasthan	51,000	7,400	2,200	9,600	1,500	660	340	160	4,800	7,400	200	870	700	180	220	2,200
Tamil Nadu	61,000	10,000	5,700	16,000	1,300	1,300	600	71	7,100	10,000	260	2,000	940	1,400	1,100	5,700
Uttar Pradesh	160,000	22,000	6,400	28,000	8,400	4,400	1,400	760	6,900	22,000	660	2,700	1,900	610	500	6,400
Uttarakhand	8,000	1,300	430	1,700	240	160	25	8	820	1,300	24	190	120	78	14	430
West Bengal	77,000	12,000	4,600	17,000	1,200	530	110	130	10,000	12,000	470	1,800	580	650	1,100	4,600
Total	**960,000**	**143,312**	**55,792**	**198,503**	**30,000**	**19,000**	**5,400**	**3,000**	**86,000**	**140,000**	**4,800**	**19,000**	**11,000**	**12,000**	**8,200**	**56,000**

Source: National Sample Survey of India, 60th Round (January– June 2004); National Sample Survey Organization of India.

Table A.2: Cost of Providing Toilets to Households Without Toilets

		Households		% of households without toilets		Cost of providing toilets to households without toilets (Rs million) *		
State	Population	Rural (R)	Urban (U)	R	U	R	U	Total
Andaman and Nicobar	330,000	49,000	25,000	55.3	7.4	74	63	136
Andhra Pradesh	72,000,000	13,000,000	5,000,000	78.1	19.7	19,500	12,500	32,000
Assam	24,000,000	4,000,000	530,000	12.6	0.7	6,000	1,325	7,325
Bihar	69,000,000	11,000,000	1,400,000	88.1	21.2	16,500	3,500	20,000
Chandigarh	730,000	23,000	180,000	10.0	3.7	35	450	485
Chhattisgarh	20,000,000	3,500,000	620,000	97.6	40.6	5,250	1,550	6,800
Dadra and Nagar Haveli	250,000	46,000	5,926	71.8	9.9	69	15	84
Daman and Diu	140,000	28,000	9,148	34.1	11.8	42	23	65
Delhi	12,000,000	340,000	2,300,000	8.3	6.4	510	5,750	6,260
Goa	1,700,000	290,000	130,000	20.6	24.7	435	325	760
Gujarat	47,000,000	6,100,000	3,700,000	78.4	19.6	9,150	9,250	18,400
Haryana	19,000,000	2,600,000	1,000,000	65.5	16.6	3,900	2,500	6,400
Himachal Pradesh	5,800,000	1,100,000	150,000	72.2	21.4	1,650	375	2,025
Jammu and Kashmir	7,300,000	1,100,000	270,000	52.2	13.5	1,650	675	2,325
Jharkhand	23,000,000	3,700,000	760,000	94.3	20.5	5,550	1,900	7,450
Karnataka	46,000,000	7,000,000	3,100,000	81.4	23.6	10,500	7,750	18,250
Kerala	31,000,000	5,200,000	2,000,000	11.0	2.6	7,800	5,000	12,800
Lakshadweep	52,000	4,902	4,686	2.9	8.0	7	12	19
Madhya Pradesh	60,000,000	8,500,000	2,800,000	93.9	28.4	12,750	7,000	19,750
Maharashtra	94,000,000	12,000,000	9,100,000	82.4	28.7	18,000	22,750	40,750
North-East	9,840,000	1,647,000	447,000	12	2	2,471	1,119	3,590
Orissa	34,000,000	6,400,000	970,000	92.3	31.4	9,600	2,425	12,025
Pondicherry	960,000	84,000	160,000	69.1	23.6	126	400	526
Punjab	23,000,000	2,900,000	1,800,000	44.2	10.8	4,350	4,500	8,850
Rajasthan	51,000,000	7,400,000	2,200,000	84.8	21.2	11,100	5,500	16,600
Tamil Nadu	61,000,000	10,000,000	5,700,000	81.6	24.8	15,000	14,250	29,250
Uttar Pradesh	160,000,000	22,000,000	6,400,000	85.8	22.9	33,000	16,000	49,000
Uttarakhand	8,000,000	1,300,000	430,000	70.9	3.2	1,950	1,075	3,025
West Bengal	77,000,000	12,000,000	4,600,000	60.6	8.6	18,000	11,500	29,500
Total	**960,000,000**	**140,000,000**	**56,000,000**	**75.5**	**20.3**	**214,968**	**139,479**	**354,447**

* The cost of providing toilets was calculated at Rs2,500 per toilet in urban areas and Rs1,500 per toilet in rural areas.

Source: National Sample Survey of India, 60th Round (January– June 2004); National Sample Survey Organization of India for estimates on population and households. Cost estimates were based on ADB's estimates.

Table A.3: Cost of Providing Underground Drainage for Households Without Underground Drainage

	Total Households (in thousands)		Households connected to underground drainage		Cost in Rs millions for connecting to sewer		Cost in million dollars for connecting to sewer ($=Rs45)	
State	Rural	Urban	Rural	Urban	Rural	Urban	Rural	Urban
Andaman and Nicobar	49	25	0	2	392	184	9	4
Andhra Pradesh	13,000	5,000	240	1,100	102,080	31,200	2,268	693
Assam	4,000	530	26	9	31,792	4,168	706	93
Bihar	11,000	1,400	160	120	86,720	10,240	1,927	228
Chandigarh	23	180	6	170	136	80	3	2
Chhattisgarh	3,500	620	61	78	27,512	4,336	611	96
Dadra and Nagar Haveli	46	6	1	0	360	48	8	1
Daman and Diu	28	9	0	3	224	48	5	1
Delhi	340	2,300	1	710	2,712	12,720	60	283
Goa	290	130	1	11	2,312	952	51	21
Gujarat	6,100	3,700	390	1,600	45,680	16,800	1,015	373
Haryana	2,600	1,000	78	380	20,176	4,960	448	110
Himachal Pradesh	1,100	150	31	17	8,552	1,064	190	24
Jammu and Kashmir	1,100	270	17	35	8,664	1,880	193	42
Jharkhand	3,700	760	44	21	29,248	5,912	650	131
Karnataka	7,000	3,100	110	730	55,120	18,960	1,225	421
Kerala	5,200	2,000	130	180	40,560	14,560	901	324
Lakshadweep	5	5	1	0	32	40	1	1
Madhya Pradesh	8,500	2,800	220	410	66,240	19,120	1,472	425
Maharashtra	12,000	9,100	170	3,400	94,640	45,600	2,103	1,013
North-East	1,647	447	16	6	13,048	3,528	290	77
Orissa	6,400	970	13	41	51,096	7,432	1,135	165
Pondicherry	84	160	0	9	672	1,208	15	27
Punjab	2,900	1,800	170	410	21,840	11,120	485	247
Rajasthan	7,400	2,200	160	180	57,920	16,160	1,287	359
Tamil Nadu	10,000	5,700	71	1,400	79,432	34,400	1,765	764
Uttar Pradesh	22,000	6,400	760	610	169,920	46,320	3,776	1,029
Uttarakhand	1,300	430	8	78	10,336	2,816	230	63
West Bengal	12,000	4,600	130	650	94,960	31,600	2,110	702
Total	**143,312**	**55,792**	**3,000**	**12,000**	**1,122,496**	**350,336**	**24,944**	**7,785**

Note: Cost of connecting to sewer was estimated at Rs8,000 per household for those currently without underground drainage connection.

Source: Data on households in different categories were obtained from the National Sample Survey of India, 60th Round (January–June 2004); National Sample Survey Organization of India.