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Review Paper

The uneven progress of sanitation in India

Arabinda Ghosh and Sandy Cairncross

ABSTRACT

The 2001 and 2011 Census of India returns are used to document the proportion of households with access to a latrine on their premises, in the different regions, states and districts of India. While some states have already achieved coverage of 90% or more, in others the proportion served is as low as 22%. There are also wide disparities between urban and rural households. Overall, more than 81.4% of urban households, but only 30.7% of rural households have a latrine. The difference varies widely across the country. Coverage has increased by 10.5% over the decade from 2001. This progress also varied widely between states and between districts within each state; 6.3% of districts made negative progress during that period. The variation between states and districts means that some have already achieved the Millennium Development Goal of halving the proportion of their population that lacks sanitation, while others, if they continue at the present rate, will not do so for many decades. Study of the causes of these differences offers the hope of finding ways to accelerate progress in the laggard states and districts. For example, we find a close association between district sanitation coverage and female literacy, suggesting an important role for education.

Key words | coverage, India, latrine, open defecation, sanitation

INTRODUCTION

Poor sanitation is one of the leading risk factors for child mortality worldwide. Improved sanitation, the practice of appropriate hygiene and use of improved sources of drinking water could prevent 2.4 million deaths (4.2% of all deaths) annually in our world (Bartram & Cairncross 2010), including an estimated 1.2 million children under the age of five who die from diarrhoea (UNICEF 2012). 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. Improved sanitation alone could reduce diarrhoea-related morbidity by more than a third (UNICEF 2006).

Childhood underweight causes about 35% of all deaths of children under the age of five years worldwide (WHO 2013). An estimated 50% of this underweight or malnutrition is associated with repeated diarrhoea or intestinal nematode infections as a result of inadequate sanitation or hygiene

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(Prüss-Üstün *et al.* 2008). Intestinal helminth infections cause stunting, late entry to school and impaired cognitive function (Bartram & Cairncross 2010).

Regrettably, it is no surprise that much ill-health is attributable to a lack of hygiene, sanitation and water. Only 63% of the global population use improved sanitation facilities. At the current rate of progress, the world will miss the Millennium Development Goals target of halving the proportion of people without access to basic sanitation. In 2010, 44% of the population in the developing regions were without improved sanitation facilities. The two regions facing the greatest challenges are sub-Saharan Africa and Southern Asia, where 70% and 59% of the population, respectively, lack access to improved sanitation (WHO/UNICEF 2012a).

In addition to its impact on health and nutrition, improved sanitation generates both social and economic benefits. The main motivations for sanitation adoption and

use include the desire for privacy, to avoid embarrassment and to be modern, the desire for convenience, to avoid the discomforts or dangers of the bush, and for social acceptance or status (Mara *et al.* 2010).

The economic benefits of improved sanitation include savings in health system costs, fewer days lost at work or at school through illness or through caring for an ill relative, and time savings from increased convenience (Hutton *et al.* 2007).

Among sanitation practices, the one that poses not only the greatest threat to human health but also an affront to human dignity is open defecation. Though the proportion of people practising open defecation is decreasing, the absolute number has remained at over 1 billion for several years, because of population growth. Most of them (59%) live in India (WHO/UNICEF 2012a). The 2011 census in India found that 49.8% of all households practise open defecation. In the rural parts of India this proportion is as high as 67.3% (Govt of India 2012).

The objective of this study is therefore to highlight the extent of access to sanitation facilities in Indian districts, an essential step to ending the practice of open defecation, and to assess its association with socio-economic inequalities.

METHODS

Population data

The current study uses data from the House Listing and Housing Census Data from the 2001 and 2011 Censuses of India to depict the scenario of access to latrine facilities in India. Of the 35 states and union territories in India, some are very small, so that data presented by state are for the 20 most populous states of India. The definition of each region, state and district was as used by the Government of India.

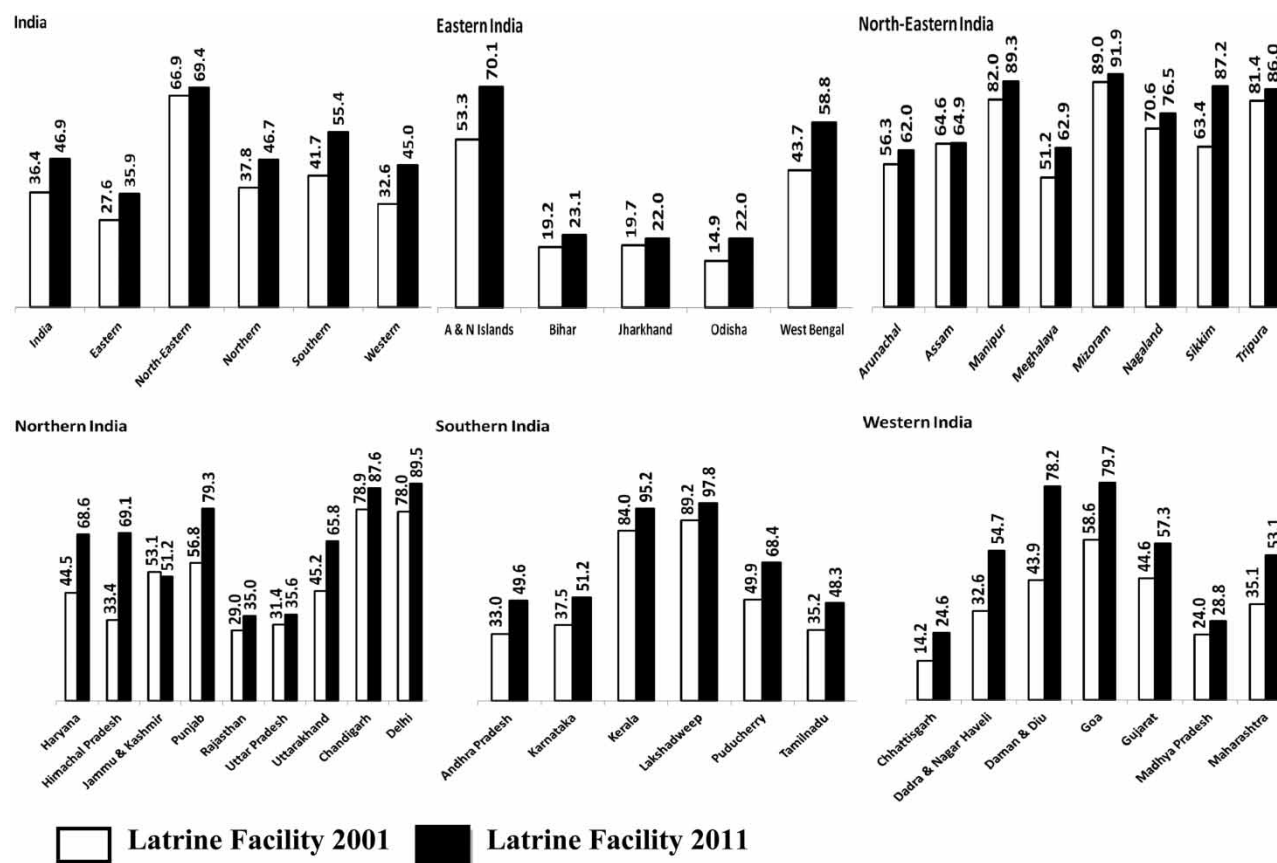


Figure 1 | Proportion of households with a latrine facility available within premises in Indian regions, states and union territories, 2001 and 2011.

The WHO/UNICEF Joint Monitoring Programme (JMP) for water supply and sanitation has developed a ‘sanitation ladder’ to provide an understanding of the proportion of the population globally with no sanitation facilities at all, of those reliant on technologies defined by JMP as ‘unimproved’, of those sharing sanitation facilities of otherwise acceptable technology, and those using ‘improved’ sanitation facilities (WHO/UNICEF 2012b). In our study, households reporting that they have any type of latrine facility within their premises have been considered to have access to a latrine facility. As far as we know, their responses to the questionnaire were not checked by observation.

Analysis

The present study focuses on sanitation facilities at district level in India. Initially the data are presented descriptively, highlighting the differences in coverage between regions in

India, between the states in each region, and between districts. Box plots have been used to illustrate the present scenario of access to latrine facilities and provide a summary based on the median, quartile and extreme values.

RESULTS

Figure 1 highlights the percentage of households in Indian states having a latrine facility in their household, along with progress in extending coverage from 2001 and 2011. It shows that the proportion of households with a latrine facility is highest in the states of North-Eastern Region at 69.4% and lowest in Eastern Region at 35.9%. There is a wide disparity in access to a latrine facility, not only between the regions but also within each region. In Eastern India, coverage is as high as 70.1% in the Andaman and Nicobar Islands and as low as 22.0% in Jharkhand and Odisha

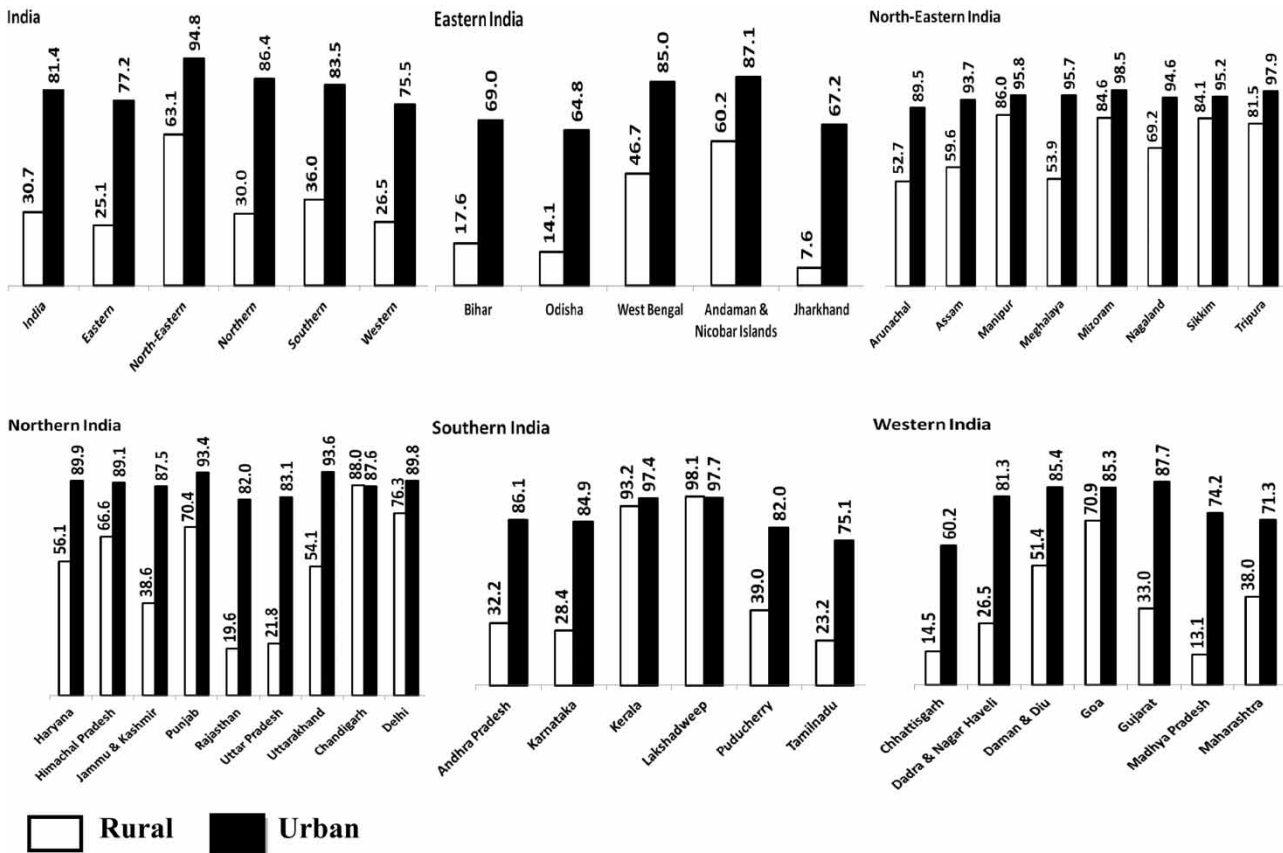


Figure 2 | Proportion of rural and urban households with a latrine facility available on the premises in Indian states and union territories, 2011.

(Orissa). In the North-Eastern states, it is relatively high. Coverage with a latrine facility in the household ranges from 91.9% in Mizoram to only 62.0% in Arunachal Pradesh. In Northern Region it ranges from 89.5% in Delhi to 35.0% in Rajasthan. There is also a wide disparity in Western India, where the proportion of households having a latrine varies from 79.7% in Goa, to 24.6% in Chhattisgarh. Coverage in Southern Region is also reasonably good. It is as high as 97.8% in Lakshadweep, but only 48.3% in Tamil Nadu.

Figure 1 also shows that availability of a latrine in the households in India has increased by 10.5% during the period from 2001 to 2011. However, here too there were wide disparities between states. The increase in coverage made by Himachal Pradesh during this period was the highest in the country at 35.7%, followed by Haryana, Sikkim, Punjab and Uttarakhand at 24.1, 23.8, 22.4 and 20.6%, respectively. On the other hand, performance was worst in Jammu and Kashmir, which actually went backwards,

losing 2% in sanitation coverage, while slow progress was made in Assam, Jharkhand, Mizoram and Bihar at 0.3, 2.4, 2.9 and 3.9%, respectively.

Figure 2 highlights coverage with a latrine facility in 2011, separately for rural and urban households. It transpires that only 30.7% of the rural households have a latrine facility against 81.4% of households in the urban areas. The rural–urban gap is highest in Northern Region and lowest in North-Eastern Region. In Eastern India, 25.1% of rural households have a latrine within their household against 77.2% in urban areas. Within the Eastern Region, Jharkhand has the highest rural–urban disparity, followed by Bihar and Orissa. Rural–urban disparity is least in Sikkim. In North-Eastern India, Meghalaya has the highest rural–urban disparity followed by Arunachal Pradesh. In Northern India, the highest rural–urban disparity is in Rajasthan followed by Uttar Pradesh. Karnataka has the highest rural–urban disparity in Southern Region followed by Andhra Pradesh and Tamil Nadu. Kerala has made

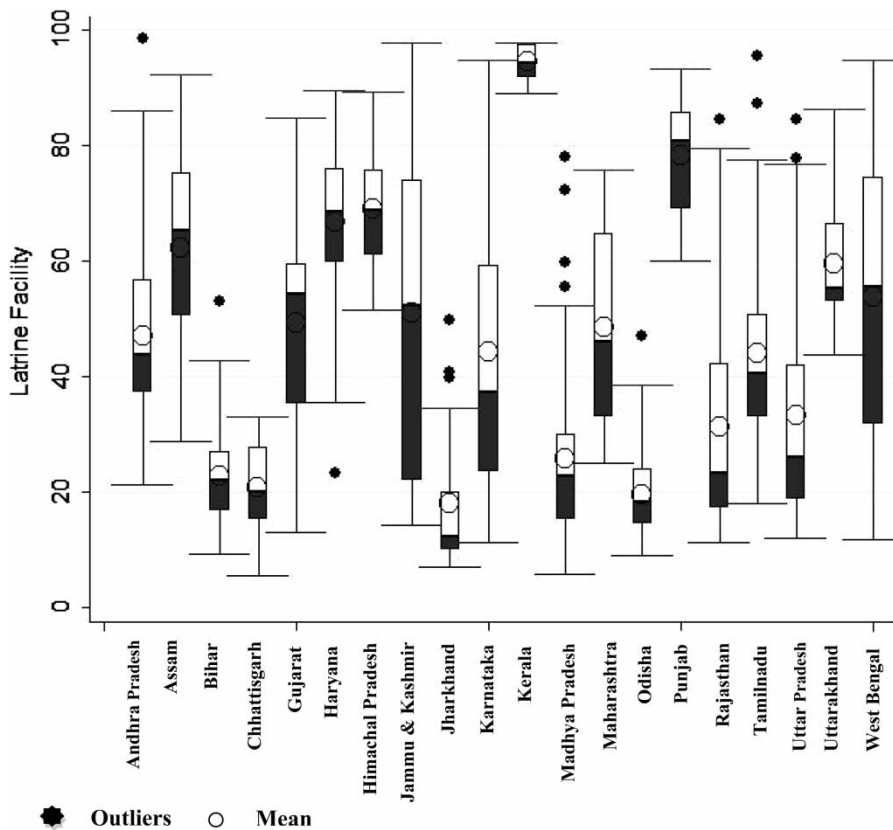


Figure 3 | Latrine facility available on premises in Indian districts by state (2011), showing means, medians, quartiles, extremes and outliers.

significant progress among Indian states toward achieving the target of sanitation for all. Latrine coverage in the rural and urban households of Kerala is 93.2% and 97.4%, respectively. In Western Region, the rural–urban disparity is highest in Madhya Pradesh followed by Dadra & Nagar Haveli. Availability of a latrine facility in the rural and urban households of Chhattisgarh is extremely low and needs special attention.

In Figure 3, a box plot has been used to illustrate further the wide range of latrine coverage levels in different districts in each state of India. They provide a summary based on the median, quartile and extreme values and represent the inter-quartile range that contains the middle 50% of the values. The box plots show the lowest value (the bottom horizontal line on each plot) and the highest value (the top horizontal line of each plot). The whiskers are lines that extend from

the box to those highest and lowest values, excluding outliers. A line across the box indicates the median, and the centre of the circle within the box indicates the mean.

In order to formulate strategy at the national level, it is important to know the present situation not only by states but also by district. The average performance of individual states may hide the intra-state disparities among the districts. Table 1 depicts the progress in household coverage with latrines in Indian districts during the period 2001–11. During this period, some of the districts were reorganised and are not comparable between 2001 and 2011. In our selected 20 major states, there are 558 districts. In this study, it was possible to compare results for 509 districts (i.e. 91.2% of the total districts) and so assess their progress. The districts have been divided into six categories according to their rates of progress.

Table 1 | Progress in latrine coverage in Indian districts during 2001–11

State	No. of districts	Districts studied	Progress during 2001–11						
			Negative	Very slow (0–10%)	Slow (10–20%)	Moderate (20–30%)	Good (30–40%)	Very good (40–50%)	Excellent (>50%)
Andhra	23	21	0	5	11	5	0	0	0
Assam	27	21	6	14	1	0	0	0	0
Bihar	38	37	0	37	0	0	0	0	0
Chhattisgarh	18	14	0	7	7	0	0	0	0
Gujarat	26	25	1	7	14	3	0	0	0
Haryana	21	19	0	0	5	9	4	1	0
Himachal	12	12	0	0	1	3	6	0	2
Jammu	22	14	4	9	1	0	0	0	0
Jharkhand	24	18	4	13	1	0	0	0	0
Karnataka	30	27	0	13	8	3	2	1	0
Kerala	14	14	0	5	7	2	0	0	0
Madhya	50	45	6	33	6	0	0	0	0
Maharashtra	35	35	0	10	14	6	2	3	0
Orissa	30	30	0	27	3	0	0	0	0
Punjab	20	16	0	1	4	9	2	0	0
Rajasthan	33	32	2	26	4	0	0	0	0
Tamilnadu	32	30	0	12	17	1	0	0	0
Uttar Pradesh	71	69	8	56	4	1	0	0	0
Uttarakhand	13	13	0	0	6	6	1	0	0
West Bengal	19	17	1	5	8	2	1	0	0
Total	558	509	32	280	122	50	18	5	2

Table 1 shows that 6.3% of the districts made negative progress, and 55.0% and 24.0% of them have made very slow and slow progress, respectively. Only 9.8% of them has made moderate progress. On the other hand 3.5, 1.0 and 0.4% of them made good, very good and excellent progress, respectively, during this period. During 2001–11, the best performing Indian states in terms of their progress were Haryana, Himachal Pradesh, Punjab, Uttarakhand and Maharashtra, respectively. On the other hand, the worst performing Indian states were Assam, Uttar Pradesh, Jammu & Kashmir, Jharkhand and Madhya Pradesh.

Table 2 shows, for each state, the numbers of districts where in 2011, the percentage of households with a latrine was in a given range. It shows that in 19.5% of all districts in India, no more than 20% of households have a latrine

Table 2 | Percentage of households with a latrine facility available within premises in 2011

State	No. of districts according to percentage of households having latrine facility available within premises					Total districts
	≤ 20	> 20– ≤ 40	> 40– ≤ 60	> 60– ≤ 80	> 80	
Andhra	0	8	11	2	2	23
Assam	0	3	9	10	5	27
Bihar	14	23	1	0	0	38
Chhattisgarh	9	9	0	0	0	18
Gujarat	1	8	11	4	2	26
Haryana	0	1	5	11	4	21
Himachal	0	0	2	8	2	12
Jammu	4	5	4	5	4	22
Jharkhand	18	4	2	0	0	24
Karnataka	4	13	6	3	4	30
Kerala	0	0	0	0	14	14
Madhya	21	22	5	2	0	50
Maharashtra	0	14	10	11	0	35
Orissa	18	11	1	0	0	30
Punjab	0	0	0	10	10	20
Rajasthan	12	12	6	1	2	33
Tamilnadu	2	13	12	3	2	32
Uttar Pradesh	21	31	8	10	1	71
Uttarakhand	0	0	9	3	1	13
West Bengal	1	6	4	5	3	19
India	125	186	118	117	94	640

within the premises. In 29.1% of districts in India, 20% to 40% of households have such a facility. In 18.4, 18.3 and 14.7% of Indian districts, respectively, the percentage of households with a latrine available on the premises is 40–60%, 60–80%, and above 80%. Kerala is the only state in India where in all districts, more than 80% of households have a latrine on the premises.

The pattern visible in the data at national level, in which access to sanitation is closely associated with socio-economic status of the household, is borne out at state level in our data. The percentage of households with a latrine in each state is closely correlated with the state's wealth concentration index, an indicator of the degree of concentration of latrines in the hands of wealthier households ($r = -0.924$; $p < 0.001$; data not shown). Only Jammu & Kashmir departs markedly from the trend, with a lower concentration index than its coverage rate would suggest (IIPS 2010; Kakwani *et al.* 1997).

Figure 4 shows the rate of access to sanitation in each district, plotted against the female literacy rate. There is a marked inverse relationship; in districts with higher female literacy rates, open defecation is markedly less prevalent.

Figure 5 shows, for selected Indian states, how long it will take to achieve the MDG sanitation target at the current rate of progress. The rate of progress was assessed by comparing the 2001 and 2011 census results as before.

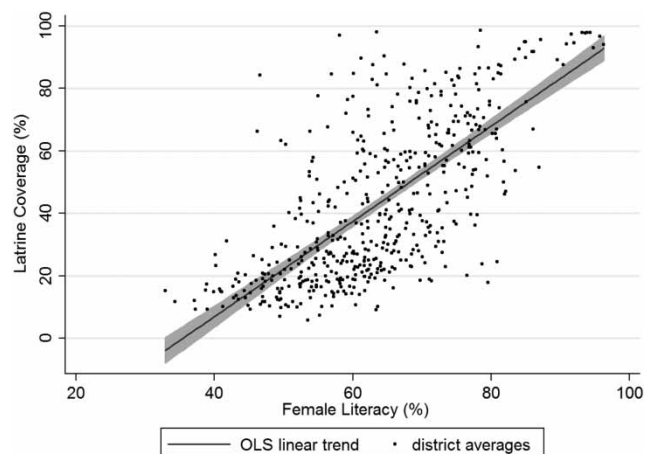


Figure 4 | Scatter plot of latrine facilities in the household rates in Indian districts against female literacy rates. The trend line is based on ordinary least squares regression, and the narrow strip on either side of it shows the 95% confidence limits for its position. R^2 Linear = 0.476. Source: Data from the 2011 Census of India.

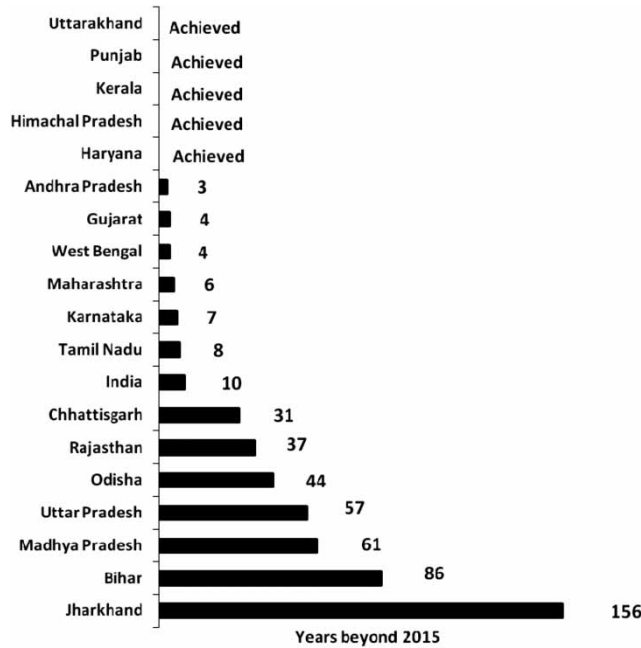


Figure 5 | Predicted delay in reaching the MDG sanitation target: selected Indian states.

Millennium Development Goals for individual states were set on the basis of the National Family Health Survey (NFHS-1) data (1992–93).

Five Indian states had already achieved the MDG target in 2011. The estimated number of years required to achieve the MDG target for sanitation has been expressed as years of delay from the 2015 deadline. For example, Andhra Pradesh will need another 3 years to achieve the target and Jharkhand, at the present rate, requires 156 years. As can be seen from Table 2, the range for individual districts is still wider than that for states.

DISCUSSION

We have shown very large discrepancies in latrine coverage between different parts of India. If we can improve our understanding of the reasons underlying these differences, it would help us to identify policies to increase the rate of progress toward sanitation for all. In this context, the association between sanitation coverage and female literacy is a striking finding. It is likely that both of these variables are collinear with a number of other factors, such as social

equity and good governance, and it is very hard to tell which associations, if any, are due to causal links.

Kerala's high adult literacy rate is probably the first of these variables in which Kerala stands out, having been noteworthy since the 19th century when the princely states of Travancore and Cochin devoted more resources than the rest of India to public education, and pulled ahead of the rest of India in all indicators of social development (George 2011).

Target 7C of the Millennium Development Goals is to halve the proportion of the population (baseline 1990) without basic sanitation by 2015. The *Millennium Development Goals Report 2012* has highlighted that despite improvement in most of the developing regions, the MDG sanitation target is still out of reach (United Nations 2012). Given that 76% of households lacked any sanitation facility in 1990, India is required to reduce this proportion to 38% by 2015 (UNDP 2011).

Open defecation is a traditional behaviour in rural India. This, along with the relative neglect of sanitation in terms of development priorities, was reflected in the country's low sanitation coverage at the close of the 1990s when only one in five rural households had access to a toilet (Census 2001). This fact, combined with low awareness of hygiene, made the achievement of the sanitation target a pressing challenge, particularly in rural India. In response to this challenge, the Government of India launched the Total Sanitation Campaign (TSC) in 1999 with the goal of achieving universal rural sanitation coverage by 2012 (World Bank Water & Sanitation Program 2010). In spite of this prioritisation of sanitation, the country is expected to miss the millennium target by about 11 percentage points. If the present trend continues, it will take an additional 20 years to achieve the MDG sanitation target.

A minority of states have already reached the target (Figure 5), thus proving that it is achievable and not unrealistic under Indian conditions. However, the goal can only be reached nationally in the foreseeable future if radical measures are taken and substantial effort devoted to the underachieving states and districts.

ACKNOWLEDGEMENT

Professor Cairncross's input to this study was supported by UK aid from the Department for International Development

(DFID) as part of the SHARE research programme (www.SHAREresearch.org). However, the views expressed do not necessarily reflect the Department's official policies.

REFERENCES

- Bartram, J. & Cairncross, S. 2010 *Hygiene, sanitation, and water: forgotten foundations of health*. *PLoS Med* 7 (11), e1000367.
- George, K. K. 2011 *Kerala's Economy; Growth, Structure, Strength and Weakness*. CSES Working Paper No. 25. Centre for Socio-economic & Environmental Studies, Kochi, India, <http://csesindia.org/publications.php?page=2> (accessed 16 October 2013).
- Government of India 2012 *Houselisting and Housing Census Data Tables – District Level*. Office of the Registrar General & Census Commissioner, India, http://www.censusindia.gov.in/2011census/hlo/District_Tables/HLO_District_Tables.html (accessed 16 October 2013).
- Hutton, G., Haller, L. & Bartram, J. 2007 *Economic and Health Effects of Increasing Coverage of Low Cost Household Drinking-water Supply and Sanitation Interventions to Countries Off-track to Meet MDG Target 10*. World Health Organization, Geneva, http://www.who.int/water_sanitation_health/economic/mdg10_offtrack.pdf (accessed 23 November 2012).
- IIPS 2010 *District Level Household and Facility Survey (DLHS-3), 2007–08: India*. International Institute for Population Sciences, Mumbai, India.
- Kakwani, N. C., Wagstaff, A. & Van Doorslaer, E. 1997 *Socioeconomic inequalities in health: Measurement, computation and statistical inference*. *Journal of Econometrics* 77 (1), 87–104.
- Mara, D., Lane, J., Scott, B. & Trouba, D. 2010 *Sanitation and health*. *PLoS Med* 7 (11), e1000363.
- Prüss-Üstün, A., Bos, R., Gore, F. & Bartram, J. 2008 *Safer Water, Better Health: Costs, Benefits and Sustainability of Interventions to Protect and Promote Health*. World Health Organization, Geneva.
- UNDP 2011 Millennium Development Goals India Country Report 2011, http://www.un.org.in/UNDP/MDG/Indian_MDG_Country_Report_2011.pdf (accessed 16 October 2013).
- UNICEF 2006 *Progress for Children: A Report Card on Water and Sanitation*, Number 5, UNICEF, New York.
- UNICEF 2012 *The State of The World's Children 2012: Children in an Urban World*. http://www.unicef.org/sowc2012/pdfs/SOWC%202012-Executive%20Summary_EN_13Mar2012.pdf (accessed 16 October 2013).
- United Nations 2012 *The Millennium Development Goals Report 2012*. United Nations, New York.
- WHO 2013 *Underweight in Children*. World Health Organization, Geneva, http://www.who.int/gho/mdg/poverty_hunger/underweight_text/en/index.html (accessed 16 October 2013).
- WHO/UNICEF 2012a *Progress on Drinking Water and Sanitation: 2012 Update*. World Health Organization, Geneva and UNICEF, New York. Available at: <http://www.unicef.org/media/files/JMPreport2012.pdf> (accessed 29 January 2014).
- WHO/UNICEF 2012b *Definitions and Methods: Introduction*. Joint Monitoring Programme for Water Supply and Sanitation, <http://www.wssinfo.org/definitions-methods/introduction/> (accessed 16 October 2013).
- World Bank Water & Sanitation Program 2010 *A Decade of the Total Sanitation Campaign: Rapid Assessment of Processes and Outcomes*. WSP India, Delhi, http://www.wsp.org/sites/wsp.org/files/publications/WSP_India_TSC_Report_Vol_1_Press.pdf (accessed 16 October 2013).

First received 4 July 2013; accepted in revised form 10 October 2013. Available online 12 December 2013