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Quick Response Code:

Website: www.jehp.net
DOI: 10.4103/jehp.jehp_1658_20

Achievements and challenges of India's sanitation campaign under clean India mission: A commentary

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Abstract:

Universal access to safe sanitation is yet to be accomplished in India. Although Clean India Mission (named as "Swachh Bharat Mission (Gramin)" for rural India) claims that the sanitation coverage in rural India has increased from 39% to 100% of households from 2014 and 2019, yet open defaecation continues in India in large numbers. This article discusses the achievements on Swachh Bharat Mission (Gramin) and identifies the existing challenges that need to be acted on to achieve the success of India's Swachh Bharat Mission. We searched international database mainly Google scholar, Pubmed, Medline, Scopus, and Science direct using "Clean India," "Swachh Bharat," "Sanitation," "Open defecation," "Environmental health," and "India" as search keywords in different combinations. In addition, websites of relevant United Nations (UN) agencies, Government of India and leading newspaper and national agencies were also searched manually for related publications and reports. In the last 5 years (2014-2019), significant efforts have been made for the Swachh Bharat Mission by creating various social movements and awareness program to improve toilet coverage throughout India. Over 100 million, latrines have been built as of the end of the first phase of Swachh Bharat Mission (Gramin) as on October 2, 2019 and all villages across the districts of India have been declared Open Defaecation Free. Still, nearly half of the rural population (52.1%) defecate in the open. Lack of piped water supply, poor construction of toilet substructures and misconception among people about toilet use remain as key challenges in the achievement of India's sanitation mission. Sanitation-related behavioral change and improvement in toilet facilities must be prioritized to ensure usage of built toilets and eventually can accelerate the universal access to sanitation and meet Sustainable Development Goals.

Keywords:

Environmental health, open defecation, sanitation clean India, sustainable development goals, Swachh Bharat

Introduction

The Global Nutrition Report 2018 states, the prevalence of stunting among children under 5 years of age in India is 37.9%,^[1] which is highest in the world.^[1] Also as per the latest National Family Health Survey IV (2015-2016), 38.4% of children below 5 years suffer from stunting.^[2] In addition, diarrhea is the third most common cause of death among children below 5 years in India

and is responsible for 13% of deaths in this age group.^[3,4] Thus, in India, death due to diarrhea alone constitutes an estimated of 300,000 children per year.^[3,4] Both these conditions are strongly associated with the unsafe water, poor sanitation, and hygiene practices. Evidences suggest, three main pathways between poor sanitation and stunting, for example, environmental enteric dysfunction (EED),^[5] diarrheal diseases,^[6] and nematode infections.^[7] First, a study in Gambian children illustrates that

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How to cite this article: Behera MR, Pradhan HS, Behera D, Jena D, Satpathy SK. Achievements and challenges of India's sanitation campaign under clean India mission: A commentary. J Edu Health Promot 2021;10:350.

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Received: 24-12-2020

Accepted: 03-02-2021

Published: 30-09-2021

growth retardation had an association with persistent abnormalities to the intestinal mucosa, leading to EED.^[8,9] This is proposed to be primary causal pathway between poor sanitation and stunting.^[5] The second casual pathway where households are not practicing safe disposal of stool can result in the spread of fecal contamination to the environment. If left untreated, human feces containing pathogens enter the fecal-oral route of transmission,^[10] causing diarrhea.^[6,11] The repeated episode of diarrhea results in stunting or chronic malnutrition. The third casual pathway suggests, poor sanitation had an association with stunting is through soil-transmitted infections (helminths), such as *Trichuris Trichiura*, Hookworm, and *Ascaris Lumbricoides*. These infections create mal-absorption of nutrients resulting growth failure among children.^[12] Evidence highlights the use of toilet facilities reduces the soil-transmitted infections (helminths), confirming the third casual pathway.^[13,14] Hence, safe sanitation is essential for growth of the child, for reduction of the infectious diseases, for human dignity, health, and wellbeing and for gender equity,^[15-23] has yet to reach 25% of the global population.^[24]

Open defecation and poor sanitation facilities hinder any country's public health development and directly associated with child's growth resulting premature mortality.^[25] Literatures suggest that open defecation plays a crucial role in determining childhood malnutrition in India.^[26,27] However, few studies have also pointed out that genetics might have the reasons for the stunted growth of Indian Children,^[28] but most studies contradicting this point claim that stunted growth among children is strongly correlated with unsafe environmental condition and open defecation. In addition, lack of sanitation leads to psychosocial stress among girls and women because of the environmental obstacles, such as unsafe toilets and physical distance, fears of sexual violence, and social factors.^[21] UNICEF also estimates that inadequate sanitation costs about \$189 billion (i.e., 7.9% of GDP) to India due to productivity lost, losses in tourism, and medical costs.^[29]

Although open defecation in rural India has declined significantly and improvements in toilet coverage has been made under Swachh Bharat Mission (Gramin), still interstate variations across regions in coverage and toilet uptake has been found. Many researchers have also expressed uncertainty about how open defecation-free (ODF) status is verified and about the statistics that government publishes publicly.^[30,31] For example, one study reported that out of eight villages that had actually universal sanitation coverage in 2018, only one declare to be ODF.^[32] Therefore, in this paper, we examine the achievements on Swachh Bharat Mission (Gramin) and identify the existing gaps and

challenges that need to be acted upon to achieve the success of India's Swachh Bharat Mission.

About India's Swachh Bharat Mission

Many countries especially, South East Asia and sub-Saharan Africa, have engaged in putting efforts to improve their latrine ownership rate. India – a part of global south, in the past 5 years have been transformed through centrally led government program named the Clean India Mission (*Swachh Bharat Mission*) (*Gramin*) or SBM (G). The SBM is the world's largest sanitation program, launched in the year of 2014 by the current Indian Prime Minister Mr. Narendra Modi. It aims to achieve universal access to sanitation for all and to make villages clean, sanitized, and ODF.^[33] Since its inception, official figures suggested nearly 100 million toilets have been built, by providing monetary incentives to the eligible households, engaging local governments (also known as Panchyat Raj Institutions) and communities in toilet construction, by conducting mass awareness campaigns for behavioral change and in monitoring the progress to achieve the targets.^[34] In 2015, India puts national sanitation coverage at 39%^[35] and rural India, was accountable for 60% ODF.^[36] Today, India has reached at milestone, where the latest SBM data show almost 100% sanitation coverage in total population^[33] and other sample studies reveals, in rural India, there is good progress insanitation coverage (93.3%),^[37] but latrine ownership rate is found to be lower (71.3%).^[38]

The basic of sanitation in public health is to prevent the harmful pathogens entering into human bodies and to stop fecal-oral transmissions. SBM, therefore, constituted an instrumental barrier in terminating this though construction of latrine and the promotion of the latrine usage. Studies across the globe demonstrates, widespread sanitation practice have a significant association with the improvement of health and nutritional status among children; thereby reducing catastrophic household health-care expenditure.^[29,39,40] Now, India needs to accelerate this nationwide sanitation drive by strengthening the links between health and sanitation to optimize potential gains attributed by SBM.

Sanitation Technology under Swachh Bharat Mission

The safely managed sanitation in households is mainly dependent on the adaption of toilet technology, and the availability of space for on-site containment system. There are various safe sanitation technologies available such twin leach pit, eco scan, bio-toilets, and septic tank with soak pit. However, SBM encouraged in building twin-leach pit latrines. These latrines are made up with low-cost sanitation technology, easy to build and

have simpler on-site treatment process, which can effectively deal with excreta, if constructed correctly. However, misconception about, this technology has limited acceptance due to poor construction of toilet substructures and incorrect architecture modification, that reduces toilet efficacy.^[41] Many rural households have built structure for excreta containment that fails to treat human waste from toilets, rather it just holds the excreta. This is because, people believe that these latrines (twin-leach pit) are meant for poor households and fears that the pits will fill-up in a rapid way. Family occasionally construct wider or deeper pits that have flout design principle, without referring the suggestive distance recommended by government from the water sources.^[41,42] Across country, water table variation and terrain difference (hilly, rocky, coastal, and dessert) exist, that calls for adapting different technologies for toilet construction; failure to which can lead environmental contamination.^[41] There is need for site-specific solutions to ensure safe sanitation for all. In addition, single leach pit latrines, septic tanks and containment structures, once filled, require skilled services for emptying and transportation of the fecal sludge to the treatment facilities for its subsequent disposal or reuse.^[43] The absence of such facilities mainly in rural areas can lead to in-human practice of manual scavenging resulting caste-based stigma and oppression among marginalized sections of society.^[44]

Some Challenges and Focus on Behavior Change

Infrastructures for toilet are important, but cannot alone stand as pre-requisite to interrupt fecal-oral transmission of pathogens. In rural areas, lack of water supply is a key issue,^[30] only 42.5% of households had access to water for use in toilets,^[45] which increase toilet nonusage rates. Other challenges such as improper fecal sludge management, inappropriate toilet technologies, and inadequate human resources persist that endanger in achieving sanitation coverage in rural areas. Important considerations such as appropriate and sustainable technologies, full involvement in sanitation program, social norms and individual attitude toward latrine use, sanitation-related behaviors, awareness creation, and various social movements are needed which not only increase toilet use, but also, helps in sustaining ODF status that ultimately, reap benefits to population health.

Sanitation-related behaviors require top priority in this context. Recent national surveys indicate that 95.7% of females and 94.7% of males used toilet regularly in rural areas among those households had access to toilet.^[46] Another study conducted in four north Indian states suggest that toilet usage in rural households are increasing to an extent of 56%.^[38] In addition, research

in rural India and field experience suggest that people are slowly developing the habit of using toilet. Data suggest that open defecation has decreased by 12% from 2015 to 2019, which means that nearly half of the rural population still defecates in the open.^[24] Open defecation is traditional behavior in rural India and people perceive it to be healthier, cleaner, and sometimes “religiously acceptable.”^[34] This issue of open defecation is of greater concern and worrisome because government studies indicate, the proportion of children below 15 years of old is practicing open defecation more frequently than other age groups.^[45] Nearly, 57% of children younger than 10 years in cities and 15 years in rural areas are defecating in the open. This puts the child health at risk, leading to various diseases that are linked to unsafe sanitary practices. The recent study suggests that unsafe stool disposal is one of the major causative factors accountable for stunting and under-five mortality in India.^[47] The prevalence of diarrhea and stunting is clearly found to be higher in those households, where unsafe stool disposal and open defecation was practiced.^[47,48] Therefore, investment alone cannot be held responsible to bring improvement of the sanitation program in India. O’Reilly and Louiss in their study in rural villages of Himachal Pradesh and West Bengal suggested three factors (i.e., Toilet Tripod) (1) favorable political environment, (2) strong political will, and (3) person to person contact (proximate) social pressure can be considered as successful adaptation of the sanitation program in India.^[49] Another important cost-effective public health intervention is hand hygiene,^[50] which are as important as toilet use. Even though, an individual use toilet but if he/she cannot wash hands post-defecation or after handling child excreta, then they still remain at a risk of transmitting pathogens to the children during feeding the child, cooking, and eating. Hand washing facilities such as water, soap, and hand washing space are not always available; thus practice of hand washing with soap and water becomes inconsistent in many areas of rural India.^[51] To bring out favorable health outcomes, well-designed strategies addressing sanitation and hygiene behaviors are fundamental to ensure availability of water and soap while using toilet.^[52]

Discussion and Way Forward

While, India has made substantial progress in sanitation coverage, some individuals, households, and community belonging to disadvantage sections of the society such as female-headed household, landless people, migrant laborers, and disable people-still do not have toilets in their home or find the existing toilets not accessible. It is crucial to support these un-served populations both from human rights and public health perspectives because these marginalized sections are already without access to basic services and experience various health

issues. Educational institutions, child-care centers, hospitals, and other government facilities need further development in sanitation practices. Sanitation coverage disaggregated data in public facilities and among the disadvantaged sections of society requires innovation to cover missed population will be vital in this context.

For India to realize in achieving sustainable development goal 6 (SDG), i.e., “ensure access to water and sanitation for all” by 2030, a number of factors needs to be considered. Country like India, which is vast in her diversity, culture, and population, where 60% of total population resides in rural areas,^[53] only access to toilet does not ensure hygienic and safe sanitation practices. For instance, lesson from the India’s first sanitation program “Central Rural Sanitation Programme” launched in 1986, stated that only toilet construction did not translate to usage of toilets. This program focused on the household toilets construction and promotion of the pour-flush toilets. However, this program lacks the focus on behavior change toward toilet use that led failure of the program.^[34,46] Further, the succeeding Total Sanitation Campaign (TSC) which launched in 1999, aimed at making India ODF by 2017. Unfortunately, this campaign blamed with poor results mainly due to inadequacy in political leadership, the misuse of subsidies, lack of confidence to measure success, poor monitoring mechanisms, and supply-led top-down approach.^[54] Under TSC, nearly 34.8 million toilets in below poverty line households and 64.3 million individual household toilets were constructed. Despite, such efforts and investments, a review of TSC mentioned, nearly 72.63% of household in rural areas still defecates openly even though they have access to toilets.^[55] Considering this fact, the SBM (G) has learnt how to resolve, some of these issues, by capitalizing political support, to pay subsidies directly to households through e-banking, strengthening monitoring system through technological platform and broadcasting the success of the program. Moreover, one of the main aims of the SBM (G) is to change behavior of the people through information, education, and communication campaign and to provide individual toilet facilities in all households to achieve the goal of ODF by October 2, 2019 – to honor the 150th birthday of Mahatma Gandhi. The central government is also focusing how to change the mindset of the people to adopt improved sanitation and to stop open defecation. It also emphasizes on the adverse health outcome that comes as a result of unsafe sanitary practices. The *Swachha Status Report* of GoI states, in rural areas, only 45.3% households reported access to sanitary toilets that ensures hygienic practices of sanitation and safe stool disposal. Empirical evidence also highlights the benefits of having improved sanitation facilities and safe disposal of stool that significantly reduce the under-5 mortality rate and childhood stunting.^[47] The rural population

must be made aware about the adverse health conditions due to unsafe sanitary practices. Movies like “*Toilet: Ek Prem Katha*” (“Toilet: a love story”) role played by popular country actor must be screened and promoted in rural India. This can make general public be aware of about the necessity of toilet use and the adoption of hygienic and safe household sanitation practices. Some studies highlighted that school teachers and local leaders from the community act as catalyst in spreading awareness and encouraging behavioral changes.^[56] Education should be made to village leaders and key informants to spread awareness on healthy sanitation.

This paper is relevant in highlighting the sanitation coverage and ODF status in the last 5 years from 2014 to 2019 under first phase of SBM (G). Most studies have looked at the sanitation programming, such as community participation,^[57,58] construction of toilets,^[59,60] technology options,^[61] environmental factors,^[49] provision of subsidy,^[62,63] and impacts of sanitation program,^[64-66] but in this paper, we try to find out the challenges and success of centrally led government sanitation programs. The noble aspects of this study were to focus on the behavioral change among people to improve the overall cleanliness in villages and neighborhood, so that children can spend the childhood free from stunting and malnourishment. This is not an impossible task for India as Mawlynnong village of the Meghalaya state in India has declared as the cleanest village in Asia.^[47]

Conclusion

The first phase of SBM (G) has got over (2014-2019) and the government report suggest that all villages and districts across the country had declared themselves ODF.^[67] Currently, SBM (G) phase II (2020-2025) has been implemented by the Government of India with a total estimated cost of Rs. 1,40,881 crores^[67] with main aim to transform all villages from ODF to ODF plus. The key objective of SBM (G) phase II is to sustain the investment made in SBM (G) phase I on ODF status of villages and to improve the cleanliness level in rural areas through effective management of liquid and solid waste, making villages ODF plus.^[67] The ODF plus village is defined as a village that must sustains the ODF status, ensure solid, and liquid waste management and visually clean.^[67] We have to watch and see how SBM (G) phase II will be impacting millions of people in rural villages by maintaining ODF status and ensure proper solid and liquid waste management activities by 2025. In addition, the reasons for non-usage of toilet must be addressed, so that health and well-being of people in India can continue to be improved. Further, an independent credible robust monitoring tool must be put in place to accurately measure the sanitation progress of the country under phase II SBM (G).

No doubt, India has made rapid progress to achieve the SDG 6 by increasing nationwide toilet access under SBM (G). At the same time, India must scrutinize its success within the framework of environment safety and fecal-oral transmission of disease that help, especially to children to spend their childhood free from malnourishment or premature death. By doing so, and by responding to the complexities of SBM identified in this study, will show India and other countries, the pathways of full-filling the sanitation agendas, by achieving universal sanitation for all and to meet the SDGs.

Acknowledgment

We are thankful to the Indian Council of Social Science Research (ICSSR), Ministry of Human Resource Development, Government of India, for providing financial support for this on-going research project (No. IMPRESS/P101/414/2018-19/ICSSR).

Financial support and sponsorship

Research grant has been provided by the Indian Council of Social Research (ICSSR), Ministry of Human Resource Development, Government of India for this ongoing project.

Conflicts of interest

There are no conflicts of interest.

References

1. Development Initiatives. Global Nutrition Report: Shining a Light to Spur Action on Nutrition; 2018. Available from: <https://globalnutritionreport.org/reports/global-nutrition-report-2018/>. [Last accessed on 2020 Nov 13].
2. International Institute for Population Sciences, ORC Macro. National Family Health Survey (NFHS-4), 2015–16. Mumbai: IIPS; 2020. Available from: <https://dhsprogram.com/data/>. [Last accessed on 2020 Nov 17].
3. Liu L, Oza S, Hogan D, Perin J, Rudan I, Lawn JE, et al. Global, regional, and national causes of child mortality in 2000-13, with projections to inform post-2015 priorities: An updated systematic analysis. *Lancet* 2015;385:430-40.
4. Liu L, Johnson HL, Cousens S, Perin J, Scott S, Lawn JE, et al. Global, regional, and national causes of child mortality: An updated systematic analysis for 2010 with time trends since 2000. *Lancet* 2012;379:2151-61.
5. Humphrey JH. Child under-nutrition, tropical enteropathy, toilets, and hand washing. *Lancet* 2009;374:1032-5.
6. Briend A. Is diarrhoea a major cause of malnutrition among the under-fives in developing countries? A review of available evidence. *Eur J Clin Nutr* 1990;44:611-28.
7. Pruss-Ustun A, Corvalan C. Preventing Disease through Healthy Environments. Towards an Estimate of the Environmental Burden of Disease. Geneva: World Health Organization; 2006.
8. Lunn PG, Northrop-Clewes CA, Downes RM. Intestinal permeability, mucosal injury, and growth faltering in Gambian infants. *Lancet* 1991;338:907-10.
9. Lunn PG, Northrop-Clewes CA, Downes RM. Recent developments in the nutritional management of diarrhoea. 2. Chronic diarrhoea and malnutrition in The Gambia: Studies on intestinal permeability. *Trans R Soc Trop Med Hyg* 1991;85:8-11.
10. Curtis V, Cairncross S, Yonli R. Domestic hygiene and diarrhoea – Pinpointing the problem. *Trop Med Int Health* 2000;5:22-32.
11. Clasen TF, Bostoen K, Schmidt WP, Boisson S, Fung IC, Jenkins MW, et al. Interventions to improve disposal of human excreta for preventing diarrhoea. *Cochrane Database Syst Rev* 2010;6:1-30.
12. O’Lorcain P, Holland CV. The public health importance of *Ascaris lumbricoides*. *Parasitology* 2000;121 Suppl: S51-71.
13. Strunz EC, Addiss DG, Stocks ME, Ogden S, Utzinger J, Freeman MC. Water, sanitation, hygiene, and soil-transmitted helminth infection: A systematic review and meta-analysis. *PLoS Med* 2014;11:1-38.
14. Ziegelbauer K, Speich B, Mäusezahl D, Bos R, Keiser J, Utzinger J. Effect of sanitation on soil-transmitted helminth infection: Systematic review and meta-analysis. *PLoS Med* 2012;9:1-17.
15. Wolfe M, Kaur M, Yates T, Woodin M, Lantagne D. A systematic review and meta-analysis of the association between water, sanitation, and hygiene exposures and cholera in case-control studies. *Am J Trop Med Hyg* 2018;99:534-45.
16. Pickering AJ, Djebbari H, Lopez C, Coulibaly M, Alzua ML. Effect of a community-led sanitation intervention on child diarrhoea and child growth in rural Mali: A cluster-randomised controlled trial. *Lancet Glob Health* 2015;3:e701-11.
17. Hammer J, Spears D. Village sanitation and child health: Effects and external validity in a randomized field experiment in rural India. *J Health Econ* 2016;48:135-48.
18. Prüss-Ustün A, Bartram J, Clasen T, Colford JM Jr., Cumming O, Curtis V, et al. Burden of disease from inadequate water, sanitation and hygiene in low-and middle-income settings: A retrospective analysis of data from 145 countries. *Trop Med Int Health* 2014;19:894-905.
19. Sumpter C, Torondel B. A systematic review of the health and social effects of menstrual hygiene management. *PLoS One* 2013;8:1-15.
20. Kjellén M, Pensulo C, Nordqvist P, Fogde M. Global Review of Sanitation Systems Trends and Interactions with Menstrual Management Practices – Report for the Menstrual Management and Sanitation Systems Project. Stockholm, Sweden: Stockholm Environment Institute (SEI); 2012.
21. Sahoo KC, Hulland KR, Caruso BA, Swain R, Freeman MC, Panigrahi P, et al. Sanitation-related psychosocial stress: A grounded theory study of women across the life-course in Odisha, India. *Soc Sci Med* 2015;139:80-9.
22. Routray P, Torondel B, Clasen T, Schmidt WP. Women’s role in sanitation decision making in rural coastal Odisha, India. *PLoS One* 2017;12:1-17.
23. UNICEF. Gender-Responsive Water, Sanitation and Hygiene: Key Elements for Effective Wash Programming. UNICEF; 2017.
24. UNICEF/WHO. Progress on Household Drinking Water, Sanitation and Hygiene 2000-2017. Special Focus on Inequalities. New York: United Nations Children’s Fund (UNICEF) and World Health Organization (WHO); 2019.
25. Spears D, Ghosh A, Cumming O. Open defecation and childhood stunting in India: An ecological analysis of new data from 112 districts. *PLoS One* 2013;8:1-9.
26. Chambers R, Von Medeazza G. Sanitation and stunting in India. *Econ Polit Wkly* 2013;48:15.
27. Coffey D, Deaton A, Dreze J, Spears D, Tarozzi, A. Stunting among children. *Econ Polit Wkly* 2013;48:68-9.
28. Panagariya A. Does India really suffer from worse child malnutrition than sub-Saharan Africa? *Eco Polit Wkly* 2013;48:98-111.
29. UNICEF. The Financial and Economic Impact of Swachh Bharat Mission in India – Summary Report. New Delhi: United Nations Children’s Emergency Fund; 2018. Available from: http://www.indiaenvironmentportal.org.in/files/file/UNICEF_Economic_impact_study.pdf. [Last accessed on 2020 Oct 19].

30. Routray P, Schmidt WP, Boisson S, Clasen T, Jenkins MW. Socio-cultural and behavioural factors constraining latrine adoption in rural coastal Odisha: An exploratory qualitative study. *BMC Public Health* 2015;15:880.
31. Gupta A, Khalid N, Hathi P, Srivastav N, Vyas S, Coffey D. Coercion, construction, and 'ODF paper pe': The Swachh Bharat Mission, according to local government officials. *India Forum* 2019;4:5.
32. Abraham M, Bharadwaj S, Chambers R, Dheeraj Hueso A, Joseph MJ, Mukerjee R, *et al.* Using Immersive Research to Understand Rural Sanitation: Lessons from the Swachh Bharat mission in India. In Proceedings of the Transform. Sustain. Resilient WASH Serv. 41st WEDC International Conference; Egerton University, Nakuru, Kenya, 9-13 July 2018.
33. Ministry of Drinking Water and Sanitation. Swachh Bharat Mission – Gramin; 2020. <https://swachhbharatmission.gov.in/sbmcms/index.htm>. [Last accessed on 2020 Oct 03].
34. Bharat GK, Dkhar NB, Abraham M. Aligning India's Sanitation Policies with Sustainable Development Goals (SDGs). The Energy and Resources Institute (TERI) Discussion Paper; 2020. Available from: <https://www.teriin.org/sites/default/files/2020-01/aligning-Indias-sanitation-policy-with-the-SDGs.pdf>. [Last accessed on 2020 Aug 23].
35. Ministry of Drinking Water and Sanitation. Swachh Bharat Mission – Gramin (All India); 2020. Available from: <https://sbm.gov.in/sbmReport/home.aspx>. [Last accessed on 2020 Aug 21].
36. Curtis V. Explaining the outcomes of the 'Clean India' campaign: Institutional behavior and sanitation transformation in India. *BMJ Glob Health* 2019;4:1-11.
37. Kantar Public, IPE Global. National Annual Rural Sanitation Survey (NARSS) 2018–19. New Delhi: Ministry of Drinking Water and Sanitation; 2018. Available from: <https://jalshakti-ddws.gov.in/sites/default/files/NARSS-2018-19.pdf>. [Last accessed on 2020 Nov 19].
38. Gupta A, Khalid N, Deshpande D, Hathi P, Kapur A, Srivastav N, *et al.* Changes in Open Defecation in Rural North India: 2014–2018. New Delhi: Research Institute for Compassionate Economics; 2018. Available from: <https://riceinstitute.org/research/changes-in-open-defecation-in-rural-north-india-2014-2018-2/>. [Last accessed on 2020 Sep 23].
39. Kantar Public. Review of Health Data in Selected ODF and Non-ODF Districts Under the SBM. New Delhi: Ministry of Drinking Water and Sanitation; 2017. Available from: https://jalshakti-ddws.gov.in/sites/default/files/BMGF_Health_Impact_Study_final.pdf. [Last accessed on 2020 Sep 23].
40. WHO. Summary of Preliminary Estimations of Potential Health Impacts from Increased Sanitation Coverage through the Swachh Bharat Mission. New Delhi: World Health Organization; 2018. Available from: <http://origin.searo.who.int/india/mediacentre/events/2018/swachh-bharat-report-web.pdf>. [Last accessed on 2020 Oct 19].
41. Water Aid India. Quality and Sustainability of Toilets: A Rapid Assessment of Technologies under Swachh Bharat Mission. New Delhi: Water Aid India; 2017. Available from: <https://www.wateraidindia.in/sites/g/files/jkxooof336/files/quality-and-sustainability-of-toilets.pdf>. [Last accessed on 2020 Sep 13].
42. Biswas D, Jamwal P. Swachh Bharat Mission: Groundwater contamination in peri-urban India. *Econ Polit Wkly* 2017;52:18-20.
43. Verhagen J, Scott P. Safely Managed Sanitation in High-Density Rural Areas: Turning Fecal Sludge into a Resource through Innovative Waste Management. Washington, DC 20433: The World Bank; 2019.
44. Coffey D, Spears D. Where India Goes: Abandoned Toilets, Stunted Development and the Costs of Caste. New Delhi: HarperCollins Publishers India; 2017.
45. National Sample Survey Organization (NSSO). Swachhata Status Report. Ministry of Statistics and Programme Implementation 2016, Govt. of India.
46. 2018 National Sample Survey Organization (NSSO) Report No. 584: Drinking Water, Sanitation, Hygiene and Housing Condition in India. NSS 76th round (July-December 2018), National Statistical Office. Ministry of Statistics and Programme Implementation 2019, Govt. of India.
47. Dwivedi LK, Banerjee K, Jain N, Ranjan M, Dixit P. Child health and unhealthy sanitary practices in India: Evidence from recent round of national family health survey-IV. *SSM Popul Health* 2019;7:1-9.
48. Bawankule R, Singh A, Kumat K, Pedgaonkar S. Disposal of child's stools and its association with diarrhoea in India. *BMC Public Health* 2017;17:12.
49. O'Reilly K, Louis E. The toilet tripod: Understanding successful sanitation in rural India. *Health Place* 2014;29:43-51.
50. Greenland K, Cairncross S, Cumming O, Curtis V. Can we afford to overlook hand hygiene again? *Trop Med Int Health* 2013;18:246-9.
51. Water Aid India. Spotlight on Hand Washing in Rural India. Water Aid India; 2017. Available from: <https://www.wateraidindia.in/publications/spotlight-on-handwashing-in-rural-india>. [Last accessed on 2020 Nov 07].
52. Institute of Development Studies, Praxis, Water Aid. Swachh Bharat Mission (Gramin) Immersive Research – Main Report. Water Aid India; 2017. Available from: <http://wateraidindia.in/wp-content/themes/wateraid/immersion-sbm/images/SBM-immersive-research-findings-online.pdf>. [Last accessed on 2020 Aug 19].
53. National Health Profile 2019, 14th Issue. Central Bureau of Health Intelligence, Directorate General of Health Services, Ministry of Health and Family Welfare, Government of India. Available from: <https://www.issuelab.org/resources/29151/29151.pdf>. [Last accessed on 2020 Dec 19].
54. Hueso A, Bell B. An untold story of policy failure: The Total Sanitation campaign in India. *Water Policy* 2013;15:1001-17.
55. Programme Evaluation Organisation. Evaluation Study on Total Sanitation Campaign, Planning Commission Government of India; 2013. Available from: https://niti.gov.in/planningcommission.gov.in/docs/reports/peoreport/peo/rep_tscv1_2205.pdf. [Last accessed on 2020 Jun 19].
56. Crocker J, Saywell D, Bartram J. Sustainability of community-led total sanitation outcomes: Evidence from Ethiopia and Ghana. *Int J Hyg Environ Health* 2017;220:551-7.
57. Chambers R, Kar K. Handbook on Community-Led Total Sanitation. Brighton: IDS; 2008.
58. Venkataramanan V, Crocker J, Karon A, Bartram J. Community-led total sanitation: A mixed-methods systematic review of evidence and its quality. *Environ Health Perspect* 2018;126:1-17.
59. Jenkins MW, Curtis V. Achieving the 'good life': Why some people want latrines in rural Benin. *Soc Sci Med* 2005;61:2446-59.
60. Novotný J, Hasman J, Lepič M. Contextual factors and motivations affecting rural community sanitation in low- and middle-income countries: A systematic review. *Int J Hyg Environ Health* 2018;221:121-33.
61. Chunga RM, Ensink JH, Jenkins MW, Brown J. Adopt or adapt: Sanitation technology choices in urbanizing malawi. *PLoS One* 2016;11:1-16.
62. Pattanayak SK, Yang JC, Dickinson KL, Poulos C, Patil SR, Mallick RK, *et al.* Shame or subsidy revisited: Social mobilization for sanitation in Orissa, India. *Bull World Health Organ* 2009;87:580-7.
63. Guiteras R, Levinsohn J, Mobarak AM. Sanitation subsidies. Encouraging sanitation investment in the developing world: A cluster-randomized trial. *Science* 2015;348:903-6.
64. Clasen T, Boisson S, Routray P, Cumming O, Jenkins M, Ensink JH,

- et al.* The effect of improved rural sanitation on diarrhoea and helminth infection: Design of a cluster-randomized trial in Orissa, India. *Emerg Themes Epidemiol* 2012;9:7.
65. Humphrey JH, Mbuya MNN, Ntozini R, Moulton LH, Stoltzfus RJ, Tavengwa NV, *et al.* Independent and combined effects of improved water, sanitation, and hygiene, and improved complementary feeding, on child stunting and anaemia in rural Zimbabwe: A cluster-randomised trial. *Lancet Glob Health* 2019;7:e132-47.
66. Tofail F, Fernald LC, Das KK, Rahman M, Ahmed T, Jannat KK, *et al.* Effect of water quality, sanitation, hand washing, and nutritional interventions on child development in rural Bangladesh (WASH Benefits Bangladesh): A cluster-randomised controlled trial. *Lancet Child Adolesc Health* 2018;2:255-68.
67. Ministry of Drinking Water and Sanitation. Swachh Bharat Mission (Grameen), Phase II. Operational Guideline; 2020. Available from: <https://swachhbharatmission.gov.in/SBMCMS/guidelines.htm>. [Last accessed on 2020 Dec 22].