



Multidimensional impact of Inadequate sanitation in India: Situation analysis

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Abstract

This epidemiological review paper provides an analytical review of the current situation of sanitation in India, and its impact on health and other societal factors. Accelerating progress on sanitation in India remains one of the global development agenda's most urgent yet most difficult challenges. The problem of sanitation is receiving considerable attention worldwide. Sanitation is an important development indicator; United Nation has given it a strong priority in Millennium Development Goals (MDG). Poor sanitation, hygiene, quality and quantity of water are one of the main reasons behind more than 80% of reported cases of infectious diseases in India. Numerous national and international efforts have been made over the past few decades to enhance sanitation in India. Nonetheless, the net result is reported to be not proportionate to the efforts and money spent. Upon analysis of national level political, economic and social dynamics this study reveals that low political priority, lack of properly designed, penetrated awareness programs, poor delivery mechanism, beneficiary participation, lack of research and innovation are prime barriers towards achieving total sanitation.

Keywords: Awareness, India, latrine, open defecation, sanitation, swachh Bharat.

Introduction

Long over before 1947 the statement of Mahatma Gandhi - "Sanitation is more essential than independence" that is backed by the Prime Minister of India in 2014 by reiterating "Toilet first-Temple next" indicates the pressing need towards improvement of sanitation standard in India. The term "sanitation" be that as it may, is a much more extensive but neglected subject. Poor and insufficient sanitation has been a central reason for spread of a few preventable and transmittable diseases in developing nations of the world. Sanitation is closely associated with the individual cleanliness as well as a reflection of the human pride, society, instruction, monetary and social improvement of a general public. WHO defines "sanitation as the provision of facilities and services for the safe disposal of human urine and feces" (WHO home page). The United Nations-World Health Organization Joint Monitoring Program for Water Supply and Sanitation defines "improved" sanitation as: "the means that hygienically separate human excreta from human contact and hence reduces health risks to humans"¹. A Sanitation handbook defines the term "sanitation as a process whereby people demand, effect, and sustain a hygienic and healthy environment for themselves by erecting barriers to prevent the transmission of disease agents"².

Poor access to water, sanitation and hygiene brings colossal human and monetary expenses and makes a few societal imbalances, most remarkably for women and girls³. Sanitation and hygiene carry a sturdy direct and indirect relationship with vital health and socioeconomic aspects, considering its impact on the society. United Nations have appropriately included

Sanitation in the United Nations Millennium Development Goals (MDGs) in the year 2000. Reduction of child mortality, combat diseases and environmental sustainability are three goals among eight MDGs, which are directly or indirectly related to sanitation and hygiene. Here it is important to mention that even the first goal of the MDG to eliminate extreme poverty is directly associated with eradication of poor sanitation as diseases related to poor sanitation and increasing cost of healthcare decreases the efficiency as well as income of the society. United Nation noted that improvement in sanitation, hygiene and safe drinking water can help to achieve a notable growth in terms of targets set by MDG⁴.

In more than 6 numerous decades of Independence, India has achieved about 50% of the sanitation scope. "Subsequently, with the current advancement rate, it oblige an alternate five to six decades to achieve complete sanitation"⁵. India has a populace of nearly 1.2 billion in which 97 million individuals don't have admittance of enhanced drinking water, 814 million individuals don't have adequate access to sanitation, 55% of this populace (almost 600 million individuals) have no right to gain access to toilets, and in excess of 186,000 kids die consistently from diarrhoea due to unsafe water and poor sanitation. Out of 1.1 billion individuals far and wide who defecate in open, 626 million are from India, while only 14 million fits in with China, which shows, regardless of bigger populace and demographic region, China have attained a recognizable development towards giving better sanitation to the natives and heading the group of creating countries⁶.

diseases caused by poor sanitation, poverty and infancy are majorly interlinked and accounts for more than 10% of global burden of diseases⁷. Improvement in these fundamental components of a healthy life can substantially reduce notable burden of health care from a society. The major diseases that are ascribed to environmental contamination and poor drinking water supply are: diarrhoeal diseases, cholera, pneumonia, poliomyelitis, typhoid, water borne viral hepatitis, trachoma etc. Various studies indicate that sanitation, hygiene and improved water supply helped reduce the morbidity and mortality due to infectious diseases to a great extent⁸⁻¹⁰.

There are multi dimensional impacts of poor sanitation which includes losing approx US\$ 54 billion annually as estimated by the World Bank. Along with health and economic burden open defecation and non availability of toilets bring several other social challenges for the urban as well as rural population, especially for women and girls who face shame, guilt and harassment while opting for open defecation. Sanitation can't be envisioned without improving fundamental facilities such as water supply, waste management technologies and other essential needs of an organized human settlement. To review the current situation of sanitation in India and its impact on various societal factors, this paper provides a comprehensive review and analysis of various programs and policies launched by the government of India to eliminate sanitation crisis.

Objective: The objective of this study is a literature review of the current scenario of sanitation in India, determinants of poor sanitation and its impact on public health and other factors of life.

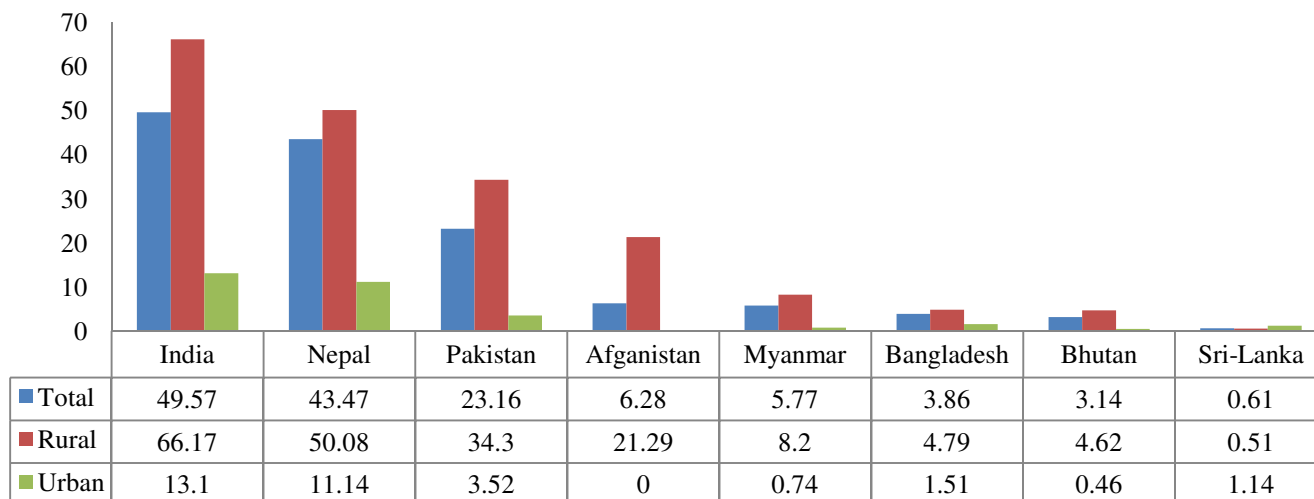
Methodology

This Paper is focused around a desktop research of literature on the subject by distinctive organizations and open source data accessible at entrances of government of India to evaluate the flow circumstance, determinants and effect of sanitation, hygiene and water. This review is based on online information from World Bank and United Nations, articles and research papers accessible on online databases such as Web of Science, PubMed, Google Scholar, etc. and data available at website of Water Aid India, UNICEF/WHO/Planning Commission (India) assessments which are focused around various government of India sample surveys.

Tragically, in the sanitation, hygiene and water sector, the multitude of government services, managing independently with rural and urban planning, various national level reviews that do not utilize a uniform methodology for evaluating scope and an absence of autonomous studies at a sufficiently illustrative scale complicates the critical assessment of the circumstances on the ground. An aggregate of more than 100 studies from distinctive sources was looked into and dissected to create and analyze the effect of adequate sanitation, good hygiene and safe drinking water, which together structure a solid principal to a sound life alongside social and financial improvement.

Situation analysis: Poor sanitation and hygiene was identified as a major source of diseases and epidemics during British rule in India. The British government set up a commission to discover the effect of sanitation and cleanliness on the British Army and the related diseases. Cholera and plague were influencing the strength of the British Army and death rate among them was as high as 69 every 1000. The commission suggested every presidency to form a Public Health commission and proposed the need to enhance sanitary conditions among society and British Army. In 1885 the local self government act came into the power and local bodies were selected alongside accessibility of funds at the local level. Nonetheless, in 1912 the administration of India designed its strategy to focus at micro level and endorsed to choose Deputy Sanitary Commissioners and Health Officers with easy access to funds for sanitation¹¹. Post independence, first to fifth five year allotment of funds for the water supply and sanitation improvement was under 1.5%. In the 6th five year plan (1980 – 1985) amid the international decade for water supply and sanitation the allocation was expanded to more than 4% (Planning Commission, 2002). The government launched the Central Rural Sanitation Program (CRSP) in 1986, the first nationwide sanitation program with the objective of providing 80 percent subsidy for building individual household latrine facilities for below poverty line (BPL) households on demand basis. Total sanitation campaign (TSC) was launched in 1999 with objective to accelerate the sanitation coverage in rural areas and providing universal access to sanitation facilities targeted eradication of open defecation by 2012, later rescheduled for 2019. Under TSC 91 percent of school toilets, 73 and 61 percent of toilets for below poverty line and above poverty line families, separately have been constructed¹². TSC restructured as “Nirmal Bharat Abhiyan” in 2007 and “Swachh Bharat Mission” in 2014. There were numerous factors attributed to the fruitless impact of all these programs and policy and uneven progress towards coverage and usage. Traditional cultures and religious beliefs, lack of awareness towards health and hygiene, water crisis, inappropriate and technology lacked design of toilets along with a lack of involvement, monitoring and initiative from both people and the government, were the biggest factors behind failure¹³.

Goal 7 Target 7c of the Millennium Development Goals (MDGs) aims to reduce the extent of the worldwide populace without reasonable access to safe drinking water and essential sanitation to a significant level. By 2015, the MDG focus on sanitation is to halve the extent of the worldwide populace without access to enhanced sanitation, from 51 percent in 1990 to 25 percent. According to a report on “Drinking Water and Sanitation-2014” India is a country with the most elevated number of individuals practicing open defecation even today. Figure 1 shows open defecation pattern among SAARC nations including China and Myanmar who are SAARC observers, 49.57% of Indian populace defecate in open which incorporates 66.17% of rural and 13.1% of urban populace. Nepal and Pakistan are second and third in the rundown with open defecation of 43.47 and 23.16 % individually. However, one of the SAARC nations, the Maldives has officially accomplished the objective with zero open defecation.



Source: Compiled from WHO/UNICEF Water Supply Statistics, 2013

Figure-1
Percentage of open defecation pattern in SAARC countries, 2011

India stands out amongst the densest populated nations on the planet with least sanitation scope and have indicated moderate advancement for the marker of sanitation. According to World Health Organization (WHO) and UNICEF's Joint Monitoring Program for Water Supply and Sanitation (JMPWSS) when looked at comprehensively on the targets set under MDG, states for example, Madhya Pradesh and Orissa will attain MDG target in the one century from now. Further, 17 States, including Kerala, Haryana, Meghalaya, Himachal Pradesh, Punjab and most Union domains effectively arrived at the MDG and TSC target while Assam, Andhra Pradesh will attain it in the following 10 years. States like Karnataka, Maharashtra, Tamil Nadu and Chhattisgarh will achieve the focus in the following 25 years, Madhya Pradesh is relied upon to achieve the objective in 2105 and Odisha just in 2160¹⁴.

Five states in India, Chhattisgarh, Madhya Pradesh, Bihar, Jharkhand and Odisha to a great extent rustic and spotted in the central and eastern parts of the nation have less than 30 percent access to sanitation¹⁴. In Odisha a review revealed that the deficient and unplanned Information, Education, Communication (IEC) exercises by the District Water and Sanitation Missions (DWSMS) prompted lack of awareness, low demand and lack of community participation in planning and implementation. It prompted non-accomplishment of the targets set by the Center for guaranteeing total sanitation by 2012¹⁵. In Jharkhand TSC is an extreme challenge in light of the fact that Jharkhand stays as one of the poorest and lowest education rate states in the nation in which almost 80 percent of the populace live in rustic regions, approximately 62 percent of the individuals live in Below Poverty Line (BPL).

Independent of having or not having a toilet, there is an imperative angle and MDG indicator of the sanitation facilities, whether the households have admittance to "improved source of

latrine". Here "improved source" of latrine includes sources, for example, "flush/pour-flush, piped sewer system/septic tank/pit latrine", "ventilated improved pit latrine", "pit latrine with slab" and "composting toilet". "Key Indicators of Drinking Water, Sanitation, Hygiene and Housing Condition in India", published by NSSO 69th round in 2012 demonstrates that 59.40 percent and 8.80 percent families in rural India and urban India separately had no latrine. In the event that if one considers the corresponding estimates across rural areas of bigger states it is observed that Jharkhand had the most noteworthy (90.5 percent) extent of households that had no toilet latrines, much higher than the all India extent. Among the other bigger states where the estimated proportion (among rural households) was higher than the corresponding all India figure includes Tamil Nadu (66.4 percent), Karnataka (70.8 percent), Bihar (72.8 percent), Rajasthan (73.0 percent), Uttar Pradesh (75.3 percent), Chhattisgarh (76.7 percent), Madhya Pradesh (79.0 percent) and Odisha (81.3 percent) had no latrine facilities. The same trend is also seen in urban regions of these states.

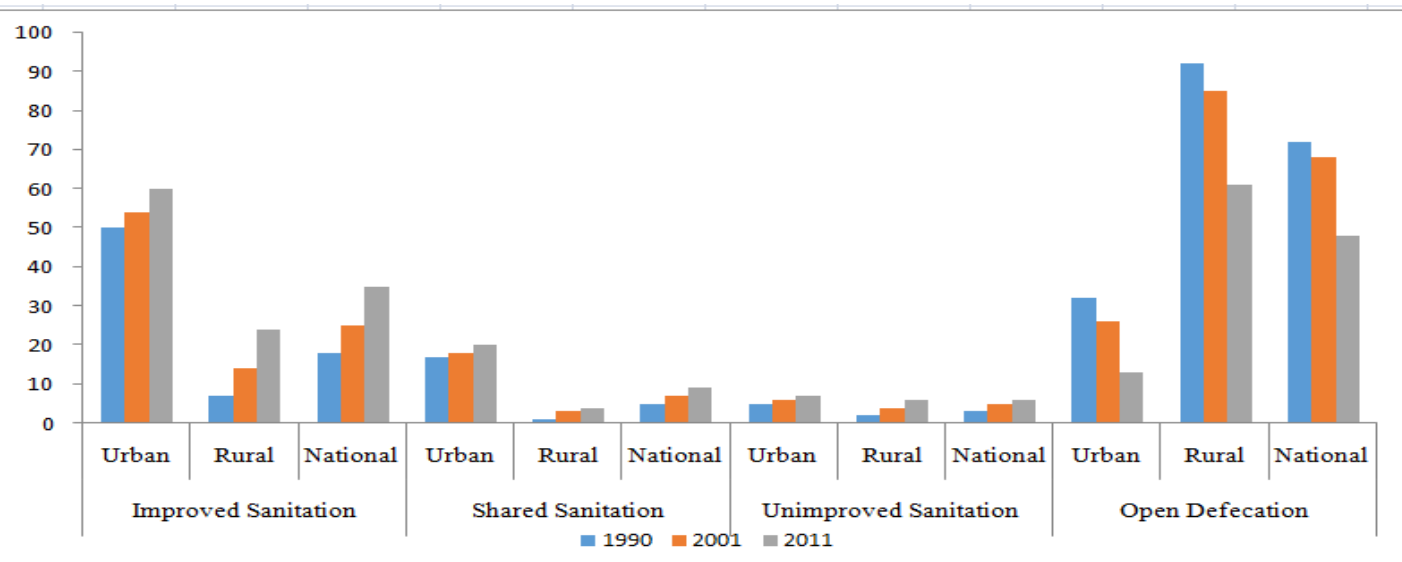
The changing pattern of improved sanitation is shown in figure 2 based on different factors of MDG indicators. Studies indicate that there is unnoticeable progress in terms of improved sanitation in two decades. Even shared and unimproved sanitation facilities in urban, rural and national are not noticeable. A mere decline of 20 Percent in open defecation pattern after the launch of TSC indicates that there are major gaps in the policy design and implementation. Constructing toilets and sanitary complexes can not only improve the situation theoretically. However, there is a strong need to align and radical revision of government programs and policy at grass root level, and it is important to bring behavioral changes among the population.

Changes in open defecation pattern since 2001 when TSC was recently launched have not been noteworthy. In one decade just

six states attained 20 percent or more decline in open defecation, though 10 states were ineffectively affected by TSC and recorded 5 percent or less decline in practicing open defecation and combining all states together the average decline percentage in India is just 10 percent.

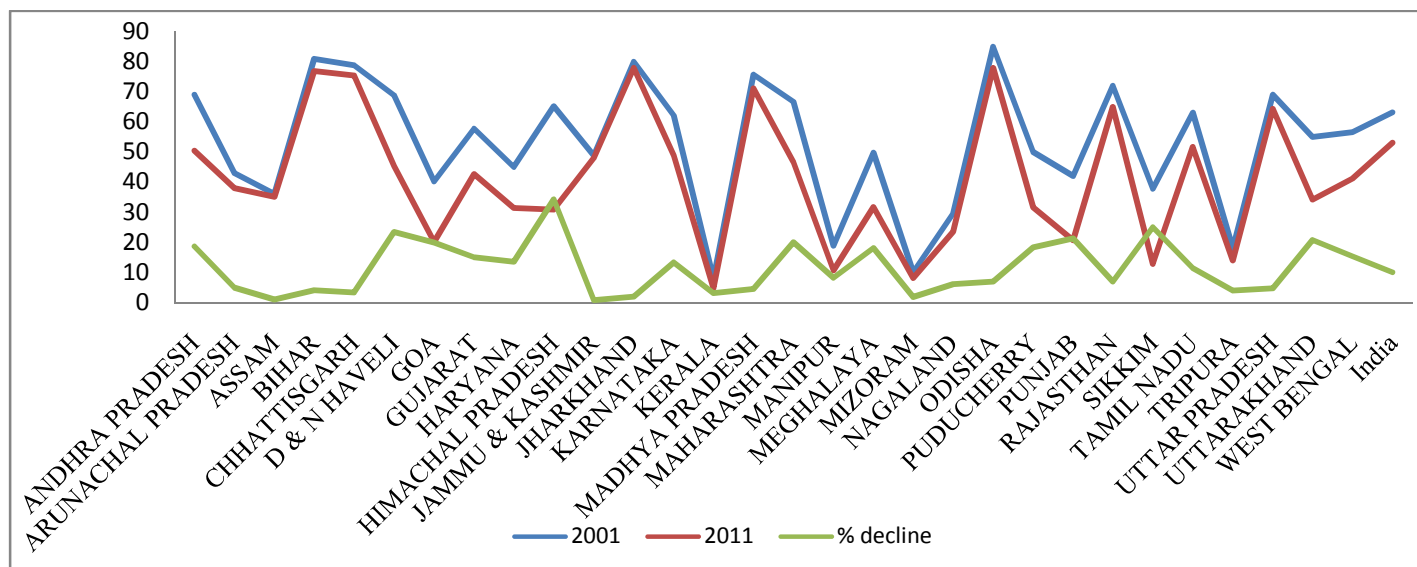
With a budget of INR 620.09 billions the government of India has launched “Swachh Bharat Mission” on 2nd October, 2014 to

achieve total sanitation goal by 2019. It is an upgraded version of earlier sanitation policies launched by various governments in India. Public private participation, awareness, solid waste management, infrastructure development, capacity building and behavioral change are the key objectives of this program¹⁶. Improved sanitation can bring substantial economic, social and developmental benefits. Some of notable issues related with sanitation have been described in this paper.



Source: Compiled from UNICEF /WHO 2014 (Progress on Sanitation and Drinking Water Update: 2014)

Figure-2
Trends of sanitation facilities in India (percentage of population)



Source: Compiled from NSSO 69th Round 2012, Government of India. Key Indicators of Drinking Water, Sanitation, Hygiene and Housing Condition in India

Figure-3
Open defecation pattern 2001 & 2011

Sanitation and public health in India: Absence of sanitation prompts infection, as it was rightly pointed out as early as in 1842 in Chadwick's original "Report on an inquiry into the sanitary condition of the laboring population of Great Britain"¹⁷. British Medical Journal (BMJ) readers in 2007 choose the "sanitary revolution" as a greatest medical milestone since 1840¹⁸.

Eighty eight percent identified infections are created by water, sanitation and natural contamination which prompts mortality and incapacity¹⁹. Adults and children get diarrhoea and different diseases from ingesting the disease causing germs in human excreta, these results in dehydration, malnutrition, fever, and even death, particularly of children, and those with bargained insusceptible immune systems in the same way as more established persons and HIV/AIDS patients²⁰. Different diseases associated with fecal transmission are polio, hepatitis A and E, intestinal worms, skin diseases like scabies, and eye contaminations like trachoma that can result in visual impairment. Polio can occur due to oro-fecal contamination, and intestinal worms can result in cognitive hindrance and pallor physical distortions and inabilities, and hepatitis can induce liver disappointment²¹.

Every 20 seconds, a child dies of preventable waterborne disease²². In India, 72 of the 1000 children failed to achieve their fifth birthday. The real executioners are gastrointestinal diseases, pneumonia, preterm birth complications, diarrhoea and malaria¹⁹. Diarrhoea is the second highest reason for death among children under five internationally. Lacking accessibility and access to safe and clean drinking water, essential enhanced sanitation, and poor hygiene cause about 88 percent of all mortality due to diarrhoea^{23,24}.

Twenty percent of world populace is contaminated by Hepatitis-E. In an across the nation study led by the All India Institute of Medical Sciences (AIIMS) it was discovered that waterborne Hepatitis E was the essential reason for intense liver disappointment in almost 60 percent of pregnant ladies. Hepatitis E, a preventable disease is transmitted basically through drinking water and can prompt demise by activating an intense liver distress. The immunization for Hepatitis E is still in the pipeline, yet Hepatitis E could be forestalled by taking preventive measures as far as enhanced sanitation and safe drinking water²⁵. Table 2 shows burden of water and sanitation borne diseases and their societal as well as economic impact on Nation.

Improved sanitation itself could lessen diarrhoea-related morbidity by more than 75% and improved water sources decrease the diarrhea morbidity by 21%²⁶. A methodical survey of the impact of hand washing with soap has demonstrated that this basic measure is connected with a lessening of 43 percent in diarrhoeal sickness²⁷. Sanitation and water can lessen overall child mortality by 55%. In 1991 study by Esrey identified six

diseases ascariasis, diarrhoea, dracunculiasis, hookworm infection, schistosomiasis, and trachoma where the positive impacts of water supply, sanitation and hygiene have been demonstrated²⁸. Spears (2013) calculated positive relation between TSC coverage in rural areas and progress in weight and height of the children²⁹.

Figure 4 shows that there is immediate relation between Infant Mortality Rate (IMR) and sanitation, IMR is low in the states where TSC has more prominent coverage, for example, Kerala and Tamil Nadu has accomplished 100 and 77 percent of its IHHL target and has an IMR of 13 and 28 percent. Then again, Bihar built just 31 percent of the endorsed IHHL's and there the IMR is 48 percent.

Figure 5 shows the number of cases reported for diarrhoea, cholera, typhoid and V. Hepatitis since 1999 when the government of India launched TSC. While instances of cholera and Hepatitis have been lessened yet the major sanitation and hygiene borne diseases like diarrhoea and typhoid are on the rising side only. It shows that the effect of sanitation and hygiene improvement programs have not been effective and have not specifically affected in diminishment of diseases. Reported instances of cholera have been less than 10,000 since 1999. However, it has recorded a declining trend and only 1127 cases were reported in 2013.

Economic burden of poor sanitation and hygiene: It has been established that the financial expenses connected with poor sanitation are generous. At the worldwide level, failure to meet the MDG target would have consequences in the range of US\$38 billion, and sanitation represents 92% of this amount^{30,31}.

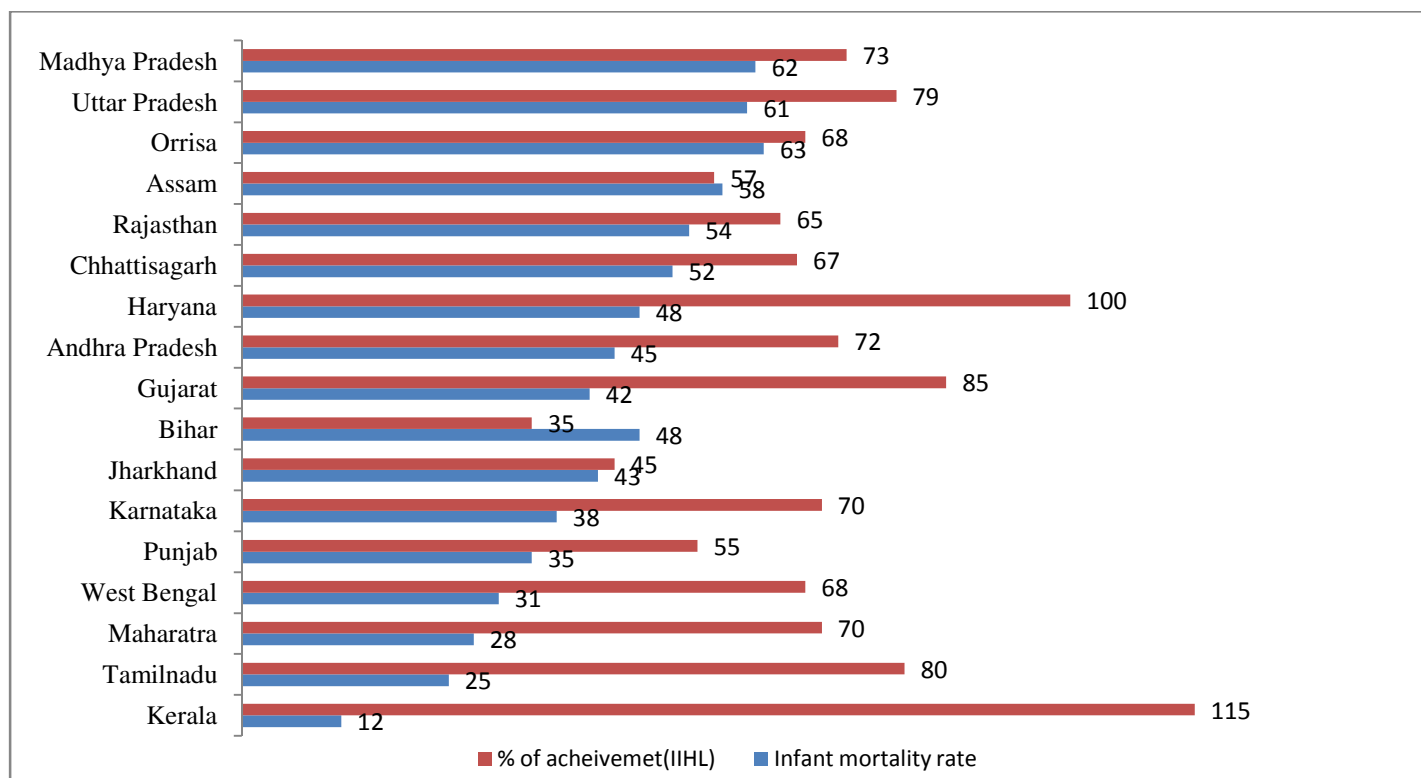
At the regional level a late study led to Southeast Asia found that the monetary expenses of poor sanitation and cleanliness added up to over US\$9.2 billion a year (2005) in Cambodia, Indonesia, the Philippines, and Vietnam, representing 2% of the aggregate GDP for the greater part of the nations consolidated. Poor sanitation influences everybody, except particularly the poor and defenseless (youngsters, ladies, the impaired, and the elderly)³².

A study "*Financial Impact of Inadequate Sanitation in India*" conducted by the World Bank's South Asia Water and Sanitation Unit says the absence of toilets and conventional sanitation costs in India almost \$54 billion (INR 24,000 crore) likeness 6.4% of India's GDP in 2006. The expense of treating diseases identified with poor sanitation costs India \$38.5 billion every year. The expenses are split up under four heads- Health, Education, Access time and tourism³³. A study was carried out on the social and the financial effect of attaining full sanitation in Odisha State, for the first time provides solid confirmation to authorities that sanitation gives critical returns³⁴.

Table-1
Diseases associated with Sanitation and water in India

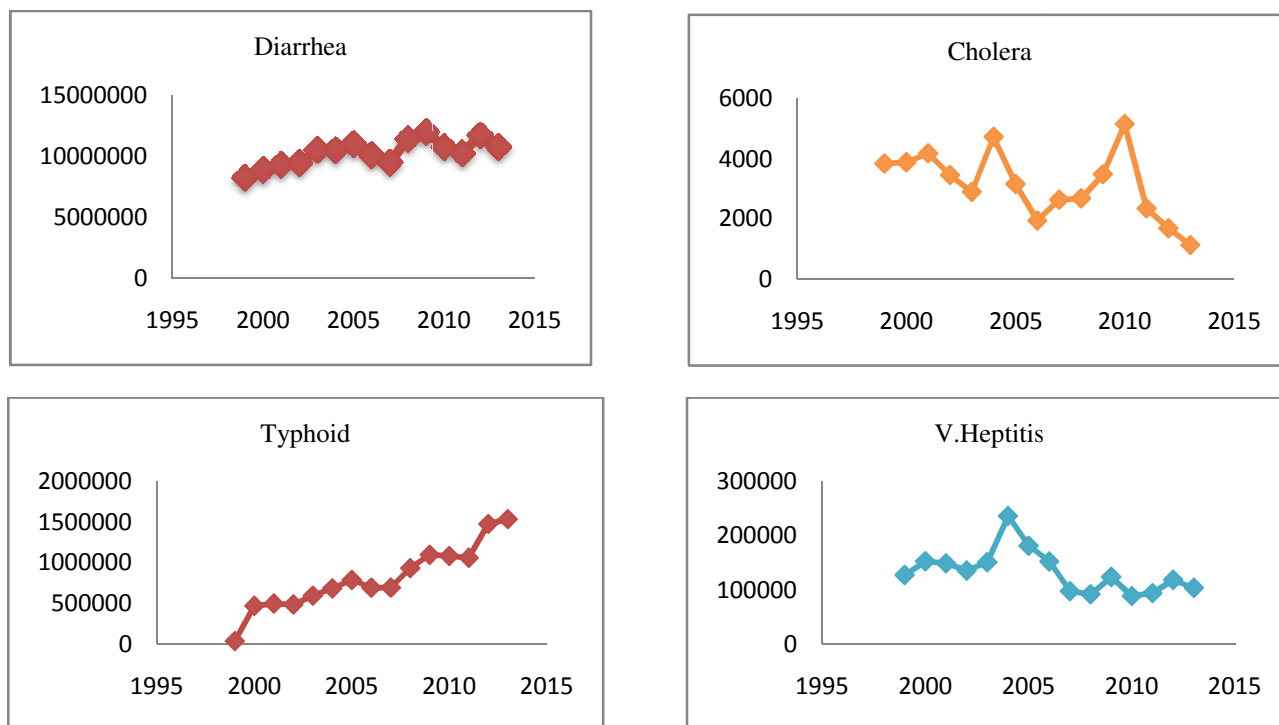
Diseases preventable by sanitation and water		Cause of diseases (Transmission)	Morbidity in 2013	Mortality in 2013	Prevention rate by sanitation and safe drinking water	Approximately estimated economic burden
Water born and sanitation	Acute Diarrhea	Pathogens, including bacteria, viruses, rotaviruses and protozoa. (oro-fecal)	10762500	1535	88%	\$25-50 billion
	Typhoid	<i>Bacteria: Salmonella typhi</i> (oro-fecal)	1537118	361	32%	\$1-2 billion
	Cholera	<i>Bacterium Vibrio cholera</i> (oro-fecal)	1127	5	80%	\$15-20 million
	Hepatitis A	Virus(oro-fecal)	104145	512	15-45%	\$1.5-3 billion
	Hepatitis E	Virus (oro-fecal)	97832	163	15-57%	--
Water based disease	Intestinal worms	Parasite: helminthes and protozoa (oro-fecal)	117180	Not reported	29%	\$3.99 -5.50 million
Water related	Malaria	Parasite: Plasmodium vivax, Plasmodium ovale	836916	359	24%	5-7 billion
	Dengue	Virus	26,000	168	28%	\$1.11 -2 billion
	Chikungunya	Virus:Chikungunya	18639	Not reported	21%	-
	Japanese encephalitis	Virus: flavivirus	3458	199	19%	\$ 2-5 million
Sanitation and Hygiene	Trachoma	<i>Bacterium Chlamydia trachomatis</i>	22357	531(blind)	27%	-
Air pollution and Hygiene	Pulmonary Tuberculosis	<i>Bacteria: Mycobacterium tuberculosis</i>	1416014	63261	21%	\$ 3-5 billion
	Lower respiratory infection		31738762	3271	18%	\$22-24 billion
	Pneumonia	Virus\Bacteria: Streptococcus pneumon	703532	2597	27%	\$1-2 billion
	Over all child mortality				55%	

Sources: Compiled from Central Bureau of Health Intelligence, Health status indicators 2013, Ministry of Health and Family welfare, Annual report and WHO India Fact Sheet 2013 and other papers.



Source: IHHL coverage is from TSC Physical progress report (<http://tsc.gov.in/>) and IMR figures are from SRS Bulletin

Figure-4
Infant mortality rate Vs TSC coverage (2012)



Source: Central Bureau of Health Intelligence, Health status indicators from 1998-2013

Figure-5
Morbidity on Waterborne disease

Societal impact of poor sanitation: Poor and inadequate sanitation facilities are directly co-related to increased risk of social issues such as rape and sexual harassment. Evidence from different parts of the world including Kenya, Uganda and India proves the relation of poor sanitation and enumerate the risk³⁵. BBC News evaluates that 400 women would have "escaped" rape in Bihar in 2012 in the event that they had toilets in their homes. The assaults occur when ladies go outside to defecate at early in the morning or late evening. These "sanitation-related" assaults make up almost a large portion of the more than 870 instances of assault in Bihar in 2012³⁶. Open defecation and absence of sufficient toilet complexes not just uncover women towards the dangers of physical ambush additionally, make them powerless against snake and bug chomps and creature assaults.

The genuine human expense of poor sanitation then again, can't be more unmistakably illustrated than by the late event in which two young women were struck and murdered in the Uttar Pradesh (India) while chasing down a private spot to defecate³⁷. Whereas this story stood out as truly newsworthy, the truth of the matter is that many women face provocation, attack, and assault when looking for some measure of privacy.

Results and Discussion

This study found following major issues during the review of sanitation status in India. i. Despite launching several programs and policies the awareness level among mass is insufficient to change their mindset to accord priority to sanitation and latrine construction. ii. Inefficient implementation strategy and less involvement of community at the grass root level. iii. Bureaucracy, multi layer funding and delivery mechanism in sanitation programs should be minimized. iv. Lack of customized and target investments. v. Less technology involvement in designing cost-effective and sustainable model.

Merger of policies with people is the key to success in terms of achieving total sanitation India. Sanitation should gain more political priority and commitment. A few studies indicate that unless these problems are tackled, significant success in sanitation in the country will remain elusive. Following are some of the important issues which should be included and implemented in programs and policies at the micro level to achieve maximum results: i. Sanitation awareness programs from primary education level. ii. Non Government Organizations should be encouraged to participate in sanitation drive with induction of Public-Private Partnership (PPP) model. iii. Improved methods of implementation of government policies and regular monitoring of progress. iv. Inclusion of latest, affordable and sustainable technology. v. Create awareness and sensitize people about sanitation and its impact on health. vi. Community sanitary complexes should get more priority based on experiences from "Sulabh toilets", the success of community toilets in Tamilnadu, availability of space, maintenance and several other factors. vii. Involvement of

corporate and government companies by including sanitation in their CSR (Corporate Social Responsibility) programs

Sanitation should no more be overlooked and ignored. In the event that future of children are to be spared from the diseases due to poor sanitation, and generations of women and girls are to be spared from the outrage and hazard that open defecation involves then sanitation must be one of India's most noteworthy priorities.

Conclusion

This paper attempted to investigate and discuss impact of poor sanitation on different aspects of social life in India. Improved and adequate sanitation will have profound implications on human and society. Sanitation improvement programs should be aligned properly with the society to provide adequate benefits. private public partnership, strong and well designed policy, a sustainable framework with strong political commitment are must to bring the change.

References

1. WHO/ UNICEF, Progress on Sanitation and Drinking Water: 2010 Update (2010) Available: <http://www.unicef.org/eapro/JMP-2010Final.pdf> (Accessed 25 June 2014) (2014)
2. UNICEF, Towards Better Programming: A Sanitation Handbook, A joint publication of UNICEF's Water, Environment and Sanitation Section, Programme Division and USAID's Environmental Health Project, (1997)
3. Tilley E. Bieri S. and Kohler P., Sanitation in Developing countries: A Review through a Gender Lens, J. Wate. Sanit. Hyg. Dev., 3(3), 298-314(2013)
4. United Nations, The Millennium Development Goals Report 2012, United Nations, New York (2012)
5. Azim S., An Analysis of Sanitation Deprivation in Karnataka, Sociology of Sanitation -Volume-I, Sulabh International Social Service Organisation, New Delhi, India (2013)
6. WHO/ UNICEF, Progress on Drinking Water and Sanitation: 2012 Update (2012) Available: <http://www.unicef.org/media/files/JMPreport2012.pdf> (Accessed 11 April 2014)
7. Prüss -Üstün A. Bos R. Gore F. and Bartram J., Safer Water, Better Health: Costs, Benefits and Sustainability of Interventions to Protect and Promote Health, World Health Organisation, Geneva (2008)
8. Prüss A. Kay D. Fewtrell L. and Bartram J., Estimating the Burden of Disease from Water, Sanitation, and Hygiene at a Global Level, *Environ Health Perspect.*, 110(5), 537-542 (2002)

9. Nath K.J., Home hygiene and environmental sanitation: a country situation analysis for India, *Int J Environ Health Res.*, **13**:S1, S19- S28 (2003)
10. Mara D. Lane J. Scott B. and Trouba D., Sanitation and Health, *Plos Medicine*, **7**(11) (2010)
11. Mushtaq M.U., Public Health in British India: A Brief Account of the History of Medical Services and Disease Prevention in Colonial India, *Ind. J. Com. Med.*, **34**(1) 6-14 (2009)
12. Swachh Bharat Mission, State Physical progress report 2013. India.http://sbm.gov.in/tsc/Report_NBA/Physical/Rpt_PhysicalProgreReported.aspx?id=Home (Accessed 7 Sep 2014) (2014)
13. Hueso A. and Bell B., An untold story of policy failure: the Total Sanitation Campaign in India, *Water Policy*, **15**(6), 1001–1017 (2013)
14. Water and Sanitation Program, *A Decade of the Total Sanitation Campaign Rapid Assessment of Processes and Outcomes*, Ministry of Rural Development, New Delhi, India (2010)
15. Government of Odisha, Orissa Urban Water and Sanitation Communication Strategy. Housing and Urban Development Department, Odisha, India (2011)
16. Ministry of Urban Development, Government of India, *Draft Guidelines for Swachh Bharat Mission (SBM)* (2014). Available: http://moud.gov.in/sites/upload_files/moud/files/guideline.pdf (Accessed 15 December 2014)
17. Chadwick E., *Reports on an Inquiry into the Sanitary Condition of the Labouring Population of Great Britain*. London (1842)
18. Ferriman A., BMJ Readers Choose the ‘Sanitary Revolution’ as Greatest Medical Advance since 1840, *BMJ* **334**: 111(2007)
19. Chandrasekar V. and Karupiah A., Environment, Sanitation and Health: Some Issues. *Sociology of Sanitation*, Volume-I, Sulabh International Social Service Organisation, New Delhi, India (2013)
20. Attili V.S. Gulati A.K. Singh V.P. Varma D.V. Rai M. and Sundar S., Diarrhea, CD4 Counts and Enteric Infections in a Hospital-based Cohort of HIV-infected Patients Around Varanasi, India, *BMC Infect. Dis.* **6** (1)39 (2006)
21. Prüss A. Kay D. Fewtrell L. and Bartram J., Estimating the Burden of Disease from Water, Sanitation, and Hygiene at a Global Level, *Environ Health Perspect*, **110** (5), 537-542 (2002)
22. UNICEF/WHO *Diarrhoea: Why children are still dying and what can be done*, New York (2009)
23. Prüss-Üstün A. Corvalán C., Preventing disease through healthy environments: Towards an estimate of the environmental burden of disease, World Health Organisation, Geneva (2006)
24. WHO, *World Health Report 2002: Reducing Risks, Promoting Healthy Life*, World Health Organisation, Geneva (2002)
25. Daltona H.R. Huntera J.G. and Richard P.B., Hepatitis E. *Wolters Kluwer Health \ Lippincott Williams and Wilkins* (2013). Available: <http://svmi.web.vc/wh/intertips/INFECTOLOGIA-2013-HEPATITIS-E.pdf> (Accessed 5 September 2014)
26. UNICEF, *Progress for Children: A Report Card on Water and Sanitation*, Number 5. UNICEF, New York (2006)
27. Curtis V. and Cairncross S., Effect of Washing Hands with Soap on Diarrhoea Risk in the Community: A Systematic Review, *The Lancet Inf. Disea.*, **3**(1), (2003)
28. Esrey S.A. Potash J.B. and Shiff C., Effects of improved water supply and sanitation on ascariasis, diarrhoea, dracunculiasis, hookworm infection, schistosomiasis, and trachoma, *Bull World Health Organ*, **69**(5) 609–621 (1991)
29. Spears D. and Lamba S., *Effects of Early-Life Exposure to Sanitation on Childhood Cognitive Skills Evidence from India's Total Sanitation Campaign*. The World Bank Sustainable Development Network Water and Sanitation Program Unit October (2013). <http://elibrary.worldbank.org/doi/pdf/10.1596/1813-9450-6659> (Accessed 7 Oct. 2014)
30. Hutton G. and Haller L., Evaluation of the costs and benefits of water and sanitation improvement at the global level. World Health Organization, Geneva (2004)
31. Hutton G. Haller L. and Bartram J., Global costs-benefit analysis of water supply and sanitation interventions, *J. Water Health*, **5**(4), 481–502 (2007)
32. Hutton G. Rodriguez U.P. Winara A. Viet Anh N. Phyrum K. Chuan L. Blacket I. and Weitz. A., Economic efficiency of sanitation interventions in Southeast Asia, *J. Wate. Sanit. Hyg. Dev.*, **4**(1), 23-36 (2014)
33. Water and Sanitation Program, *Economic Impacts of Inadequate Sanitation in India* (2011). Available: <http://www.wsp.org/sites/wsp.org/files/publications/WSP-esi-india.pdf> (Accessed 18 Sep. 2014)
34. Cronin A.A. Ohikata M. and Kumar M., Social and economic cost-benefit analysis of sanitation in Odisha State India, *J. Wate. Sanit. Hyg. Dev.*, **4** (3) 521–531 (2014)
35. *Water Aid Sanitation and Water for Poor Urban Communities: A Manifesto* (2011) Available:[www.inclusivewash.org.au/Literature Retrieve. asp? ID=79001](http://www.inclusivewash.org.au/LiteratureRetrieve.aspx?ID=79001) (Accessed 16 June 2014)

- 36.** Tewary A., India, Bihar: Rapes 'Caused by Lack of Toilets. *BBC News, India* (2013 May 09) Available:<https://sanitationupdates.wordpress.com/tag/sexual-violence> (Accessed 21 Oct. 2014) **(2014)**
- 37.** Soutik B., Why India's sanitation crisis kills women. *BBC News, India* (2014 May 30) Available: <http://www.bbc.com/news/world-asia-india-27635363> (Accessed 21 July 2014) **(2014)**